



## **Command Reference, Cisco IOS XE Fuji 16.8.x (Catalyst 9500 Switches)**

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# Using the Command-Line Interface

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This chapter contains the following topics:

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# Using the Command-Line Interface

This chapter describes the Cisco IOS command-line interface (CLI) and how to use it to configure your switch.



## Note

The documentation set for this product strives to use bias-free language. For purposes of this documentation set, bias-free is defined as language that does not imply discrimination based on age, disability, gender, racial identity, ethnic identity, sexual orientation, socioeconomic status, and intersectionality. Exceptions may be present in the documentation due to language that is hardcoded in the user interfaces of the product software, language used based on RFP documentation, or language that is used by a referenced third-party product.

## Understanding Command Modes

The Cisco IOS user interface is divided into many different modes. The commands available to you depend on which mode you are currently in. Enter a question mark (?) at the system prompt to obtain a list of commands available for each command mode.

When you start a session on the switch, you begin in user mode, often called user EXEC mode. Only a limited subset of the commands are available in user EXEC mode. For example, most of the user EXEC commands are one-time commands, such as **show** commands, which show the current configuration status, and **clear** commands, which clear counters or interfaces. The user EXEC commands are not saved when the switch reboots.

To have access to all commands, you must enter privileged EXEC mode. Normally, you must enter a password to enter privileged EXEC mode. From this mode, you can enter any privileged EXEC command or enter global configuration mode.

Using the configuration modes (global, interface, and line), you can make changes to the running configuration. If you save the configuration, these commands are stored and used when the switch reboots. To access the various configuration modes, you must start at global configuration mode. From global configuration mode, you can enter interface configuration mode and line configuration mode.

This table describes the main command modes, how to access each one, the prompt you see in that mode, and how to exit the mode. The examples in the table use the hostname *Switch*.

**Table 1: Command Mode Summary**

Mode	Access Method	Prompt	Exit Method	About This Mode
User EXEC	Begin a session with your switch.	Switch>	Enter <b>logout</b> or <b>quit</b> .	Use this mode to <ul style="list-style-type: none"> <li>• Change terminal settings.</li> <li>• Perform basic tests.</li> <li>• Display system information.</li> </ul>

Mode	Access Method	Prompt	Exit Method	About This Mode
Privileged EXEC	While in user EXEC mode, enter the <b>enable</b> command.	Device#	Enter <b>disable</b> to exit.	Use this mode to verify commands that you have entered. Use a password to protect access to this mode.
Global configuration	While in privileged EXEC mode, enter the <b>configure</b> command.	Device (config) #	To exit to privileged EXEC mode, enter <b>exit</b> or <b>end</b> , or press <b>Ctrl-Z</b> .	Use this mode to configure parameters that apply to the entire switch.
VLAN configuration	While in global configuration mode, enter the <b>vlan</b> <i>vlan-id</i> command.	Device (config-vlan) #	To exit to global configuration mode, enter the <b>exit</b> command.  To return to privileged EXEC mode, press <b>Ctrl-Z</b> or enter <b>end</b> .	Use this mode to configure VLAN parameters. When VTP mode is transparent, you can create extended-range VLANs (VLAN IDs greater than 1005) and save configurations in the switch startup configuration file.
Interface configuration	While in global configuration mode, enter the <b>interface</b> command (with a specific interface).	Device (config-if) #	To exit to global configuration mode, enter <b>exit</b> .  To return to privileged EXEC mode, press <b>Ctrl-Z</b> or enter <b>end</b> .	Use this mode to configure parameters for the Ethernet ports.
Line configuration	While in global configuration mode, specify a line with the <b>line vty</b> or <b>line console</b> command.	Device (config-line) #	To exit to global configuration mode, enter <b>exit</b> .  To return to privileged EXEC mode, press <b>Ctrl-Z</b> or enter <b>end</b> .	Use this mode to configure parameters for the terminal line.

For more detailed information on the command modes, see the command reference guide for this release.

## Understanding the Help System

You can enter a question mark (?) at the system prompt to display a list of commands available for each command mode. You can also obtain a list of associated keywords and arguments for any command.

Table 2: Help Summary

Command	Purpose
<b>help</b>	Obtains a brief description of the help system in any command mode.
<i>abbreviated-command-entry ?</i>  Device# <b>di?</b> dir disable disconnect	Obtains a list of commands that begin with a particular character string.
<i>abbreviated-command-entry &lt;Tab&gt;</i>  Device# <b>sh conf&lt;tab&gt;</b> Device# <b>show configuration</b>	Completes a partial command name.
<b>?</b>  Switch> <b>?</b>	Lists all commands available for a particular command mode.
<i>command ?</i>  Switch> <b>show ?</b>	Lists the associated keywords for a command.
<i>command keyword ?</i>  Device(config)# <b>cdp holdtime ?</b> <10-255> Length of time (in sec) that receiver must keep this packet	Lists the associated arguments for a keyword.

## Understanding Abbreviated Commands

You need to enter only enough characters for the switch to recognize the command as unique.

This example shows how to enter the **show configuration** privileged EXEC command in an abbreviated form:

```
Device# show conf
```

## Understanding no and default Forms of Commands

Almost every configuration command also has a **no** form. In general, use the **no** form to disable a feature or function or reverse the action of a command. For example, the **no shutdown** interface configuration command reverses the shutdown of an interface. Use the command without the keyword **no** to re-enable a disabled feature or to enable a feature that is disabled by default.

Configuration commands can also have a **default** form. The **default** form of a command returns the command setting to its default. Most commands are disabled by default, so the **default** form is the same as the **no** form. However, some commands are enabled by default and have variables set to certain default values. In these cases, the **default** command enables the command and sets variables to their default values.

## Understanding CLI Error Messages

This table lists some error messages that you might encounter while using the CLI to configure your switch.

**Table 3: Common CLI Error Messages**

Error Message	Meaning	How to Get Help
% Ambiguous command: "show con"	You did not enter enough characters for your switch to recognize the command.	Re-enter the command followed by a question mark (?) with a space between the command and the question mark.  The possible keywords that you can enter with the command appear.
% Incomplete command.	You did not enter all the keywords or values required by this command.	Re-enter the command followed by a question mark (?) with a space between the command and the question mark.  The possible keywords that you can enter with the command appear.
% Invalid input detected at '^' marker.	You entered the command incorrectly. The caret (^) marks the point of the error.	Enter a question mark (?) to display all the commands that are available in this command mode.  The possible keywords that you can enter with the command appear.

## Using Configuration Logging

You can log and view changes to the switch configuration. You can use the Configuration Change Logging and Notification feature to track changes on a per-session and per-user basis. The logger tracks each configuration command that is applied, the user who entered the command, the time that the command was entered, and the parser return code for the command. This feature includes a mechanism for asynchronous notification to registered applications whenever the configuration changes. You can choose to have the notifications sent to the syslog.



**Note** Only CLI or HTTP changes are logged.

## Using Command History

The software provides a history or record of commands that you have entered. The command history feature is particularly useful for recalling long or complex commands or entries, including access lists. You can customize this feature to suit your needs.

## Changing the Command History Buffer Size

By default, the switch records ten command lines in its history buffer. You can alter this number for a current terminal session or for all sessions on a particular line. These procedures are optional.

Beginning in privileged EXEC mode, enter this command to change the number of command lines that the switch records during the current terminal session:

```
Device# terminal history [size number-of-lines]
```

The range is from 0 to 256.

Beginning in line configuration mode, enter this command to configure the number of command lines the switch records for all sessions on a particular line:

```
Device (config-line)# history [size number-of-lines]
```

The range is from 0 to 256.

## Recalling Commands

To recall commands from the history buffer, perform one of the actions listed in this table. These actions are optional.



**Note** The arrow keys function only on ANSI-compatible terminals such as VT100s.

**Table 4: Recalling Commands**

Action	Result
Press <b>Ctrl-P</b> or the up arrow key.	Recalls commands in the history buffer, beginning with the most recent command. Repeat the key sequence to recall successively older commands.
Press <b>Ctrl-N</b> or the down arrow key.	Returns to more recent commands in the history buffer after recalling commands with <b>Ctrl-P</b> or the up arrow key. Repeat the key sequence to recall successively more recent commands.
<b>show history</b>  Device (config)# <b>help</b>	While in privileged EXEC mode, lists the last several commands that you just entered. The number of commands that appear is controlled by the setting of the <b>terminal history</b> global configuration command and the <b>history</b> line configuration command.

## Disabling the Command History Feature

The command history feature is automatically enabled. You can disable it for the current terminal session or for the command line. These procedures are optional.

To disable the feature during the current terminal session, enter the **terminal no history** privileged EXEC command.

To disable command history for the line, enter the **no history** line configuration command.

## Using Editing Features

This section describes the editing features that can help you manipulate the command line.

### Enabling and Disabling Editing Features

Although enhanced editing mode is automatically enabled, you can disable it, re-enable it, or configure a specific line to have enhanced editing. These procedures are optional.

To globally disable enhanced editing mode, enter this command in line configuration mode:

```
Switch (config-line)# no editing
```

To re-enable the enhanced editing mode for the current terminal session, enter this command in privileged EXEC mode:

```
Device# terminal editing
```

To reconfigure a specific line to have enhanced editing mode, enter this command in line configuration mode:

```
Device(config-line)# editing
```

### Editing Commands through Keystrokes

This table shows the keystrokes that you need to edit command lines. These keystrokes are optional.



**Note** The arrow keys function only on ANSI-compatible terminals such as VT100s.

*Table 5: Editing Commands through Keystrokes*

Capability	Keystroke	Purpose
Move around the command line to make changes or corrections.	Press <b>Ctrl-B</b> , or press the left arrow key.	Moves the cursor back one character.

Capability	Keystroke	Purpose
	Press <b>Ctrl-F</b> , or press the right arrow key.	Moves the cursor forward one character.
	Press <b>Ctrl-A</b> .	Moves the cursor to the beginning of the command line.
	Press <b>Ctrl-E</b> .	Moves the cursor to the end of the command line.
	Press <b>Esc B</b> .	Moves the cursor back one word.
	Press <b>Esc F</b> .	Moves the cursor forward one word.
	Press <b>Ctrl-T</b> .	Transposes the character to the left of the cursor with the character located at the cursor.
Recall commands from the buffer and paste them in the command line. The switch provides a buffer with the last ten items that you deleted.	Press <b>Ctrl-Y</b> .	Recalls the most recent entry in the buffer.
	Press <b>Esc Y</b> .	Recalls the next buffer entry.  The buffer contains only the last 10 items that you have deleted or cut. If you press <b>Esc Y</b> more than ten times, you cycle to the first buffer entry.
Delete entries if you make a mistake or change your mind.	Press the <b>Delete</b> or <b>Backspace</b> key.	Erases the character to the left of the cursor.
	Press <b>Ctrl-D</b> .	Deletes the character at the cursor.
	Press <b>Ctrl-K</b> .	Deletes all characters from the cursor to the end of the command line.
	Press <b>Ctrl-U</b> or <b>Ctrl-X</b> .	Deletes all characters from the cursor to the beginning of the command line.
	Press <b>Ctrl-W</b> .	Deletes the word to the left of the cursor.
	Press <b>Esc D</b> .	Deletes from the cursor to the end of the word.
Capitalize or lowercase words or capitalize a set of letters.	Press <b>Esc C</b> .	Capitalizes at the cursor.
	Press <b>Esc L</b> .	Changes the word at the cursor to lowercase.
	Press <b>Esc U</b> .	Capitalizes letters from the cursor to the end of the word.



Capability	Keystroke	Purpose
Designate a particular keystroke as an executable command, perhaps as a shortcut.	Press <b>Ctrl-V</b> or <b>Esc Q</b> .	
Scroll down a line or screen on displays that are longer than the terminal screen can display.  <b>Note</b> The More prompt is used for any output that has more lines than can be displayed on the terminal screen, including <b>show</b> command output. You can use the <b>Return</b> and <b>Space</b> bar keystrokes whenever you see the More prompt.	Press the <b>Return</b> key.	Scrolls down one line.
	Press the <b>Space</b> bar.	Scrolls down one screen.
Redisplay the current command line if the switch suddenly sends a message to your screen.	Press <b>Ctrl-L</b> or <b>Ctrl-R</b> .	Redisplays the current command line.

## Editing Command Lines that Wrap

You can use a wraparound feature for commands that extend beyond a single line on the screen. When the cursor reaches the right margin, the command line shifts ten spaces to the left. You cannot see the first ten characters of the line, but you can scroll back and check the syntax at the beginning of the command. The keystroke actions are optional.

To scroll back to the beginning of the command entry, press **Ctrl-B** or the left arrow key repeatedly. You can also press **Ctrl-A** to immediately move to the beginning of the line.



**Note** The arrow keys function only on ANSI-compatible terminals such as VT100s.

In this example, the **access-list** global configuration command entry extends beyond one line. When the cursor first reaches the end of the line, the line is shifted ten spaces to the left and redisplayed. The dollar sign (\$) shows that the line has been scrolled to the left. Each time the cursor reaches the end of the line, the line is again shifted ten spaces to the left.

```
Device(config)# access-list 101 permit tcp 131.108.2.5 255.255.255.0 131.108.1
Device(config)# $ 101 permit tcp 131.108.2.5 255.255.255.0 131.108.1.20 255.25
Device(config)# $t tcp 131.108.2.5 255.255.255.0 131.108.1.20 255.255.255.0 eq
Device(config)# $108.2.5 255.255.255.0 131.108.1.20 255.255.255.0 eq 45
```

After you complete the entry, press **Ctrl-A** to check the complete syntax before pressing the **Return** key to execute the command. The dollar sign (\$) appears at the end of the line to show that the line has been scrolled to the right:

```
Device(config)# access-list 101 permit tcp 131.108.2.5 255.255.255.0 131.108.1$
```

The software assumes that you have a terminal screen that is 80 columns wide. If you have a width other than that, use the **terminal width** privileged EXEC command to set the width of your terminal.

Use line wrapping with the command history feature to recall and modify previous complex command entries.

## Searching and Filtering Output of show and more Commands

You can search and filter the output for **show** and **more** commands. This is useful when you need to sort through large amounts of output or if you want to exclude output that you do not need to see. Using these commands is optional.

To use this functionality, enter a **show** or **more** command followed by the pipe character (|), one of the keywords **begin**, **include**, or **exclude**, and an expression that you want to search for or filter out:

```
command | {begin | include | exclude} regular-expression
```

Expressions are case sensitive. For example, if you enter | **exclude output**, the lines that contain *output* are not displayed, but the lines that contain *Output* appear.

This example shows how to include in the output display only lines where the expression *protocol* appears:

```
Device# show interfaces | include protocol
Vlan1 is up, line protocol is up
Vlan10 is up, line protocol is down
GigabitEthernet1/0/1 is up, line protocol is down
GigabitEthernet1/0/2 is up, line protocol is up
```

## Accessing the CLI

You can access the CLI through a console connection, through Telnet, or by using the browser.

You manage the switch stack and the switch member interfaces through the active switch. You cannot manage switch stack members on an individual switch basis. You can connect to the active switch through the console port or the Ethernet management port of one or more switch members. Be careful with using multiple CLI sessions to the active switch. Commands you enter in one session are not displayed in the other sessions. Therefore, it is possible to lose track of the session from which you entered commands.




---

**Note** We recommend using one CLI session when managing the switch stack.

---

If you want to configure a specific switch member port, you must include the switch member number in the CLI command interface notation.

To debug a specific switch member, you can access it from the active switch by using the **session stack-member-number** privileged EXEC command. The switch member number is appended to the system prompt. For example, *Switch-2#* is the prompt in privileged EXEC mode for switch member 2, and where the

system prompt for the active switch is Switch. Only the **show** and **debug** commands are available in a CLI session to a specific switch member.

## Accessing the CLI through a Console Connection or through Telnet

Before you can access the CLI, you must connect a terminal or a PC to the switch console or connect a PC to the Ethernet management port and then power on the switch, as described in the hardware installation guide that shipped with your switch.

CLI access is available before switch setup. After your switch is configured, you can access the CLI through a remote Telnet session or SSH client.

You can use one of these methods to establish a connection with the switch:

- Connect the switch console port to a management station or dial-up modem, or connect the Ethernet management port to a PC. For information about connecting to the console or Ethernet management port, see the switch hardware installation guide.
- Use any Telnet TCP/IP or encrypted Secure Shell (SSH) package from a remote management station. The switch must have network connectivity with the Telnet or SSH client, and the switch must have an enable secret password configured.

The switch supports up to 16 simultaneous Telnet sessions. Changes made by one Telnet user are reflected in all other Telnet sessions.

The switch supports up to five simultaneous secure SSH sessions.

After you connect through the console port, through the Ethernet management port, through a Telnet session or through an SSH session, the user EXEC prompt appears on the management station.





## PART I

# High Availability

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## High Availability Commands

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# main-cpu

To enter the redundancy main configuration submode and enable the standby switch, use the **main-cpu** command in redundancy configuration mode.

## main-cpu

<b>Syntax Description</b>	This command has no arguments or keywords.
---------------------------	--

<b>Command Default</b>	None
------------------------	------

<b>Command Modes</b>	Redundancy configuration (config-red)
----------------------	---------------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	From the redundancy main configuration submode, use the <b>standby console enable</b> command to enable the standby switch.
-------------------------	---

This example shows how to enter the redundancy main configuration submode and enable the standby switch:

```
Device(config)# redundancy
Device(config-red)# main-cpu
Device(config-r-mc)# standby console enable
Device#
```



# mode sso

To set the redundancy mode to stateful switchover (SSO), use the **mode sso** command in redundancy configuration mode.

**mode sso**

<b>Syntax Description</b>	This command has no arguments or keywords.
---------------------------	--

<b>Command Default</b>	None
------------------------	------

<b>Command Modes</b>	Redundancy configuration
----------------------	--------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **mode sso** command can be entered only from within redundancy configuration mode.

Follow these guidelines when configuring your system to SSO mode:

- You must use identical Cisco IOS images on the switches in the stack to support SSO mode. Redundancy may not work due to differences between the Cisco IOS releases.
- If you perform an online insertion and removal (OIR) of the module, the switch resets during the stateful switchover and the port states are restarted only if the module is in a transient state (any state other than Ready).
- The forwarding information base (FIB) tables are cleared on a switchover. Routed traffic is interrupted until route tables reconverge.

This example shows how to set the redundancy mode to SSO:

```
Device(config)# redundancy
Device(config-red) # mode sso
Device(config-red) #
```

## policy config-sync prc reload

To reload the standby switch if a parser return code (PRC) failure occurs during configuration synchronization, use the **policy config-sync reload** command in redundancy configuration mode. To specify that the standby switch is not reloaded if a parser return code (PRC) failure occurs, use the **no** form of this command.

```
policy config-sync bulk | lbl prc reload
no policy config-sync bulk | lbl prc reload
```

<b>Syntax Description</b>	<b>bulk</b> Specifies bulk configuration mode.				
	<b>lbl</b> Specifies line-by-line (lbl) configuration mode.				
<b>Command Default</b>	The command is enabled by default.				
<b>Command Modes</b>	Redundancy configuration (config-red)				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

This example shows how to specify that the standby switch is not reloaded if a parser return code (PRC) failure occurs during configuration synchronization:

```
Device(config-red)# no policy config-sync bulk prc reload
```

# redundancy

To enter redundancy configuration mode, use the **redundancy** command in global configuration mode.

## redundancy

**Syntax Description** This command has no arguments or keywords.

**Command Default** None

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The redundancy configuration mode is used to enter the main CPU submode, which is used to enable the standby switch.

To enter the main CPU submode, use the **main-cpu** command while in redundancy configuration mode.

From the main CPU submode, use the **standby console enable** command to enable the standby switch.

Use the **exit** command to exit redundancy configuration mode.

This example shows how to enter redundancy configuration mode:

```
Device(config)# redundancy
Device(config-red)#
```

This example shows how to enter the main CPU submode:

```
Device(config)# redundancy
Device(config-red)# main-cpu
Device(config-r-mc)#
```

## Related Commands

Command	Description
<b>show redundancy</b>	Displays redundancy facility information.

# reload

To reload the stack member and to apply a configuration change, use the **reload** command in privileged EXEC mode.

**reload** [/noverify | /verify] [*LINE* | **at** | **cancel** | **in** | **slot** *stack-member-number* | **standby-cpu**]

Syntax Description		
<b>/noverify</b>	(Optional)	Specifies to not verify the file signature before the reload.
<b>/verify</b>	(Optional)	Verifies the file signature before the reload.
<i>LINE</i>	(Optional)	Reason for the reload.
<b>at</b>	(Optional)	Specifies the time in hh:mm for the reload to occur.
<b>cancel</b>	(Optional)	Cancels the pending reload.
<b>in</b>	(Optional)	Specifies a time interval for reloads to occur.
<b>slot</b>	(Optional)	Saves the changes on the specified stack member and then restarts it.
<i>stack-member-number</i>	(Optional)	Stack member number on which to save the changes. The range is 1 to 9.
<b>standby-cpu</b>	(Optional)	Reloads the standby route processor (RP).

**Command Default** Immediately reloads the stack member and puts a configuration change into effect.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** If there is more than one switch in the switch stack, and you enter the **reload slot** *stack-member-number* command, you are not prompted to save the configuration.

## Examples

This example shows how to reload the switch stack:

```
Device# reload
System configuration has been modified. Save? [yes/no]: yes
Reload command is being issued on Active unit, this will reload the whole stack
Proceed with reload? [confirm] yes
```

This example shows how to reload a specific stack member:

```
Device# reload slot 6
Proceed with reload? [confirm] y
```

This example shows how to reload a single-switch switch stack (there is only one member switch):

```
Device# reload slot 3
System configuration has been modified. Save? [yes/no]: y
Proceed to reload the whole Stack? [confirm] y
```

# show redundancy

To display redundancy facility information, use the **show redundancy** command in privileged EXEC mode

**show redundancy** [**clients** | **config-sync** | **counters** | **history** [**reload** | **reverse**] | **slaves**[*slave-name*]  
**clients** | **counters** | **states** | **switchover history** [**domain default**]]

Syntax Description	
<b>clients</b>	(Optional) Displays information about the redundancy facility client.
<b>config-sync</b>	(Optional) Displays a configuration synchronization failure or the ignored mismatched command list (MCL).
<b>counters</b>	(Optional) Displays information about the redundancy facility counter.
<b>history</b>	(Optional) Displays a log of past status and related information for the redundancy facility.
<b>history reload</b>	(Optional) Displays a log of past reload information for the redundancy facility.
<b>history reverse</b>	(Optional) Displays a reverse log of past status and related information for the redundancy facility.
<b>slaves</b>	(Optional) Displays all standby switches in the redundancy facility.
<i>slave-name</i>	(Optional) The name of the redundancy facility standby switch to display specific information for. Enter additional keywords to display all clients or counters in the specified standby switch.
<b>clients</b>	Displays all redundancy facility clients in the specified secondary switch.
<b>counters</b>	Displays all counters in the specified standby switch.
<b>states</b>	(Optional) Displays information about the redundancy facility state, such as disabled, initialization, standby or active.
<b>switchover history</b>	(Optional) Displays information about the redundancy facility switchover history.
<b>domain default</b>	(Optional) Displays the default domain as the domain to display switchover history for.

**Command Default** None

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This example shows how to display information about the redundancy facility:

```
Device# show redundancy
```

```

Redundant System Information :
-----
    Available system uptime = 6 days, 5 hours, 28 minutes
Switchovers system experienced = 0
    Standby failures = 0
    Last switchover reason = none

    Hardware Mode = Duplex
Configured Redundancy Mode = sso
Operating Redundancy Mode = sso
Maintenance Mode = Disabled
Communications = Up

Current Processor Information :
-----
    Active Location = slot 5
    Current Software state = ACTIVE
    Uptime in current state = 6 days, 5 hours, 28 minutes
    Image Version = Cisco IOS Software, Catalyst L3 Switch Software
(CAT9K_IOSXE), Experimental Version 16.x.x [S2C-build-v16x_throttle-4064-/
nobackup/mcpre/BLD-BLD_V16x_THROTTLE_LATEST 102]
Copyright (c) 1986-201x by Cisco Systems, Inc.
Compiled Mon 07-Oct-xx 03:57 by mcpre
    BOOT = bootflash:packages.conf;
Configuration register = 0x102

Peer Processor Information :
-----
    Standby Location = slot 6
    Current Software state = STANDBY HOT
    Uptime in current state = 6 days, 5 hours, 25 minutes
    Image Version = Cisco IOS Software, Catalyst L3 Switch Software
(CAT9K_IOSXE), Experimental Version 16.x.x [S2C-build-v16x_throttle-4064-/
nobackup/mcpre/BLD-BLD_V16x_THROTTLE_LATEST_20191007_000645 102]
Copyright (c) 1986-201x by Cisco Systems, Inc.
Compiled Mon 07-Oct-xx 03:57 by mcpre
    BOOT = bootflash:packages.conf;
CONFIG_FILE =
Configuration register = 0x102
Device#

```

This example shows how to display redundancy facility client information:

```
Device# show redundancy clients
```

```

Group ID =      1
clientID = 29      clientSeq = 60      Redundancy Mode RF
clientID = 139     clientSeq = 62      IfIndex
clientID = 25      clientSeq = 71      CHKPT RF
clientID = 10001   clientSeq = 85      QEMU Platform RF
clientID = 77      clientSeq = 87      Event Manager
clientID = 1340    clientSeq = 104     RP Platform RF
clientID = 1501    clientSeq = 105     CWAN HA
clientID = 78      clientSeq = 109     TSPTUN HA
clientID = 305     clientSeq = 110     Multicast ISSU Consolidation RF
clientID = 304     clientSeq = 111     IP multicast RF Client
clientID = 22      clientSeq = 112     Network RF Client
clientID = 88      clientSeq = 113     HSRP
clientID = 114     clientSeq = 114     GLBP
clientID = 225     clientSeq = 115     VRRP
clientID = 4700    clientSeq = 118     COND_DEBUG RF
clientID = 1341    clientSeq = 119     IOSXE DPIDX
clientID = 1505    clientSeq = 120     IOSXE SPA TSM
clientID = 75      clientSeq = 130     Tableid HA

```

```
clientID = 501      clientSeq = 137      LAN-Switch VTP VLAN
```

<output truncated>

The output displays the following information:

- clientID displays the client's ID number.
- clientSeq displays the client's notification sequence number.
- Current redundancy facility state.

This example shows how to display the redundancy facility counter information:

```
Device# show redundancy counters
```

```
Redundancy Facility OMs
  comm link up = 0
  comm link down = 0

  invalid client tx = 0
  null tx by client = 0
  tx failures = 0
  tx msg length invalid = 0

  client not rxing msgs = 0
  rx peer msg routing errors = 0
  null peer msg rx = 0
  errored peer msg rx = 0

  buffers tx = 135884
  tx buffers unavailable = 0
  buffers rx = 135109
  buffer release errors = 0

  duplicate client registers = 0
  failed to register client = 0
  Invalid client syncs = 0
```

```
Device#
```

This example shows how to display redundancy facility history information:

```
Device# show redundancy history
```

```
00:00:04 client added: Redundancy Mode RF(29) seq=60
00:00:04 client added: IfIndex(139) seq=62
00:00:04 client added: CHKPT RF(25) seq=71
00:00:04 client added: QEMU Platform RF(10001) seq=85
00:00:04 client added: Event Manager(77) seq=87
00:00:04 client added: RP Platform RF(1340) seq=104
00:00:04 client added: CWAN HA(1501) seq=105
00:00:04 client added: Network RF Client(22) seq=112
00:00:04 client added: IOSXE SPA TSM(1505) seq=120
00:00:04 client added: LAN-Switch VTP VLAN(501) seq=137
00:00:04 client added: XDR RRP RF Client(71) seq=139
00:00:04 client added: CEF RRP RF Client(24) seq=140
00:00:04 client added: MFIB RRP RF Client(306) seq=150
00:00:04 client added: RFS RF(520) seq=163
00:00:04 client added: klib(33014) seq=167
00:00:04 client added: Config Sync RF client(5) seq=168
00:00:04 client added: NGWC FEC Rf client(10007) seq=173
00:00:04 client added: LAN-Switch Port Manager(502) seq=190
00:00:04 client added: Access Tunnel(530) seq=192
```



```
00:00:04 client added: Mac address Table Manager(519) seq=193
00:00:04 client added: DHCPD(100) seq=238
00:00:04 client added: DHCPD(101) seq=239
00:00:04 client added: SNMP RF Client(34) seq=251
00:00:04 client added: CWAN APS HA RF Client(1502) seq=252
00:00:04 client added: History RF Client(35) seq=261
```

<output truncated>

This example shows how to display information about the redundancy facility standby switches:

```
Device# show redundancy slaves
```

```
Group ID = 1
Slave/Process ID = 6107 Slave Name = [installer]
Slave/Process ID = 6109 Slave Name = [eicored]
Slave/Process ID = 6128 Slave Name = [snmp_subagent]
Slave/Process ID = 8897 Slave Name = [wcm]
Slave/Process ID = 8898 Slave Name = [table_mgr]
Slave/Process ID = 8901 Slave Name = [iosd]
```

```
Device#
```

This example shows how to display information about the redundancy facility state:

```
Device# show redundancy states
```

```
my state = 13 -ACTIVE
peer state = 8 -STANDBY HOT
  Mode = Duplex
  Unit = Primary
  Unit ID = 5

Redundancy Mode (Operational) = sso
Redundancy Mode (Configured) = sso
Redundancy State = sso
  Maintenance Mode = Disabled
  Manual Swact = enabled
  Communications = Up

  client count = 115
  client_notification_TMR = 30000 milliseconds
  RF debug mask = 0x0

Device#
```

## show redundancy config-sync

To display a configuration synchronization failure or the ignored mismatched command list (MCL), if any, use the **show redundancy config-sync** command in EXEC mode.

**show redundancy config-sync failures bem | mcl | prc ignored failures mcl**

Syntax Description	failures	Displays MCL entries or best effort method (BEM)/Parser Return Code (PRC) failures.
	<b>bem</b>	Displays a BEM failed command list, and forces the standby switch to reboot.
	<b>mcl</b>	Displays commands that exist in the switch's running configuration but are not supported by the image on the standby switch, and forces the standby switch to reboot.
	<b>prc</b>	Displays a PRC failed command list and forces the standby switch to reboot.
	<b>ignored failures mcl</b>	Displays the ignored MCL failures.

**Command Default** None

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** When two versions of Cisco IOS images are involved, the command sets supported by two images might differ. If any of those mismatched commands are executed on the active switch, the standby switch might not recognize those commands, which causes a configuration mismatch condition. If the syntax check for the command fails on the standby switch during a bulk synchronization, the command is moved into the MCL and the standby switch is reset. To display all the mismatched commands, use the **show redundancy config-sync failures mcl** command.

To clean the MCL, follow these steps:

1. Remove all mismatched commands from the active switch's running configuration.
2. Revalidate the MCL with a modified running configuration by using the **redundancy config-sync validate mismatched-commands** command.
3. Reload the standby switch.

Alternatively, you could ignore the MCL by following these steps:

1. Enter the **redundancy config-sync ignore mismatched-commands** command.
2. Reload the standby switch; the system transitions to SSO mode.



---

**Note** If you ignore the mismatched commands, the out-of-synchronization configuration on the active switch and the standby switch still exists.

---

3. You can verify the ignored MCL with the **show redundancy config-sync ignored mcl** command.

Each command sets a return code in the action function that implements the command. This return code indicates whether or not the command successfully executes. The active switch maintains the PRC after executing a command. The standby switch executes the command and sends the PRC back to the active switch. A PRC failure occurs if these two PRCs do not match. If a PRC error occurs at the standby switch either during bulk synchronization or line-by-line (LBL) synchronization, the standby switch is reset. To display all PRC failures, use the **show redundancy config-sync failures prc** command.

To display best effort method (BEM) errors, use the **show redundancy config-sync failures bem** command.

This example shows how to display the BEM failures:

```
Device> show redundancy config-sync failures bem
BEM Failed Command List
-----

The list is Empty
```

This example shows how to display the MCL failures:

```
Device> show redundancy config-sync failures mcl
Mismatched Command List
-----

The list is Empty
```

This example shows how to display the PRC failures:

```
Device# show redundancy config-sync failures prc
PRC Failed Command List
-----

The list is Empty
```

# standby console enable

To enable access to the standby console switch, use the **standby console enable** command in redundancy main configuration submode. To disable access to the standby console switch, use the **no** form of this command.

**standby console enable**  
**no standby console enable**

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** Access to the standby console switch is disabled.

---

**Command Modes** Redundancy main configuration submode

---

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

**Usage Guidelines** This command is used to collect and review specific data about the standby console. The command is useful primarily for Cisco technical support representatives troubleshooting the switch.

This example shows how to enter the redundancy main configuration submode and enable access to the standby console switch:

```
Device(config)# redundancy
Device(config-red)# main-cpu
Device(config-r-mc)# standby console enable
Device(config-r-mc)#
```



## Graceful Insertion and Removal

---

- [maintenance-template](#), on page 30
- [router routing protocol shutdown l2](#), on page 31
- [start maintenance](#), on page 32
- [stop maintenance](#), on page 33
- [system mode maintenance](#), on page 34

# maintenance-template

To create a maintenance template, use the **maintenance-template** *template\_name* command in the global configuration mode. To delete the template, use the **no** form of the command.

**maintenance-template** *template\_name*

**no maintenance-template** *template\_name*

<b>Syntax Description</b>	<b>maintenance-template</b>	Creates a template for GIR with a specific name.
	<i>template_name</i>	Name of the maintenance template.
<b>Command Default</b>	Disabled.	
<b>Command Modes</b>	Global configuration (config)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.6.1	This command was introduced.

## Example:

The following example shows how to configure a maintenance template with the name g1:

```
Device(config)# maintenance template g1
```

## router routing protocol shutdown l2

To create instances that should be isolated within a maintenance template, use the **router** *routing\_protocol instance\_id* | **shutdown l2** command in the maintenance template configuration mode. To delete the instance, use the **no** form of the command.

```
{ router routing_protocol instance_id | shutdown l2 }
no { router routing_protocol instance_id | shutdown l2 }
```

Syntax Description	router	Configures instance associated with routing protocol.
	<i>routing_protocol</i>	Routing protocol defined for the template.
	<i>instance_id</i>	Instance ID associated with the routing protocol.
	<b>shutdown l2</b>	Configures instance to shut down layer 2 interfaces.
Command Default	Disabled.	
Command Modes	Maintenance template configuration (config-maintenance-temp)	
Command History	Release	Modification
	Cisco IOS XE Everest 16.6.1	This command was introduced.

### Example:

The following example shows how to create an instance for ISIS with an instance ID of one under maintenance template temp1:

```
Device(config)# maintenance template g1
Device(config-maintenance-templ)# router isis 1
```

The following example shows how to create an instance for shutting down layer 2 interfaces under maintenance template g1:

```
Device(config)# maintenance template g1
Device(config-maintenance-templ)# shutdown l2
```

# start maintenance

To put the system into maintenance mode, use the **start maintenance** command in the privileged EXEC mode.

**start maintenance**

<b>Syntax Description</b>	<b>start maintenance</b>	Puts the system into maintenance mode.
<b>Command Default</b>	Disabled.	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.6.1	This command was introduced.

## Example:

The following example shows how to start maintenance mode:

```
Device# start maintenance
```



# stop maintenance

To put the system out of maintenance mode, use the **stop maintenance** command in the privileged EXEC mode.

## **stop maintenance**

---

**Command Default**

Disabled.

---

**Command Modes**

Privileged EXEC

---

**Command History**

---

<b>Release</b>	<b>Modification</b>
Cisco IOS XE Everest 16.6.1	This command was introduced.

---

### **Example:**

The following example shows how to stop maintenance mode:

```
Device# stop maintenance
```

# system mode maintenance

To enter the system mode maintenance configuration mode, use the **system mode maintenance** command in the global configuration mode.

**system mode maintenance**

<b>Syntax Description</b>	<b>system mode maintenance</b>	Enters the maintenance configuration mode.
<b>Command Default</b>	Disabled.	
<b>Command Modes</b>	Global configuration (config)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.6.1	This command was introduced.

## Example:

The following example shows how to enter the maintenance configuration mode:

```
Device(config)# system mode maintenance
Device(config-maintenance)#
```



## StackWise Virtual Commands

---

- [stackwise-virtual](#), on page 36
- [domain id](#), on page 37
- [dual-active detection pagp](#), on page 38
- [stackwise-virtual link](#) , on page 39
- [stackwise-virtual dual-active-detection](#), on page 40
- [show stackwise-virtual](#), on page 41

# stackwise-virtual

To enable Cisco StackWise Virtual on a switch, use the **stackwise-virtual** command in the global configuration mode. To disable Cisco StackWise Virtual, use the **no** form of this command.

**stackwise-virtual**  
**no stackwise-virtual**

<b>Syntax Description</b>	<b>stackwise-virtual</b>	Enables Cisco StackWise Virtual.
<b>Command Default</b>	Disabled.	
<b>Command Modes</b>	Global configuration (config)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.6.1	This command was introduced.
<b>Usage Guidelines</b>	After disabling Cisco StackWise Virtual, the switches must be reloaded to unstack them.	

## Example

The following example shows how to enable Cisco StackWise Virtual :

```
Device(config)# stackwise-virtual
```

# domain id

To configure Cisco StackWise Virtual domain ID on a switch, use the **domain id** command in the StackWise Virtual configuration mode. To disable, use the **no** form of this command.

**domain id**  
**no domain id**

<b>Syntax Description</b>	<b>domain</b>	Associates StackWise Virtual configuration with a specific domain.
	<i>id</i>	Value of the domain ID. The range is from 1 to 255. The default is one.
<b>Command Default</b>	No domain ID is configured.	
<b>Command Modes</b>	StackWise Virtual configuration (config-stackwise-virtual)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.6.1	This command was introduced.
<b>Usage Guidelines</b>	This command is optional. You must enable Stackwise Virtual, using the <b>stackwise-virtual</b> command, before configuring the domain ID.	

## Example

The following example shows how to enable Cisco StackWise Virtual and configure a domain ID:

```
Device(config)# stackwise-virtual
Device(config-stackwise-virtual)#domain 2
```

## dual-active detection pagp

To enable PAgP dual-active detection, use the **dual-active detection pagp** command in the StackWise Virtual configuration mode. To disable PAgP dual-active detection, use the **no** form of the command.

**dual-active detection pagp**  
**no dual-active detection pagp**

<b>Syntax Description</b>	<b>dual-active detection pagp</b>	Enables pagp dual-active detection.
<b>Command Default</b>	Enabled.	
<b>Command Modes</b>	StackWise Virtual configuration (config-stackwise-virtual)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.6.1	This command was introduced.

### Example:

The following example shows how to enable PAgP dual-active detection trust mode on channel-group:

```
Device(config)# stackwise-virtual
Device(config-stackwise-virtual)#dual-active detection pagp
Device(config-stackwise-virtual)#dual-active detection pagp trust channel-group 1
```

## stackwise-virtual link

To associate an interface with configured StackWise Virtual link, use the **stackwise-virtual link** command in the interface configuration mode. To disassociate the interface, use the **no** form of the command.

**stackwise-virtual link** *link-value*  
**no stackwise-virtual link** *link-value*

<b>Syntax Description</b>	<b>stackwise-virtual link</b>	Associates a 10-G or 40-G interface to StackWise Virtual link.
	<i>link value</i>	Domain ID configured for Cisco StackWise Virtual.
<b>Command Default</b>	Disabled.	
<b>Command Modes</b>	Interface configuration (config-if).	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.6.1	This command was introduced.

### Example:

This example shows how to associate a 40 Gigabit Ethernet interface with configured Stackwise Virtual Link (SVL):

```
Device(config)# interface FortyGigabitEthernet1/1/1
Device(config-if)#stackwise-virtual link 1
```

# stackwise-virtual dual-active-detection

To configure an interface as dual-active-detection link, use the **stackwise-virtual dual-active-detection** command in the interface configuration mode. To disassociate the interface, use the **no** form of the command.

**stackwise-virtual dual-active-detection**  
**no stackwise-virtual dual-active-detection**

<b>Syntax Description</b>	<b>stackwise-virtual dual-active-detection</b>	Enables Cisco StackWise Virtual dual-active-detection for the specified 10-G or 40-G interface.
<b>Command Default</b>	Disabled.	
<b>Command Modes</b>	Interface configuration (config-if)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.6.1	This command was introduced.

## Example:

The following example shows how to configure a 10 Gigabit Ethernet interface as Dual-Active-Detection link:

```
Device(config)# interface TenGigabitEthernet1/0/2
Device(config-if)#stackwise-virtual dual-active-detection
```



# show stackwise-virtual

To display your Cisco StackWise Virtual configuration information, use the **show stackwise-virtual** command.

```
show stackwise-virtual { [switch [switch number <1-2>] link | bandwidth | neighbors | dual-active-detection }
```

Syntax Description		
	<b>switch</b> <i>number</i>	(Optional) Displays information of a particular switch in the stack.
	<b>link</b>	Displays Stackwise Virtual link information.
	<b>bandwidth</b>	Displays bandwidth availability for StackWise Virtual.
	<b>neighbors</b>	Displays Stackwise Virtual neighbors.
	<b>dual-active-detection</b>	Displays Stackwise-Virtual dual-active-detection information.

**Command Default** None

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.6.1	This command was introduced.

## Example:

The following is a sample output from the **show stackwise-virtual** command:

```
Device# show stackwise-virtual

Stackwise Virtual: <Enabled/Disabled>
Domain Number:    <Domain Number>
Switch    Stackwise Virtual Link    Ports
-----
1          1                                Tengigabitethernet1/0/4
           2                                Tengigabitethernet1/0/5
2          1                                Tengigabitethernet2/0/4
           2                                Tengigabitethernet2/0/5
```

The following is a sample output from the **show stackwise-virtual link** command:

```
Device# show stackwise-virtual link

Stackwise Virtual Link (SVL) Information:
-----
Flags:
```

```

-----
Link Status
-----
U-Up D-Down
Protocol Status
-----
S-Suspended P-Pending E-Error T-Timeout R-Ready
-----
Switch    SVL      Ports                                Link-Status  Protocol-Status
-----
1         1        FortyGigabitEthernet1/1/1          U             R
2         1        FortyGigabitEthernet2/1/1          U             R

```

The following is a sample output from the **show stackwise-virtual bandwidth** command:

```
Device# show stackwise-virtual bandwidth
```

```
Switch  Bandwidth
1              160
2              160
```

The following is a sample output from the **show stackwise-virtual neighbors** command:

```
Device#show stackwise-virtual neighbors
```

```
Switch Number      Local Interface          Remote Interface
1                  Tengigabitethernet1/0/1  Tengigabitethernet2/0/1
                  Tengigabitethernet1/0/2  Tengigabitethernet2/0/2
2                  Tengigabitethernet2/0/1  Tengigabitethernet1/0/1
                  Tengigabitethernet2/0/2  Tengigabitethernet2/0/2
```

The following is a sample output from the **show stackwise-virtual dual-active-detection** command:

```
Device#show stackwise-virtual dual-active-detection
```

```
Stackwise Virtual Dual-Active-Detection (DAD) Configuration:
Switch Number      Dual-Active-Detection Interface
```

```
1                  Tengigabitethernet1/0/10
                  Tengigabitethernet1/0/11
2                  Tengigabitethernet2/0/12
                  Tengigabitethernet2/0/13
```

```
Stackwise Virtual Dual-Active-Detection (DAD) Configuration After Reboot:
Switch Number      Dual-Active-Detection Interface
```

```
1                  Tengigabitethernet1/0/10
                  Tengigabitethernet1/0/11
2                  Tengigabitethernet2/0/12
                  Tengigabitethernet2/0/13
```



## PART II

# Interface and Hardware Components

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## Interface and Hardware Commands

---

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# debug ilpower

To enable debugging of the power controller and Power over Ethernet (PoE) system, use the **debug ilpower** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

**debug ilpower** **cdp** | **event** | **ha** | **ipc** | **police** | **port** | **powerman** | **registries** | **scp** | **sense** | **upoe**  
**no debug ilpower** **cdp** | **event** | **ha** | **ipc** | **police** | **port** | **powerman** | **registries** | **scp** | **sense** | **upoe**

Syntax Description	
<b>cdp</b>	Displays PoE Cisco Discovery Protocol (CDP) debug messages.
<b>event</b>	Displays PoE event debug messages.
<b>ha</b>	Displays PoE high-availability messages.
<b>ipc</b>	Displays PoE Inter-Process Communication (IPC) debug messages.
<b>police</b>	Displays PoE police debug messages.
<b>port</b>	Displays PoE port manager debug messages.
<b>powerman</b>	Displays PoE power management debug messages.
<b>registries</b>	Displays PoE registries debug messages.
<b>scp</b>	Displays PoE SCP debug messages.
<b>sense</b>	Displays PoE sense debug messages.
<b>upoe</b>	Displays Cisco UPOE debug messages.

**Command Default** Debugging is disabled.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command is supported only on PoE-capable switches.

When you enable debugging on a switch stack, it is enabled only on the active switch. To enable debugging on a member switch, you can start a session from the active switch by using the **session** *switch-number* EXEC command. Then enter the **debug** command at the command-line prompt of the member switch. You also can use the **remote command** *stack-member-number* *LINE* EXEC command on the active switch to enable debugging on a member switch without first starting a session.

# debug interface

To enable debugging of interface-related activities, use the **debug interface** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

```
debug interface interface-id | counters exceptions | protocol memory | null interface-number |
port-channel port-channel-number | states | vlan vlan-id
no debug interface interface-id | counters exceptions | protocol memory | null interface-number |
port-channel port-channel-number | states | vlan vlan-id
```

## Syntax Description

<i>interface-id</i>	ID of the physical interface. Displays debug messages for the specified physical port, identified by type switch number/module number/port, for example, gigabitethernet 1/0/2.
<b>null</b> <i>interface-number</i>	Displays debug messages for null interfaces. The interface number is always <b>0</b> .
<b>port-channel</b> <i>port-channel-number</i>	Displays debug messages for the specified EtherChannel port-channel interface. The <i>port-channel-number</i> range is 1 to 48.
<b>vlan</b> <i>vlan-id</i>	Displays debug messages for the specified VLAN. The vlan range is 1 to 4094.
<b>counters</b>	Displays counters debugging information.
<b>exceptions</b>	Displays debug messages when a recoverable exceptional condition occurs during the computation of the interface packet and data rate statistics.
<b>protocol memory</b>	Displays debug messages for memory operations of protocol counters.
<b>states</b>	Displays intermediary debug messages when an interface's state transitions.

## Command Default

Debugging is disabled.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

If you do not specify a keyword, all debug messages appear.

The **undebug interface** command is the same as the **no debug interface** command.

When you enable debugging on a switch stack, it is enabled only on the active switch. To enable debugging on a member switch, you can start a session from the active switch by using the **session** *switch-number* EXEC command. Then enter the **debug** command at the command-line prompt of the member switch. You also can use the **remote command** *stack-member-number* *LINE* EXEC command on the active switch to enable debugging on a member switch without first starting a session.



# debug lldp packets

To enable debugging of Link Layer Discovery Protocol (LLDP) packets, use the **debug lldp packets** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

**debug lldp packets**  
**no debug lldp packets**

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** Debugging is disabled.

---

**Command Modes** Privileged EXEC

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

**Usage Guidelines** The **undebg lldp packets** command is the same as the **no debug lldp packets** command. When you enable debugging on a switch stack, it is enabled only on the . To enable debugging on a member switch, you can start a session from the by using the **session switch-number** EXEC command.

## debug platform poe

To enable debugging of a Power over Ethernet (PoE) port, use the **debug platform poe** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

```
debug platform poe [error | info] [switch switch-number]
no debug platform poe [error | info] [switch switch-number]
```

<b>Syntax Description</b>	<b>error</b>	(Optional) Displays PoE-related error debug messages.
	<b>info</b>	(Optional) Displays PoE-related information debug messages.
	<b>switch</b> <i>switch-number</i>	(Optional) Specifies the stack member. This keyword is supported only on stacking-capable switches.
<b>Command Default</b>	Debugging is disabled.	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	The <b>undebug platform poe</b> command is the same as the <b>no debug platform poe</b> command.	

# duplex

To specify the duplex mode of operation for a port, use the **duplex** command in interface configuration mode. To return to the default value, use the **no** form of this command.

**duplex** **auto** | **full** | **half**  
**no duplex** **auto** | **full** | **half**

## Syntax Description

**auto** Enables automatic duplex configuration. The port automatically detects whether it should run in full- or half-duplex mode, depending on the attached device mode.

**full** Enables full-duplex mode.

**half** Enables half-duplex mode (only for interfaces operating at 10 or 100 Mbps). You cannot configure half-duplex mode for interfaces operating at 1000 or 10,000 Mbps.

## Command Default

For Gigabit Ethernet ports, the default is **auto**.

## Command Modes

Interface configuration (config-if)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

For Gigabit Ethernet ports, setting the port to **auto** has the same effect as specifying **full** if the attached device does not autonegotiate the duplex parameter.

Duplex options are not supported on the 1000BASE-*x* or 10GBASE-*x* (where *x* is -BX, -CWDM, -LX, -SX, or -ZX) small form-factor pluggable (SFP) modules.



### Note

Half-duplex mode is supported on Gigabit Ethernet interfaces if the duplex mode is **auto** and the connected device is operating at half duplex. However, you cannot configure these interfaces to operate in half-duplex mode.

Certain ports can be configured to be either full duplex or half duplex. How this command is applied depends on the device to which the switch is attached.

If both ends of the line support autonegotiation, we highly recommend using the default autonegotiation settings. If one interface supports autonegotiation and the other end does not, configure duplex and speed on both interfaces, and use the **auto** setting on the supported side.

If the speed is set to **auto**, the switch negotiates with the device at the other end of the link for the speed setting and then forces the speed setting to the negotiated value. The duplex setting remains as configured on each end of the link, which could result in a duplex setting mismatch.

You can configure the duplex setting when the speed is set to **auto**.

**Caution**

Changing the interface speed and duplex mode configuration might shut down and reenables the interface during the reconfiguration.

You can verify your setting by entering the **show interfaces** privileged EXEC command.

**Examples**

This example shows how to configure an interface for full-duplex operation:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 1/0/1
Device(config-if)# duplex full
```

# enable (interface configuration)

To enable the 100 GigabitEthernet interface, use the **enable** command in interface configuration mode. Use the **no** form of the command to disable a 100 GigabitEthernet interface.

**enable**

**no enable**

## Command Default

The 100 GigabitEthernet interface is enabled on physical port numbers 25 through 32.

The 100 GigabitEthernet interface is disabled on physical port numbers 1 through 24.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Fuji 16.8.1a	The command was introduced on the Cisco Catalyst 9500 Series Switches - High Performance.

## Usage Guidelines

Use the **enable** command in the interface configuration mode, to enable the 100 GigabitEthernet interface.

Use the **no** version of the command to disable the 100 GigabitEthernet interface.

To display the current state of an interface, enter the **show interface** *interface-id* command in privileged EXEC mode.

The following example shows how to enable interface HundredGigabitEthernet 1/0/40.

When you enable the interface HundredGigabitEthernet 1/0/40, the corresponding 40 GigabitEthernet interfaces, FortyGigabitEthernet 1/0/15 and FortyGigabitEthernet 1/0/16 become inactive.

```
Device> enable
Device# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Device(config)# interface hundredgigabitethernet 1/0/40
Device(config-if)# enable
```

The following example shows how to disable interface HundredGigabitEthernet 1/0/40 to use interface 40 GigabitEthernet 1/0/16.

When you disable a HundredGigabitEthernet interface, both the corresponding 40 GigabitEthernet interfaces, FortyGigabitEthernet1/0/15 and FortyGigabitEthernet1/0/16 become active.

```
Device> enable
Device# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Device(config)# interface hundredgigabitethernet 1/0/40
Device(config-if)# no enable
Device(config-if)# exit
```

## errdisable detect cause

To enable error-disable detection for a specific cause or for all causes, use the **errdisable detect cause** command in global configuration mode. To disable the error-disable detection feature, use the **no** form of this command.

```
errdisable detect cause all | arp-inspection | bpduguard shutdown vlan | dhcp-rate-limit | dtp-flap
| gbic-invalid | inline-power | link-flap | loopback | pagp-flap | pppoe-ia-rate-limit | psp shutdown
vlan | security-violation shutdown vlan | sfp-config-mismatch
no errdisable detect cause all | arp-inspection | bpduguard shutdown vlan | dhcp-rate-limit | dtp-flap
| gbic-invalid | inline-power | link-flap | loopback | pagp-flap | pppoe-ia-rate-limit | psp shutdown
vlan | security-violation shutdown vlan | sfp-config-mismatch
```

Syntax	Description
<b>all</b>	Enables error detection for all error-disabled causes.
<b>arp-inspection</b>	Enables error detection for dynamic Address Resolution Protocol (ARP) inspection.
<b>bpduguard shutdown vlan</b>	Enables per-VLAN error-disable for BPDU guard.
<b>dhcp-rate-limit</b>	Enables error detection for DHCP snooping.
<b>dtp-flap</b>	Enables error detection for the Dynamic Trunking Protocol (DTP) flapping.
<b>gbic-invalid</b>	Enables error detection for an invalid Gigabit Interface Converter (GBIC) module.  <b>Note</b> This error refers to an invalid small form-factor pluggable (SFP) module.
<b>inline-power</b>	Enables error detection for the Power over Ethernet (PoE) error-disabled cause.  <b>Note</b> This keyword is supported only on switches with PoE ports.
<b>link-flap</b>	Enables error detection for link-state flapping.
<b>loopback</b>	Enables error detection for detected loopbacks.
<b>pagp-flap</b>	Enables error detection for the Port Aggregation Protocol (PAgP) flap error-disabled cause.
<b>pppoe-ia-rate-limit</b>	Enables error detection for the PPPoE Intermediate Agent rate-limit error-disabled cause.
<b>psp shutdown vlan</b>	Enables error detection for protocol storm protection (PSP).
<b>security-violation shutdown vlan</b>	Enables voice aware 802.1x security.
<b>sfp-config-mismatch</b>	Enables error detection on an SFP configuration mismatch.

**Command Default** Detection is enabled for all causes. All causes, except per-VLAN error disabling, are configured to shut down the entire port.

**Command Modes** Global configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** A cause (such as a link-flap or dhcp-rate-limit) is the reason for the error-disabled state. When a cause is detected on an interface, the interface is placed in an error-disabled state, an operational state that is similar to a link-down state.

When a port is error-disabled, it is effectively shut down, and no traffic is sent or received on the port. For the bridge protocol data unit (BPDU) guard, voice-aware 802.1x security, and port-security features, you can configure the switch to shut down only the offending VLAN on the port when a violation occurs, instead of shutting down the entire port.

If you set a recovery mechanism for the cause by entering the **errdisable recovery** global configuration command, the interface is brought out of the error-disabled state and allowed to retry the operation when all causes have timed out. If you do not set a recovery mechanism, you must enter the **shutdown** and then the **no shutdown** commands to manually recover an interface from the error-disabled state.

For protocol storm protection, excess packets are dropped for a maximum of two virtual ports. Virtual port error disabling using the **psp** keyword is not supported for EtherChannel and Flexlink interfaces.

To verify your settings, enter the **show errdisable detect** privileged EXEC command.

This example shows how to enable error-disabled detection for the link-flap error-disabled cause:

```
Device(config)# errdisable detect cause link-flap
```

This command shows how to globally configure BPDU guard for a per-VLAN error-disabled state:

```
Device(config)# errdisable detect cause bpduguard shutdown vlan
```

This command shows how to globally configure voice-aware 802.1x security for a per-VLAN error-disabled state:

```
Device(config)# errdisable detect cause security-violation shutdown vlan
```

You can verify your setting by entering the **show errdisable detect** privileged EXEC command.

## errdisable recovery cause

To enable the error-disabled mechanism to recover from a specific cause, use the **errdisable recovery cause** command in global configuration mode. To return to the default setting, use the **no** form of this command.

```
errdisable recovery cause all | arp-inspection | bpduguard | channel-misconfig | dhcp-rate-limit |
dtp-flap | gbic-invalid | inline-power | link-flap | loopback | mac-limit | pagp-flap | port-mode-failure |
pppoe-ia-rate-limit | psecure-violation | psp | security-violation | sfp-config-mismatch | storm-control |
udld
```

```
no errdisable recovery cause all | arp-inspection | bpduguard | channel-misconfig | dhcp-rate-limit |
dtp-flap | gbic-invalid | inline-power | link-flap | loopback | mac-limit | pagp-flap | port-mode-failure |
pppoe-ia-rate-limit | psecure-violation | psp | security-violation | sfp-config-mismatch | storm-control |
udld
```

Syntax Description	
<b>all</b>	Enables the timer to recover from all error-disabled causes.
<b>arp-inspection</b>	Enables the timer to recover from the Address Resolution Protocol (ARP) inspection error-disabled state.
<b>bpduguard</b>	Enables the timer to recover from the bridge protocol data unit (BPDU) guard error-disabled state.
<b>channel-misconfig</b>	Enables the timer to recover from the EtherChannel misconfiguration error-disabled state.
<b>dhcp-rate-limit</b>	Enables the timer to recover from the DHCP snooping error-disabled state.
<b>dtp-flap</b>	Enables the timer to recover from the Dynamic Trunking Protocol (DTP) flap error-disabled state.
<b>gbic-invalid</b>	Enables the timer to recover from an invalid Gigabit Interface Converter (GBIC) module error-disabled state.  <b>Note</b> This error refers to an invalid small form-factor pluggable (SFP) error-disabled state.
<b>inline-power</b>	Enables the timer to recover from the Power over Ethernet (PoE) error-disabled state.  This keyword is supported only on switches with PoE ports.
<b>link-flap</b>	Enables the timer to recover from the link-flap error-disabled state.
<b>loopback</b>	Enables the timer to recover from a loopback error-disabled state.
<b>mac-limit</b>	Enables the timer to recover from the mac limit error-disabled state.
<b>pagp-flap</b>	Enables the timer to recover from the Port Aggregation Protocol (PAgP)-flap error-disabled state.



<b>port-mode-failure</b>	Enables the timer to recover from the port mode change failure error-disabled state.
<b>pppoe-ia-rate-limit</b>	Enables the timer to recover from the PPPoE IA rate limit error-disabled state.
<b>psecure-violation</b>	Enables the timer to recover from a port security violation disable state.
<b>psp</b>	Enables the timer to recover from the protocol storm protection (PSP) error-disabled state.
<b>security-violation</b>	Enables the timer to recover from an IEEE 802.1x-violation disabled state.
<b>sfp-config-mismatch</b>	Enables error detection on an SFP configuration mismatch.
<b>storm-control</b>	Enables the timer to recover from a storm control error.
<b>udld</b>	Enables the timer to recover from the UniDirectional Link Detection (UDLD) error-disabled state.

**Command Default**

Recovery is disabled for all causes.

**Command Modes**

Global configuration

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

A cause (such as all or BPDU guard) is defined as the reason that the error-disabled state occurred. When a cause is detected on an interface, the interface is placed in the error-disabled state, an operational state similar to link-down state.

When a port is error-disabled, it is effectively shut down, and no traffic is sent or received on the port. For the BPDU guard and port-security features, you can configure the switch to shut down only the offending VLAN on the port when a violation occurs, instead of shutting down the entire port.

If you do not enable the recovery for the cause, the interface stays in the error-disabled state until you enter the **shutdown** and the **no shutdown** interface configuration commands. If you enable the recovery for a cause, the interface is brought out of the error-disabled state and allowed to retry the operation again when all the causes have timed out.

Otherwise, you must enter the **shutdown** and then the **no shutdown** commands to manually recover an interface from the error-disabled state.

You can verify your settings by entering the **show errdisable recovery** privileged EXEC command.

**Examples**

This example shows how to enable the recovery timer for the BPDU guard error-disabled cause:

```
Device(config)# errdisable recovery cause bpduguard
```

## errdisable recovery interval

To specify the time to recover from an error-disabled state, use the **errdisable recovery interval** command in global configuration mode. To return to the default setting, use the **no** form of this command.

**errdisable recovery interval** *timer-interval*  
**no errdisable recovery interval** *timer-interval*

<b>Syntax Description</b>	<i>timer-interval</i> Time to recover from the error-disabled state. The range is 30 to 86400 seconds. The same interval is applied to all causes. The default interval is 300 seconds.	
<b>Command Default</b>	The default recovery interval is 300 seconds.	
<b>Command Modes</b>	Global configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The error-disabled recovery timer is initialized at a random differential from the configured interval value. The difference between the actual timeout value and the configured value can be up to 15 percent of the configured interval.

You can verify your settings by entering the **show errdisable recovery** privileged EXEC command.

### Examples

This example shows how to set the timer to 500 seconds:

```
Device(config)# errdisable recovery interval 500
```

# interface

To configure an interface, use the **interface** command.

**interface** **Auto-Template** *interface-number* | **FortyGigabitEthernet** *switch-number/slot-number/port-number* | **GigabitEthernet** *switch-number/slot-number/port-number* | **Group VI** *Group VI interface number* | **Internal Interface** *Internal Interface number* | **Loopback** *interface-number* **Null** *interface-number* **Port-channel** *interface-number* **TenGigabitEthernet** *switch-number/slot-number/port-number* **Tunnel** *interface-number* **Vlan** *interface-number*

Syntax Description		
<b>Auto-Template</b> <i>interface-number</i>		Enables you to configure a auto-template interface. The range is from 1 to 999.
<b>FortyGigabitEthernet</b> <i>switch-number/slot-number/port-number</i>		Enables you to configure a 40-Gigabit Ethernet interface. <ul style="list-style-type: none"> <li>• <i>switch-number</i> — Switch ID. The range is from 1 to 8.</li> <li>• <i>slot-number</i> — Slot number. Value is 1.</li> <li>• <i>port-number</i> — Port number. The range is from 1 to 2.</li> </ul>
<b>GigabitEthernet</b> <i>switch-number/slot-number/port-number</i>		Enables you to configure a Gigabit Ethernet IEEE 802.3z interface. <ul style="list-style-type: none"> <li>• <i>switch-number</i> — Switch ID. The range is from 1 to 8.</li> <li>• <i>slot-number</i> — Slot number. The range is from 0 to 1.</li> <li>• <i>port-number</i> — Port number. The range is from 1 to 48.</li> </ul>
<b>Group VI</b> <i>Group VI interface number</i>		Enables you to configure a Group VI interface. The range is from 0 to 9.
<b>Internal Interface</b> <i>Internal Interface</i>		Enables you to configure an internal interface.
<b>Loopback</b> <i>interface-number</i>		Enables you to configure a loopback interface. The range is from 0 to 2147483647.
<b>Null</b> <i>interface-number</i>		Enables you to configure a null interface. The default value is 0.
<b>Port-channel</b> <i>interface-number</i>		Enables you to configure a port-channel interface. The range is from 1 to 128.

<b>TenGigabitEthernet</b> <i>switch-number/slot-number/port-number</i>	Enables you to configure a 10-Gigabit Ethernet interface. <ul style="list-style-type: none"> <li>• <i>switch-number</i> — Switch ID. The range is from 1 to 8.</li> <li>• <i>slot-number</i> — Slot number. The range is from 0 to 1.</li> <li>• <i>port-number</i> — Port number. The range is from 1 to 24 and 37 to 48</li> </ul>
<b>Tunnel</b> <i>interface-number</i>	Enables you to configure a tunnel interface. The range is from 0 to 2147483647.
<b>Vlan</b> <i>interface-number</i>	Enables you to configure a switch VLAN. The range is from 1 to 4094.

**Command Default** None

**Command Modes** Global configuration (config)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You can not use the "no" form of this command.

### Examples

The following example shows how to configure a tunnel interface:

```
Device(config)# interface Tunnel 15
Device(config-if)#
```

The following example shows how to configure a 40-Gigabit Ethernet interface

```
Device(config)# interface FortyGigabitEthernet 1/1/2
Device(config-if)#
```

# interface range

To configure an interface range, use the **interface range** command.

**interface range** **Auto-Template** *interface-number* | **FortyGigabitEthernet** *switch-number/slot-number/port-number* | **GigabitEthernet** *switch-number/slot-number/port-number* | **Group VI** *Group VI interface number* | **Internal Interface** *Internal Interface number* | **Loopback** *interface-number* | **Null** *interface-number* | **Port-channel** *interface-number* | **TenGigabitEthernet** *switch-number/slot-number/port-number* | **Tunnel** *interface-number* | **Vlan** *interface-number*

Syntax Description		
<b>Auto-Template</b> <i>interface-number</i>		Enables you to configure a auto-template interface. The range is from 1 to 999.
<b>FortyGigabitEthernet</b> <i>switch-number/slot-number/port-number</i>		Enables you to configure a 40-Gigabit Ethernet interface. <ul style="list-style-type: none"> <li>• <i>switch-number</i> — Switch ID. The range is from 1 to 8.</li> <li>• <i>slot-number</i> — Slot number. Value is 1.</li> <li>• <i>port-number</i> — Port number. The range is from 1 to 2.</li> </ul>
<b>GigabitEthernet</b> <i>switch-number/slot-number/port-number</i>		Enables you to configure a Gigabit Ethernet IEEE 802.3z interface. <ul style="list-style-type: none"> <li>• <i>switch-number</i> — Switch ID. The range is from 1 to 8.</li> <li>• <i>slot-number</i> — Slot number. The range is from 0 to 1.</li> <li>• <i>port-number</i> — Port number. The range is from 1 to 48.</li> </ul>
<b>Group VI</b> <i>Group VI interface number</i>		Enables you to configure a Group VI interface. The range is from 0 to 9.
<b>Internal Interface</b> <i>Internal Interface</i>		Enables you to configure an internal interface.
<b>Loopback</b> <i>interface-number</i>		Enables you to configure a loopback interface. The range is from 0 to 2147483647.
<b>Null</b> <i>interface-number</i>		Enables you to configure a null interface. The default value is 0.
<b>Port-channel</b> <i>interface-number</i>		Enables you to configure a port-channel interface. The range is from 1 to 128.

<b>TenGigabitEthernet</b> <i>switch-number/slot-number/port-number</i>	<p>Enables you to configure a 10-Gigabit Ethernet interface.</p> <ul style="list-style-type: none"> <li>• <i>switch-number</i> — Switch ID. The range is from 1 to 8.</li> <li>• <i>slot-number</i> — Slot number. The range is from 0 to 1.</li> <li>• <i>port-number</i> — Port number. The range is from 1 to 24 and 37 to 48</li> </ul>
<b>Tunnel</b> <i>interface-number</i>	Enables you to configure a tunnel interface. The range is from 0 to 2147483647.
<b>Vlan</b> <i>interface-number</i>	Enables you to configure a switch VLAN. The range is from 1 to 4094.

**Command Default** None

**Command Modes** Global configuration (config)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Examples

This example shows how you can configure interface range:

```
Device(config)# interface range vlan 1-100
```

# ip mtu

To set the IP maximum transmission unit (MTU) size of routed packets on all routed ports of the switch or switch stack, use the **ip mtu** command in interface configuration mode. To restore the default IP MTU size, use the **no** form of this command.

```
ip mtu bytes
no ip mtu bytes
```

<b>Syntax Description</b>	<i>bytes</i> MTU size, in bytes. The range is from 68 up to the system MTU value (in bytes).				
<b>Command Default</b>	The default IP MTU size for frames received and sent on all switch interfaces is 1500 bytes.				
<b>Command Modes</b>	Interface configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines** The upper limit of the IP value is based on the switch or switch stack configuration and refers to the currently applied system MTU value. For more information about setting the MTU sizes, see the **system mtu** global configuration command.

To return to the default IP MTU setting, you can apply the **default ip mtu** command or the **no ip mtu** command on the interface.

You can verify your setting by entering the **show ip interface interface-id** or **show interfaces interface-id** privileged EXEC command.

The following example sets the maximum IP packet size for VLAN 200 to 1000 bytes:

```
Device(config)# interface vlan 200
Device(config-if)# ip mtu 1000
```

The following example sets the maximum IP packet size for VLAN 200 to the default setting of 1500 bytes:

```
Device(config)# interface vlan 200
Device(config-if)# default ip mtu
```

This is an example of partial output from the **show ip interface interface-id** command. It displays the current IP MTU setting for the interface.

```
Device# show ip interface gigabitethernet4/0/1
GigabitEthernet4/0/1 is up, line protocol is up
  Internet address is 18.0.0.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
```

<output truncated>

# ipv6 mtu

To set the IPv6 maximum transmission unit (MTU) size of routed packets on all routed ports of the switch or switch stack, use the **ipv6 mtu** command in interface configuration mode. To restore the default IPv6 MTU size, use the **no** form of this command.

**ipv6 mtu** *bytes*  
**no ipv6 mtu** *bytes*

## Syntax Description

*bytes* MTU size, in bytes. The range is from 1280 up to the system MTU value (in bytes).

## Command Default

The default IPv6 MTU size for frames received and sent on all switch interfaces is 1500 bytes.

## Command Modes

Interface configuration

## Command History

### Release

Cisco IOS XE Everest 16.5.1a

### Modification

This command was introduced.

## Usage Guidelines

The upper limit of the IPv6 MTU value is based on the switch or switch stack configuration and refers to the currently applied system MTU value. For more information about setting the MTU sizes, see the **system mtu** global configuration command.

To return to the default IPv6 MTU setting, you can apply the **default ipv6 mtu** command or the **no ipv6 mtu** command on the interface.

You can verify your setting by entering the **show ipv6 interface** *interface-id* or **show interface** *interface-id* privileged EXEC command.

The following example sets the maximum IPv6 packet size for an interface to 2000 bytes:

```
Device(config)# interface gigabitethernet4/0/1
Device(config-if)# ipv6 mtu 2000
```

The following example sets the maximum IPv6 packet size for an interface to the default setting of 1500 bytes:

```
Device(config)# interface gigabitethernet4/0/1
Device(config-if)# default ipv6 mtu
```

This is an example of partial output from the **show ipv6 interface** *interface-id* command. It displays the current IPv6 MTU setting for the interface.

```
Device# show ipv6 interface gigabitethernet4/0/1
GigabitEthernet4/0/1 is up, line protocol is up
  Internet address is 18.0.0.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
```

<output truncated>



## lldp (interface configuration)

To enable Link Layer Discovery Protocol (LLDP) on an interface, use the **lldp** command in interface configuration mode. To disable LLDP on an interface, use the **no** form of this command.

**lldp med-tlv-select** *tlv* | **receive** | **tlv-select** **power-management** | **transmit**  
**no lldp med-tlv-select** *tlv* | **receive** | **tlv-select** **power-management** | **transmit**

Syntax Description		
<b>med-tlv-select</b>		Selects an LLDP Media Endpoint Discovery (MED) time-length-value (TLV) element to send.
<i>tlv</i>		String that identifies the TLV element. Valid values are the following: <ul style="list-style-type: none"> <li>• <b>inventory-management</b>— LLDP MED Inventory Management TLV.</li> <li>• <b>location</b>— LLDP MED Location TLV.</li> <li>• <b>network-policy</b>— LLDP MED Network Policy TLV.</li> <li>• <b>power-management</b>— LLDP MED Power Management TLV.</li> </ul>
<b>receive</b>		Enables the interface to receive LLDP transmissions.
<b>tlv-select</b>		Selects the LLDP TLVs to send.
<b>power-management</b>		Sends the LLDP Power Management TLV.
<b>transmit</b>		Enables LLDP transmission on the interface.

**Command Default** LLDP is disabled.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command is supported on 802.1 media types.

If the interface is configured as a tunnel port, LLDP is automatically disabled.

The following example shows how to disable LLDP transmission on an interface:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# no lldp transmit
```

The following example shows how to enable LLDP transmission on an interface:

```
Device(config)# interface gigabitethernet1/0/1
```

```
Device(config-if)# lldp transmit
```

## mode (power-stack configuration)

To configure power stack mode for the power stack, use the **mode** command in power-stack configuration mode. To return to the default settings, use the **no** form of the command.

**mode** **power-shared** | **redundant** [**strict**]  
**no mode**

Syntax Description	power-shared	redundant	strict
	Sets the power stack to operate in power-shared mode. This is the default.	Sets the power stack to operate in redundant mode. The largest power supply is removed from the power pool to be used as backup power in case one of the other power supplies fails.	(Optional) Configures the power stack mode to run a strict power budget. The stack power needs cannot exceed the available power.

**Command Default** The default modes are **power-shared** and nonstrict.

**Command Modes** Power-stack configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command is available only on switch stacks running the IP Base or IP Services feature set. To access power-stack configuration mode, enter the **stack-power stack** *power stack name* global configuration command.

Entering the **no mode** command sets the switch to the defaults of **power-shared** and non-strict mode.



**Note** For stack power, available power is the total power available for PoE from all power supplies in the power stack, available power is the power allocated to all powered devices connected to PoE ports in the stack, and consumed power is the actual power consumed by the powered devices.

In **power-shared** mode, all of the input power can be used for loads, and the total available power appears as one large power supply. The power budget includes all power from all supplies. No power is set aside for power supply failures. If a power supply fails, load shedding (shutting down of powered devices or switches) might occur.

In **redundant** mode, the largest power supply is removed from the power pool to use as backup power in case one of the other power supplies fails. The available power budget is the total power minus the largest power supply. This reduces the available power in the pool for switches and powered devices, but in case of a failure or an extreme power load, there is less chance of having to shut down switches or powered devices.

In **strict** mode, when a power supply fails and the available power drops below the budgeted power, the system balances the budget through load shedding of powered devices, even if the actual power is less than the available power. In nonstrict mode, the power stack can run in an over-allocated state and is stable as long as

the actual power does not exceed the available power. In this mode, a powered device drawing more than normal power could cause the power stack to start shedding loads. This is normally not a problem because most devices do not run at full power. The chances of multiple powered devices in the stack requiring maximum power at the same time is small.

In both strict and nonstrict modes, power is denied when there is no power available in the power budget.

This is an example of setting the power stack mode for the stack named power1 to power-shared with strict power budgeting. All power in the stack is shared, but when the total available power is allotted, no more devices are allowed power.

```
Device(config)# stack-power stack power1  
Device(config-stackpower)# mode power-shared strict  
Device(config-stackpower)# exit
```

This is an example of setting the power stack mode for the stack named power2 to redundant. The largest power supply in the stack is removed from the power pool to provide redundancy in case one of the other supplies fails.

```
Device(config)# stack-power stack power2  
Device(config-stackpower)# mode redundant  
Device(config-stackpower)# exit
```

# network-policy

To apply a network-policy profile to an interface, use the **network-policy** command in interface configuration mode. To remove the policy, use the **no** form of this command.

```
network-policy profile-number
no network-policy
```

---

## Syntax Description

*profile-number* The network-policy profile number to apply to the interface.

---

## Command Default

No network-policy profiles are applied.

## Command Modes

Interface configuration

---

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

## Usage Guidelines

Use the **network-policy** *profile number* interface configuration command to apply a profile to an interface.

You cannot apply the **switchport voice vlan** command on an interface if you first configure a network-policy profile on it. However, if **switchport voice vlan** *vlan-id* is already configured on the interface, you can apply a network-policy profile on the interface. The interface then has the voice or voice-signaling VLAN network-policy profile applied.

This example shows how to apply network-policy profile 60 to an interface:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# network-policy 60
```

## network-policy profile (global configuration)

To create a network-policy profile and to enter network-policy configuration mode, use the **network-policy profile** command in global configuration mode. To delete the policy and to return to global configuration mode, use the **no** form of this command.

**network-policy profile** *profile-number*  
**no network-policy profile** *profile-number*

<b>Syntax Description</b>	<i>profile-number</i> Network-policy profile number. The range is 1 to 4294967295.	
<b>Command Default</b>	No network-policy profiles are defined.	
<b>Command Modes</b>	Global configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **network-policy profile** global configuration command to create a profile and to enter network-policy profile configuration mode.

To return to privileged EXEC mode from the network-policy profile configuration mode, enter the **exit** command.

When you are in network-policy profile configuration mode, you can create the profile for voice and voice signaling by specifying the values for VLAN, class of service (CoS), differentiated services code point (DSCP), and tagging mode.

These profile attributes are contained in the Link Layer Discovery Protocol for Media Endpoint Devices (LLDP-MED) network-policy time-length-value (TLV).

This example shows how to create network-policy profile 60:

```
Device(config)# network-policy profile 60
Device(config-network-policy)#
```

# power-priority

To configure Cisco StackPower power-priority values for a switch in a power stack and for its high-priority and low-priority PoE ports, use the **power-priority** command in switch stack-power configuration mode. To return to the default setting, use the **no** form of the command.

**power-priority** **high** *value* | **low** *value* | **switch** *value*  
**no power-priority** **high** | **low** | **switch**

Syntax Description	high <i>value</i>	low <i>value</i>	switch <i>value</i>
	Sets the power priority for the ports configured as high-priority ports. The range is 1 to 27, with 1 as the highest priority. The <b>high</b> value must be lower than the value set for the low-priority ports and higher than the value set for the switch.	Sets the power priority for the ports configured as low-priority ports. The range is 1 to 27. The <b>low</b> value must be higher than the value set for the high-priority ports and the value set for the switch.	Sets the power priority for the switch. The range is 1 to 27. The <b>switch</b> value must be lower than the values set for the low and high-priority ports.

**Command Default** If no values are configured, the power stack randomly determines a default priority. The default ranges are 1 to 9 for switches, 10 to 18 for high-priority ports, 19 to 27 for low-priority ports. On non-PoE switches, the high and low values (for port priority) have no effect.

**Command Modes** Switch stack-power configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** To access switch stack-power configuration mode, enter the **stack-power switch** *switch-number* global configuration command.

Cisco StackPower power-priority values determine the order for shutting down switches and ports when power is lost and load shedding must occur. Priority values are from 1 to 27; the highest numbers are shut down first.

We recommend that you configure different priority values for each switch and for its high priority ports and low priority ports to limit the number of devices shut down at one time during a loss of power. If you try to configure the same priority value on different switches in a power stack, the configuration is allowed, but you receive a warning message.



**Note** This command is available only on switch stacks running the IP Base or IP Services feature set.

## Examples

This is an example of setting the power priority for switch 1 in power stack a to 7, for the high-priority ports to 11, and for the low-priority ports to 20.

```
Device(config)# stack-power switch 1  
Device(config-switch-stackpower)# stack-id power_stack_a  
Device(config-switch-stackpower)# power-priority high 11  
Device(config-switch-stackpower)# power-priority low 20  
Device(config-switch-stackpower)# power-priority switch 7  
Device(config-switch-stackpower)# exit
```



# power supply

To configure and manage the internal power supplies on a switch, use the **power supply** command in privileged EXEC mode.

**power supply** *stack-member-number* **slot A | B** **off | on**

Syntax Description		
<i>stack-member-number</i>		Stack member number for which to configure the internal power supplies. The range is 1 to 9, depending on the number of switches in the stack.  This parameter is available only on stacking-capable switches.
<b>slot</b>		Selects the switch power supply to set.
<b>A</b>		Selects the power supply in slot A.
<b>B</b>		Selects the power supply in slot B.  <b>Note</b> Power supply slot B is the closest slot to the outer edge of the switch.
<b>off</b>		Sets the switch power supply to off.
<b>on</b>		Sets the switch power supply to on.

**Command Default** The switch power supply is on.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **power supply** command applies to a switch or to a switch stack where all switches are the same platform. In a switch stack with the same platform switches, you must specify the stack member before entering the **slot {A | B} off** or **on** keywords.

To return to the default setting, use the **power supply stack-member-number on** command.

You can verify your settings by entering the **show env power** privileged EXEC command.

## Examples

This example shows how to set the power supply in slot A to off:

```
Device> power supply 2 slot A off
Disabling Power supply A may result in a power loss to PoE devices and/or switches ...
Continue? (yes/[no]): yes
Device
Jun 10 04:52:54.389: %PLATFORM_ENV-6-FRU_PS_OIR: FRU Power Supply 1 powered off
Jun 10 04:52:56.717: %PLATFORM_ENV-1-FAN_NOT_PRESENT: Fan is not present
```

This example shows how to set the power supply in slot A to on:

```
Device> power supply 1 slot B on
Jun 10 04:54:39.600: %PLATFORM_ENV-6-FRU_PS_OIR: FRU Power Supply 1 powered on
```

This example shows the output of the show env power command:

```
Device> show env power
SW  PID                Serial#      Status      Sys Pwr  PoE Pwr  Watts
--  -
1A  PWR-1RUC2-640WAC    DCB1705B05B OK           Good     Good    250/390
1B  Not Present
```

# show env

To display fan, temperature, and power information, use the **show env** command in EXEC mode.

**show env** **all** | **fan** | **power** [**all** | **switch** [*stack-member-number*]] | **stack** [*stack-member-number*] | **temperature** [**status**]

Syntax Description	
<b>all</b>	Displays the fan and temperature environmental status and the status of the internal power supplies.
<b>fan</b>	Displays the switch fan status.
<b>power</b>	Displays the internal power status of the active switch.
<b>all</b>	(Optional) Displays the status of all the internal power supplies in a standalone switch when the command is entered on the switch, or in all the member switches when the command is entered on the active switch.
<b>switch</b>	(Optional) Displays the status of the internal power supplies for each switch in the stack or for the specified switch.  This keyword is available only on stacking-capable switches.
<i>stack-member-number</i>	(Optional) Number of the member switch for which to display the status of the internal power supplies or the environmental status.
<b>stack</b>	Displays all environmental status for each switch in the stack or for the specified switch.  This keyword is available only on stacking-capable switches.
<b>temperature</b>	Displays the switch temperature status.
<b>status</b>	(Optional) Displays the switch internal temperature (not the external temperature) and the threshold values.

**Command Default** None

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **show env** EXEC command to display the information for the switch being accessed—a standalone switch or the active switch. Use this command with the **stack** and **switch** keywords to display all information for the stack or for the specified member switch.

If you enter the **show env temperature status** command, the command output shows the switch temperature state and the threshold level.

You can also use the **show env temperature** command to display the switch temperature status. The command output shows the green and yellow states as *OK* and the red state as *FAULTY*. If you enter the **show env all** command, the command output is the same as the **show env temperature status** command output.

## Examples

This is an example of output from the **show env power all** command on the active switch:

**Table 6: States in the show env temperature status Command Output**

State	Description
Green	The switch temperature is in the <i>normal</i> operating range.
Yellow	The temperature is in the <i>warning</i> range. You should check the external temperature around the switch.
Red	The temperature is in the <i>critical</i> range. The switch might not run properly if the temperature is in this range.

# show errdisable detect

To display error-disabled detection status, use the **show errdisable detect** command in EXEC mode.

**show errdisable detect**

**Syntax Description** This command has no arguments or keywords.

**Command Default** None

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** A gbic-invalid error reason refers to an invalid small form-factor pluggable (SFP) module.

The error-disable reasons in the command output are listed in alphabetical order. The mode column shows how error-disable is configured for each feature.

You can configure error-disabled detection in these modes:

- port mode—The entire physical port is error-disabled if a violation occurs.
- vlan mode—The VLAN is error-disabled if a violation occurs.
- port/vlan mode—The entire physical port is error-disabled on some ports and is per-VLAN error-disabled on other ports.

# show errdisable recovery

To display the error-disabled recovery timer information, use the **show errdisable recovery** command in EXEC mode.

## show errdisable recovery

**Syntax Description** This command has no arguments or keywords.

**Command Default** None

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** A gbic-invalid error-disable reason refers to an invalid small form-factor pluggable (SFP) module interface.



**Note** Though visible in the output, the unicast-flood field is not valid.

This is an example of output from the **show errdisable recovery** command:

# show ip interface

To display the usability status of interfaces configured for IP, use the **show ip interface** command in privileged EXEC mode.

**show ip interface** [*type number*] [**brief**]

Syntax Description	
<i>type</i>	(Optional) Interface type.
<i>number</i>	(Optional) Interface number.
<b>brief</b>	(Optional) Displays a summary of the usability status information for each interface.
<b>Note</b>	The output of the <b>show ip interface brief</b> command displays information of all the available interfaces whether or not the corresponding network module for these interfaces are connected. These interfaces can be configured if the network module is connected. Run the <b>show interface status</b> command to see which network modules are connected.  This is not applicable for Cisco Catalyst 9500 Series High-Performance switches.

**Command Default** The full usability status is displayed for all interfaces configured for IP.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The Cisco IOS software automatically enters a directly connected route in the routing table if the interface is usable (which means that it can send and receive packets). If an interface is not usable, the directly connected routing entry is removed from the routing table. Removing the entry lets the software use dynamic routing protocols to determine backup routes to the network, if any.

If the interface can provide two-way communication, the line protocol is marked "up." If the interface hardware is usable, the interface is marked "up."

If you specify an optional interface type, information for that specific interface is displayed. If you specify no optional arguments, information on all the interfaces is displayed.

When an asynchronous interface is encapsulated with PPP or Serial Line Internet Protocol (SLIP), IP fast switching is enabled. A **show ip interface** command on an asynchronous interface encapsulated with PPP or SLIP displays a message indicating that IP fast switching is enabled.

You can use the **show ip interface brief** command to display a summary of the device interfaces. This command displays the IP address, the interface status, and other information.

The **show ip interface brief** command does not display any information related to Unicast RPF.

## Examples

The following example shows interface information on Gigabit Ethernet interface 1/0/1:

```
Device# show ip interface gigabitethernet 1/0/1
```

```
GigabitEthernet1/0/1 is up, line protocol is up
  Internet address is 10.1.1.1/16
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Outgoing access list is not set
  Inbound access list is not set
  Proxy ARP is enabled
  Local Proxy ARP is disabled
  Security level is default
  Split horizon is enabled
  ICMP redirects are always sent
  ICMP unreachable are always sent
  ICMP mask replies are never sent
  IP fast switching is enabled
  IP fast switching on the same interface is disabled
  IP Flow switching is disabled
  IP CEF switching is enabled
  IP Feature Fast switching turbo vector
  IP VPN Flow CEF switching turbo vector
  IP multicast fast switching is enabled
  IP multicast distributed fast switching is disabled
  IP route-cache flags are Fast, CEF
  Router Discovery is disabled
  IP output packet accounting is disabled
  IP access violation accounting is disabled
  TCP/IP header compression is disabled
  RTP/IP header compression is disabled
  Policy routing is enabled, using route map PBR
  Network address translation is disabled
  BGP Policy Mapping is disabled
  IP Multi-Processor Forwarding is enabled
    IP Input features, "PBR",
      are not supported by MPF and are IGNORED
    IP Output features, "NetFlow",
      are not supported by MPF and are IGNORED
```

The following example shows how to display the usability status for a specific VLAN:

```
Device# show ip interface vlan 1

Vlan1 is up, line protocol is up
  Internet address is 10.0.0.4/24
  Broadcast address is 255.255.255.255
  Address determined by non-volatile memory
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Outgoing access list is not set
  Inbound access list is not set
  Proxy ARP is enabled
  Local Proxy ARP is disabled
  Security level is default
  Split horizon is enabled
  ICMP redirects are always sent
  ICMP unreachable are always sent
  ICMP mask replies are never sent
  IP fast switching is enabled
  IP fast switching on the same interface is disabled
  IP Flow switching is disabled
```



```

IP CEF switching is enabled
IP Fast switching turbo vector
IP Normal CEF switching turbo vector
IP multicast fast switching is enabled
IP multicast distributed fast switching is disabled
IP route-cache flags are Fast, CEF
Router Discovery is disabled
IP output packet accounting is disabled
IP access violation accounting is disabled
TCP/IP header compression is disabled
RTP/IP header compression is disabled
Probe proxy name replies are disabled
Policy routing is disabled
Network address translation is disabled
WCCP Redirect outbound is disabled
WCCP Redirect inbound is disabled
WCCP Redirect exclude is disabled
BGP Policy Mapping is disabled
Sampled Netflow is disabled
IP multicast multilayer switching is disabled
Netflow Data Export (hardware) is enabled

```

The table below describes the significant fields shown in the display.

**Table 7: show ip interface Field Descriptions**

Field	Description
Broadcast address is	Broadcast address.
Peer address is	Peer address.
MTU is	MTU value set on the interface, in bytes.
Helper address	Helper address, if one is set.
Directed broadcast forwarding	Shows whether directed broadcast forwarding is enabled.
Outgoing access list	Shows whether the interface has an outgoing access list set.
Inbound access list	Shows whether the interface has an incoming access list set.
Proxy ARP	Shows whether Proxy Address Resolution Protocol (ARP) is enabled for the interface.
Security level	IP Security Option (IPSO) security level set for this interface.
Split horizon	Shows whether split horizon is enabled.
ICMP redirects	Shows whether redirect messages will be sent on this interface.
ICMP unreachable	Shows whether unreachable messages will be sent on this interface.
ICMP mask replies	Shows whether mask replies will be sent on this interface.
IP fast switching	Shows whether fast switching is enabled for this interface. It is generally enabled on serial interfaces, such as this one.
IP Flow switching	Shows whether Flow switching is enabled for this interface.

Field	Description
IP CEF switching	Shows whether Cisco Express Forwarding switching is enabled for the interface.
IP multicast fast switching	Shows whether multicast fast switching is enabled for the interface.
IP route-cache flags are Fast	Shows whether NetFlow is enabled on an interface. Displays "Flow init" to specify that NetFlow is enabled on the interface. Displays "Ingress Flow" to specify that NetFlow is enabled on a subinterface using the <b>ip flow ingress</b> command. Shows "Flow" to specify that NetFlow is enabled on a main interface using the <b>ip route-cache flow</b> command.
Router Discovery	Shows whether the discovery process is enabled for this interface. It is generally disabled on serial interfaces.
IP output packet accounting	Shows whether IP accounting is enabled for this interface and what the threshold (maximum number of entries) is.
TCP/IP header compression	Shows whether compression is enabled.
WCCP Redirect outbound is disabled	Shows the status of whether packets received on an interface are redirected to a cache engine. Displays "enabled" or "disabled."
WCCP Redirect exclude is disabled	Shows the status of whether packets targeted for an interface will be excluded from being redirected to a cache engine. Displays "enabled" or "disabled."
Netflow Data Export (hardware) is enabled	NetFlow Data Expert (NDE) hardware flow status on the interface.

The following example shows how to display a summary of the usability status information for each interface:

```
Device# show ip interface brief
```

```
Interface          IP-Address      OK? Method Status          Protocol
Vlan1              unassigned     YES NVRAM   administratively down  down
GigabitEthernet0/0 unassigned     YES NVRAM   down            down
GigabitEthernet1/0/1 unassigned     YES NVRAM   down            down
GigabitEthernet1/0/2 unassigned     YES unset   down            down
GigabitEthernet1/0/3 unassigned     YES unset   down            down
GigabitEthernet1/0/4 unassigned     YES unset   down            down
GigabitEthernet1/0/5 unassigned     YES unset   down            down
GigabitEthernet1/0/6 unassigned     YES unset   down            down
GigabitEthernet1/0/7 unassigned     YES unset   down            down
```

<output truncated>

**Table 8: show ip interface brief Field Descriptions**

Field	Description
Interface	Type of interface.

Field	Description
IP-Address	IP address assigned to the interface.
OK?	"Yes" means that the IP Address is valid. "No" means that the IP Address is not valid.
Method	<p>The Method field has the following possible values:</p> <ul style="list-style-type: none"> <li>• RARP or SLARP: Reverse Address Resolution Protocol (RARP) or Serial Line Address Resolution Protocol (SLARP) request.</li> <li>• BOOTP: Bootstrap protocol.</li> <li>• TFTP: Configuration file obtained from the TFTP server.</li> <li>• manual: Manually changed by the command-line interface.</li> <li>• NVRAM: Configuration file in NVRAM.</li> <li>• IPCP: <b>ip address negotiated</b> command.</li> <li>• DHCP: <b>ip address dhcp</b> command.</li> <li>• unset: Unset.</li> <li>• other: Unknown.</li> </ul>
Status	<p>Shows the status of the interface. Valid values and their meanings are:</p> <ul style="list-style-type: none"> <li>• up: Interface is up.</li> <li>• down: Interface is down.</li> <li>• administratively down: Interface is administratively down.</li> </ul>
Protocol	Shows the operational status of the routing protocol on this interface.

**Related Commands**

Command	Description
<b>ip interface</b>	Configures a virtual gateway IP interface on a Secure Socket Layer Virtual Private Network (SSL VPN) gateway
<b>show interface status</b>	Displays the status of the interface.

# show interfaces

To display the administrative and operational status of all interfaces or for a specified interface, use the **show interfaces** command in the EXEC mode.

```
show interfaces [ interface-id | vlan vlan-id ] [ accounting | capabilities [ module number ]
| description | etherchannel | flowcontrol | link [ module number ] | private-vlan mapping | pruning
| stats | status [ err-disabled | inactive ] | trunk ]
```

Syntax	Description
<i>interface-id</i>	(Optional) ID of the interface. Valid interfaces include physical ports (including type, stack member for stacking-capable switches, module, and port number) and port channels.  The port channel range is 1 to 128.
<b>vlan</b> <i>vlan-id</i>	(Optional) VLAN identification. The range is 1 to 4094.
<b>accounting</b>	(Optional) Displays accounting information on the interface, including active protocols and input and output packets and octets.  <b>Note</b> The display shows only packets processed in software; hardware-switched packets do not appear.
<b>capabilities</b>	(Optional) Displays the capabilities of all interfaces or the specified interface, including the features and options that you can configure on the interface. Though visible in the command line help, this option is not available for VLAN IDs.
<b>module</b> <i>number</i>	(Optional) Displays capabilities of all interfaces on the switch or specified stack member.  The range is 1 to 9.  This option is not available if you entered a specific interface ID.
<b>description</b>	(Optional) Displays the administrative status and description set for interfaces.  <b>Note</b> The output of the <b>show interfaces description</b> command displays information of all the available interfaces whether or not the corresponding network module for these interfaces are connected. These interfaces can be configured if the network module is connected. Run the <b>show interface status</b> command to see which network modules are connected.  This is not applicable for Cisco Catalyst 9500 Series High-Performance switches.
<b>etherchannel</b>	(Optional) Displays interface EtherChannel information.
<b>flowcontrol</b>	(Optional) Displays interface flow control information.

<b>link</b> [ <i>modulenumber</i> ]	(Optional) Displays the up time and down time of the interface.
<b>private-vlan mapping</b>	(Optional) Displays private-VLAN mapping information for the VLAN switch virtual interfaces (SVIs). This keyword is not available if the switch is running the LAN base feature set.
<b>pruning</b>	(Optional) Displays trunk VTP pruning information for the interface.
<b>stats</b>	(Optional) Displays the input and output packets by switching the path for the interface.
<b>status</b>	(Optional) Displays the status of the interface. A status of unsupported in the Type field means that a non-Cisco small form-factor pluggable (SFP) module is inserted in the module slot.
<b>err-disabled</b>	(Optional) Displays interfaces in an error-disabled state.
<b>inactive</b>	(Optional) Displays interfaces in an inactive state.
<b>trunk</b>	(Optional) Displays interface trunk information. If you do not specify an interface, only information for active trunking ports appears.



**Note** Though visible in the command-line help strings, the **crb**, **fair-queue**, **irb**, **mac-accounting**, **precedence**, **random-detect**, **rate-limit**, and **shape** keywords are not supported.

#### Command Default

None

#### Command Modes

Privileged EXEC (#)

#### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.
Cisco IOS XE Gibraltar 16.12.1	The <b>link</b> keyword was introduced.

#### Usage Guidelines

The **show interfaces capabilities** command with different keywords has these results:

- Use the **show interface capabilities module** *number* command to display the capabilities of all interfaces on that switch in the stack. If there is no switch with that module number in the stack, there is no output.
- Use the **show interfaces** *interface-id* **capabilities** to display the capabilities of the specified interface.
- Use the **show interfaces capabilities** (with no module number or interface ID) to display the capabilities of all interfaces in the stack.



**Note** The field **Last Input** displayed in the command output indicates the number of hours, minutes, and seconds since the last packet was successfully received by an interface and processed by the CPU on the device. This information can be used to know when a dead interface failed.

**Last Input** is not updated by fast-switched traffic.

The field **output** displayed in the command output indicates the number of hours, minutes, and seconds since the last packet was successfully transmitted by the interface. The information provided by this field can be useful for knowing when a dead interface failed.

The **show interfaces link** command with different keywords has these results:

- Use the **show interface link module** *number* command to display the up time and down time of all interfaces on that switch in the stack. If there is no switch with that module number in the stack, there is no output.



**Note** On a standalone switch, the **module** *number* refers to the slot number.

- Use the **show interfaces** *interface-id* **link** to display the up time and down time of the specified interface.
- Use the **show interfaces link** (with no module number or interface ID) to display the up time and down time of all interfaces in the stack.
- If the interface is up, the up time displays the time (hours, minutes, and seconds) and the down time displays 00:00:00.
- If the interface is down, only the down time displays the time (hours, minutes, and seconds).

## Examples

```
Device# show interfaces accounting

Vlan1
      Protocol  Pkts In  Chars In  Pkts Out  Chars Out
      IP         0         0           6         378

Vlan200
      Protocol  Pkts In  Chars In  Pkts Out  Chars Out
No traffic sent or received on this interface.
GigabitEthernet0/0
      Protocol  Pkts In  Chars In  Pkts Out  Chars Out
      Other    165476  11417844  0         0
      Spanning Tree 1240284  64494768  0         0
      ARP       7096    425760   0         0
      CDP       41368  18781072 82908     35318808

GigabitEthernet1/0/1
      Protocol  Pkts In  Chars In  Pkts Out  Chars Out
No traffic sent or received on this interface.
GigabitEthernet1/0/2
      Protocol  Pkts In  Chars In  Pkts Out  Chars Out
No traffic sent or received on this interface.

<output truncated>
```

This is an example of output from the **show interfaces interface description** command when the interface has been described as *Connects to Marketing* by using the **description** interface configuration command:

```
Device# show interfaces fortyGigabitEthernet6/0/2 description

Interface              Status      Protocol Description
Fo1/0/2                up          Connects to Marketing
```

```
Device# show interfaces etherchannel
----
Port-channel34:
Age of the Port-channel = 28d:18h:51m:46s
Logical slot/port      = 12/34          Number of ports = 0
GC                    = 0x00000000      HotStandBy port = null
Passive port list     =
Port state            = Port-channel L3-Ag Ag-Not-Inuse
Protocol              = -
Port security         = Disabled
```

This is an example of output from the **show interfaces stats** command for a specified VLAN interface:

```
Device# show interfaces vlan 1 stats

Switching path  Pkts In   Chars In   Pkts Out   Chars Out
  Processor    1165354  136205310   570800     91731594
  Route cache      0         0           0           0
  Total        1165354  136205310   570800     91731594
```

This is an example of output from the **show interfaces status err-disabled** command. It displays the status of interfaces in the error-disabled state:

```
Device# show interfaces status err-disabled

Port   Name      Status      Reason
Fo1/0/2   err-disabled  gbic-invalid
Fo2/0/3   err-disabled  dtp-flap
```

This is an example of output from the **show interfaces interface-id pruning** command:

```
Device# show interfaces gigabitethernet1/0/2 pruning

Port Vlans pruned for lack of request by neighbor
```

This is an example of output from the **show interfaces description** command:

```
Device# show interfaces description

Interface              Status      Protocol Description
Vl1                    admin down  down
Gi0/0                  down        down
Gi1/0/1                down        down
Gi1/0/2                down        down
Gi1/0/3                down        down
Gi1/0/4                down        down
Gi1/0/5                down        down
Gi1/0/6                down        down
Gi1/0/7                down        down

<output truncated>
```

The following is a sample output of the **show interfaces link** command:

```
Device> enable
Device# show interfaces link
Port          Name          Down Time    Up Time
Gi1/0/1      Gi1/0/1      6w0d
Gi1/0/2      Gi1/0/2      6w0d
Gi1/0/3      Gi1/0/3      00:00:00     5w3d
Gi1/0/4      Gi1/0/4      6w0d
Gi1/0/5      Gi1/0/5      6w0d
Gi1/0/6      Gi1/0/6      6w0d
Gi1/0/7      Gi1/0/7      6w0d
Gi1/0/8      Gi1/0/8      6w0d
Gi1/0/9      Gi1/0/9      6w0d
Gi1/0/10     Gi1/0/10     6w0d
Gi1/0/11     Gi1/0/11     2d17h
Gi1/0/12     Gi1/0/12     6w0d
Gi1/0/13     Gi1/0/13     6w0d
Gi1/0/14     Gi1/0/14     6w0d
Gi1/0/15     Gi1/0/15     6w0d
Gi1/0/16     Gi1/0/16     6w0d
Gi1/0/17     Gi1/0/17     6w0d
Gi1/0/18     Gi1/0/18     6w0d
Gi1/0/19     Gi1/0/19     6w0d
Gi1/0/20     Gi1/0/20     6w0d
Gi1/0/21     Gi1/0/21     6w0d
```



# show interfaces counters

To display various counters for the switch or for a specific interface, use the **show interfaces counters** command in privileged EXEC mode.

**show interfaces** [*interface-id*] **counters** [**errors** | **etherchannel** | **module** *stack-member-number* | **protocol status** | **trunk**]

Syntax Description	
<i>interface-id</i>	(Optional) ID of the physical interface, including type, stack member (stacking-capable switches only) module, and port number.
<b>errors</b>	(Optional) Displays error counters.
<b>etherchannel</b>	(Optional) Displays EtherChannel counters, including octets, broadcast packets, multicast packets, and unicast packets received and sent.
<b>module</b> <i>stack-member-number</i>	(Optional) Displays counters for the specified stack member. The range is 1 to 9.  <b>Note</b> In this command, the <b>module</b> keyword refers to the stack member number. The module number that is part of the interface ID is always zero.
<b>protocol status</b>	(Optional) Displays the status of protocols enabled on interfaces.
<b>trunk</b>	(Optional) Displays trunk counters.



**Note** Though visible in the command-line help string, the **vlan** *vlan-id* keyword is not supported.

**Command Default** None

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** If you do not enter any keywords, all counters for all interfaces are included.

This is an example of partial output from the **show interfaces counters** command. It displays all counters for the switch.

```
Device# show interfaces counters
Port          InOctets    InUcastPkts  InMcastPkts  InBcastPkts
Gi1/0/1             0             0             0             0
Gi1/0/2             0             0             0             0
Gi1/0/3       95285341     43115         1178430       1950
Gi1/0/4             0             0             0             0
```

<output truncated>

This is an example of partial output from the **show interfaces counters module** command for stack member 2. It displays all counters for the specified switch in the stack.

```
Device# show interfaces counters module 2
Port          InOctets    InUcastPkts  InMcastPkts  InBcastPkts
Gi1/0/1       520         2            0            0
Gi1/0/2       520         2            0            0
Gi1/0/3       520         2            0            0
Gi1/0/4       520         2            0            0
```

<output truncated>

This is an example of partial output from the **show interfaces counters protocol status** command for all interfaces:

```
Device# show interfaces counters protocol status
Protocols allocated:
Vlan1: Other, IP
Vlan20: Other, IP, ARP
Vlan30: Other, IP, ARP
Vlan40: Other, IP, ARP
Vlan50: Other, IP, ARP
Vlan60: Other, IP, ARP
Vlan70: Other, IP, ARP
Vlan80: Other, IP, ARP
Vlan90: Other, IP, ARP
Vlan900: Other, IP, ARP
Vlan3000: Other, IP
Vlan3500: Other, IP
GigabitEthernet1/0/1: Other, IP, ARP, CDP
GigabitEthernet1/0/2: Other, IP
GigabitEthernet1/0/3: Other, IP
GigabitEthernet1/0/4: Other, IP
GigabitEthernet1/0/5: Other, IP
GigabitEthernet1/0/6: Other, IP
GigabitEthernet1/0/7: Other, IP
GigabitEthernet1/0/8: Other, IP
GigabitEthernet1/0/9: Other, IP
GigabitEthernet1/0/10: Other, IP, CDP
```

<output truncated>

This is an example of output from the **show interfaces counters trunk** command. It displays trunk counters for all interfaces.

```
Device# show interfaces counters trunk
Port          TrunkFramesTx  TrunkFramesRx  WrongEncap
Gi1/0/1       0              0              0
Gi1/0/2       0              0              0
Gi1/0/3       80678         0              0
Gi1/0/4       82320         0              0
Gi1/0/5       0              0              0
```

<output truncated>

# show interfaces switchport

To display the administrative and operational status of a switching (nonrouting) port, including port blocking and port protection settings, use the **show interfaces switchport** command in privileged EXEC mode.

**show interfaces** [*interface-id*] **switchport** [**backup** [**detail**] | **module** *number*]

Syntax Description	
<i>interface-id</i>	(Optional) ID of the interface. Valid interfaces include physical ports (including type, stack member for stacking-capable switches, module, and port number) and port channels. The port channel range is 1 to 48.
<b>backup</b>	(Optional) Displays Flex Link backup interface configuration for the specified interface or all interfaces.
<b>detail</b>	(Optional) Displays detailed backup information for the specified interface or all interfaces on the switch or the stack.
<b>module</b> <i>number</i>	(Optional) Displays switchport configuration of all interfaces on the switch or specified stack member.  The range is 1 to 9.  This option is not available if you entered a specific interface ID.

**Command Default** None

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **show interface switchport module** *number* command to display the switch port characteristics of all interfaces on that switch in the stack. If there is no switch with that module number in the stack, there is no output.

This is an example of output from the **show interfaces switchport** command for a port. The table that follows describes the fields in the display.



**Note** Private VLANs are not supported in this release, so those fields are not applicable.

```
Device# show interfaces gigabitethernet1/0/1 switchport
Name: Gi1/0/1
Switchport: Enabled
Administrative Mode: trunk
Operational Mode: down
Administrative Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 10 (VLAN0010)
```

## show interfaces switchport

```

Administrative Native VLAN tagging: enabled
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk associations: none
Administrative private-vlan trunk mappings: none
Operational private-vlan: none
Trunking VLANs Enabled: 11-20
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL

Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none

```

Field	Description
Name	Displays the port name.
Switchport	Displays the administrative and operational status of the port. In this display, the port is in switchport mode.
Administrative Mode Operational Mode	Displays the administrative and operational modes.
Administrative Trunking Encapsulation Operational Trunking Encapsulation Negotiation of Trunking	Displays the administrative and operational encapsulation method and whether trunking negotiation is enabled.
Access Mode VLAN	Displays the VLAN ID to which the port is configured.
Trunking Native Mode VLAN Trunking VLANs Enabled Trunking VLANs Active	Lists the VLAN ID of the trunk that is in native mode. Lists the allowed VLANs on the trunk. Lists the active VLANs on the trunk.
Pruning VLANs Enabled	Lists the VLANs that are pruning-eligible.
Protected	Displays whether or not protected port is enabled (True) or disabled (False) on the interface.
Unknown unicast blocked Unknown multicast blocked	Displays whether or not unknown multicast and unknown unicast traffic is blocked on the interface.
Voice VLAN	Displays the VLAN ID on which voice VLAN is enabled.

Field	Description
Appliance trust	Displays the class of service (CoS) setting of the data packets of the IP phone.

This is an example of output from the **show interfaces switchport backup** command:

```
Device# show interfaces switchport backup
Switch Backup Interface Pairs:
Active Interface      Backup Interface      State
-----
Gi1/0/1              Gi1/0/2              Active Up/Backup Standby
Gi3/0/3              Gi4/0/5              Active Down/Backup Up
Po1                  Po2                  Active Standby/Backup Up
```

In this example of output from the **show interfaces switchport backup** command, VLANs 1 to 50, 60, and 100 to 120 are configured on the switch:

```
Device(config)# interface gigabitethernet 2/0/6
Device(config-if)# switchport backup interface gigabitethernet 2/0/8
prefer vlan 60,100-120
```

When both interfaces are up, Gi2/0/8 forwards traffic for VLANs 60, 100 to 120, and Gi2/0/6 will forward traffic for VLANs 1 to 50.

```
Device# show interfaces switchport backup

Switch Backup Interface Pairs:
Active Interface      Backup Interface      State
-----
GigabitEthernet2/0/6  GigabitEthernet2/0/8  Active Up/Backup Up
Vlans on Interface Gi 2/0/6: 1-50
Vlans on Interface Gi 2/0/8: 60, 100-120
```

When a Flex Link interface goes down (LINK\_DOWN), VLANs preferred on this interface are moved to the peer interface of the Flex Link pair. In this example, if interface Gi2/0/6 goes down, Gi2/0/8 carries all VLANs of the Flex Link pair.

```
Device# show interfaces switchport backup

Switch Backup Interface Pairs:
Active Interface      Backup Interface      State
-----
GigabitEthernet2/0/6  GigabitEthernet2/0/8  Active Down/Backup Up
Vlans on Interface Gi 2/0/6:
Vlans on Interface Gi 2/0/8: 1-50, 60, 100-120
```

When a Flex Link interface comes up, VLANs preferred on this interface are blocked on the peer interface and moved to the forwarding state on the interface that has just come up. In this example, if interface Gi2/0/6 comes up, then VLANs preferred on this interface are blocked on the peer interface Gi2/0/8 and forwarded on Gi2/0/6.

```
Device# show interfaces switchport backup

Switch Backup Interface Pairs:
Active Interface      Backup Interface      State
-----
GigabitEthernet2/0/6  GigabitEthernet2/0/8  Active Up/Backup Up
Vlans on Interface Gi 2/0/6: 1-50
```

```
Vlans on Interface Gi 2/0/8: 60, 100-120
```

# show interfaces transceiver

To display the physical properties of a small form-factor pluggable (SFP) module interface, use the **show interfaces transceiver** command in EXEC mode.

**show interfaces** [*interface-id*] **transceiver** [**detail** | **module** *number* | **properties** | **supported-list** | **threshold-table**]

Syntax Description	
<i>interface-id</i>	(Optional) ID of the physical interface, including type, stack member (stacking-capable switches only) module, and port number.
<b>detail</b>	(Optional) Displays calibration properties, including high and low numbers and any alarm information for any Digital Optical Monitoring (DoM)-capable transceiver if one is installed in the switch.
<b>module</b> <i>number</i>	(Optional) Limits display to interfaces on module on the switch. This option is not available if you entered a specific interface ID.
<b>properties</b>	(Optional) Displays speed, duplex, and inline power settings on an interface.
<b>supported-list</b>	(Optional) Lists all supported transceivers.
<b>threshold-table</b>	(Optional) Displays alarm and warning threshold table.

Command Modes	
	User EXEC
	Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

This is an example of output from the **show interfaces *interface-id* transceiver detail** command:

```
Device# show interfaces gigabitethernet1/1/1 transceiver detail
  ITU Channel not available (Wavelength not available),
  Transceiver is internally calibrated.
  mA:milliamperes, dBm:decibels (milliwatts), N/A:not applicable.
  ++:high alarm, +:high warning, -:low warning, -- :low alarm.
  A2D readouts (if they differ), are reported in parentheses.
  The threshold values are uncalibrated.
```

Port	Temperature (Celsius)	High Alarm Threshold (Celsius)	High Warn Threshold (Celsius)	Low Warn Threshold (Celsius)	Low Alarm Threshold (Celsius)
Gil1/1/1	29.9	74.0	70.0	0.0	-4.0

Port	Voltage (Volts)	High Alarm Threshold (Volts)	High Warn Threshold (Volts)	Low Warn Threshold (Volts)	Low Alarm Threshold (Volts)
Gil1/1/1	3.28	3.60	3.50	3.10	3.00

## show interfaces transceiver

Port	Optical Transmit Power (dBm)	High Alarm Threshold (dBm)	High Warn Threshold (dBm)	Low Warn Threshold (dBm)	Low Alarm Threshold (dBm)
Gil/1/1	1.8	7.9	3.9	0.0	-4.0

Port	Optical Receive Power (dBm)	High Alarm Threshold (dBm)	High Warn Threshold (dBm)	Low Warn Threshold (dBm)	Low Alarm Threshold (dBm)
Gil/1/1	-23.5	-5.0	-9.0	-28.2	-32.2

This is an example of output from the **show interfaces transceiver threshold-table** command:

```
Device# show interfaces transceiver threshold-table
```

	Optical Tx	Optical Rx	Temp	Laser Bias current	Voltage
DWDM GBIC					
Min1	-4.00	-32.00	-4	N/A	4.65
Min2	0.00	-28.00	0	N/A	4.75
Max2	4.00	-9.00	70	N/A	5.25
Max1	7.00	-5.00	74	N/A	5.40
DWDM SFP					
Min1	-4.00	-32.00	-4	N/A	3.00
Min2	0.00	-28.00	0	N/A	3.10
Max2	4.00	-9.00	70	N/A	3.50
Max1	8.00	-5.00	74	N/A	3.60
RX only WDM GBIC					
Min1	N/A	-32.00	-4	N/A	4.65
Min2	N/A	-28.30	0	N/A	4.75
Max2	N/A	-9.00	70	N/A	5.25
Max1	N/A	-5.00	74	N/A	5.40
DWDM XENPAK					
Min1	-5.00	-28.00	-4	N/A	N/A
Min2	-1.00	-24.00	0	N/A	N/A
Max2	3.00	-7.00	70	N/A	N/A
Max1	7.00	-3.00	74	N/A	N/A
DWDM X2					
Min1	-5.00	-28.00	-4	N/A	N/A
Min2	-1.00	-24.00	0	N/A	N/A
Max2	3.00	-7.00	70	N/A	N/A
Max1	7.00	-3.00	74	N/A	N/A
DWDM XFP					
Min1	-5.00	-28.00	-4	N/A	N/A
Min2	-1.00	-24.00	0	N/A	N/A
Max2	3.00	-7.00	70	N/A	N/A
Max1	7.00	-3.00	74	N/A	N/A
CWDM X2					
Min1	N/A	N/A	0	N/A	N/A
Min2	N/A	N/A	0	N/A	N/A
Max2	N/A	N/A	0	N/A	N/A
Max1	N/A	N/A	0	N/A	N/A

<output truncated>



# show inventory

To display the product inventory listing of all Cisco products installed in the networking device, use the **show inventory** command in user EXEC or privileged EXEC mode.

**show inventory fru | oid | raw [entity]**

<b>fru</b>	(Optional) Retrieves information about all Field Replaceable Units (FRUs) installed in the Cisco networking device.
<b>oid</b>	(Optional) Retrieves information about the vendor specific hardware registration identifier referred to as object identifier (OID).  The OID identifies the MIB object's location in the MIB hierarchy, and provides a means of accessing the MIB object in a network of managed devices
<b>raw</b>	(Optional) Retrieves information about all Cisco products referred to as entities installed in the Cisco networking device, even if the entities do not have a product ID (PID) value, a unique device identifier (UDI), or other physical identification.
<i>entity</i>	(Optional) Name of a Cisco entity (for example, chassis, backplane, module, or slot). A quoted string may be used to display very specific UDI information; for example "sfslot 1" will display the UDI information for slot 1 of an entity named sfslot.

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.6.1	This command was introduced.
Cisco IOS XE Everest 16.6.3	This command was enhanced to display the serial number for the chassis.

## Usage Guidelines

The **show inventory** command retrieves and displays inventory information about each Cisco product in the form of a UDI. The UDI is a combination of three separate data elements: a product identifier (PID), a version identifier (VID), and the serial number (SN).

The PID is the name by which the product can be ordered; it has been historically called the "Product Name" or "Part Number." This is the identifier that one would use to order an exact replacement part.

The VID is the version of the product. Whenever a product has been revised, the VID will be incremented. The VID is incremented according to a rigorous process derived from Telcordia GR-209-CORE, an industry guideline that governs product change notices.

The SN is the vendor-unique serialization of the product. Each manufactured product will carry a unique serial number assigned at the factory, which cannot be changed in the field. This is the means by which to identify an individual, specific instance of a product.

The UDI refers to each product as an entity. Some entities, such as a chassis, will have subtentities like slots. Each entity will display on a separate line in a logically ordered presentation that is arranged hierarchically by Cisco entities.

Use the **show inventory** command without options to display a list of Cisco entities installed in the networking device that are assigned a PID.

The following is sample output from the **show inventory** command:

```
Device#show inventory
9500-32QC-SVL#show inv
NAME: "Switch 1 Chassis", DESCR: "Cisco Catalyst 9500 Series Chassis"
PID: C9500-32QC      , VID: V00  , SN: CAT2144L10V

NAME: "Switch 1 Power Supply Module 0", DESCR: "Cisco Catalyst 9500 Series 650W AC Power
Supply"
PID: C9K-PWR-650WAC-R  , VID: V00  , SN: ART2148F53T

NAME: "Switch 1 Power Supply Module 1", DESCR: "Cisco Catalyst 9500 Series 650W AC Power
Supply"
PID: C9K-PWR-650WAC-R  , VID: V01  , SN: ART2151FC04

NAME: "Switch 1 Fan Tray 0", DESCR: "Cisco Catalyst 9500 Series Fan Tray"
PID: C9K-T1-FANTRAY    , VID:      , SN:

NAME: "Switch 1 Fan Tray 1", DESCR: "Cisco Catalyst 9500 Series Fan Tray"
PID: C9K-T1-FANTRAY    , VID:      , SN:

NAME: "Switch 1 Slot 1 Supervisor", DESCR: "Cisco Catalyst 9500 Series Router"
PID: C9500-32QC      , VID: V00  , SN: CAT2144L10V

NAME: "FortyGigabitEthernet1/0/2", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M    , VID: A0   , SN: JPC2144034J-A

NAME: "FortyGigabitEthernet1/0/4", DESCR: "QSFP 40GE SR4"
PID: QSFP-40G-SR4      , VID: 03   , SN: AVP1824S0YQ

NAME: "FortyGigabitEthernet1/0/5", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M   , VID: D    , SN: FIW211101UL-B

NAME: "FortyGigabitEthernet1/0/8", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M   , VID: D    , SN: FIW211101N6-B

NAME: "FortyGigabitEthernet1/0/10", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M   , VID: A    , SN: DTS2045A271-B

NAME: "FortyGigabitEthernet1/0/11", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M    , VID: D    , SN: TED2047K013-B

NAME: "FortyGigabitEthernet1/0/15", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M   , VID: D    , SN: FIS1922011T-B

NAME: "FortyGigabitEthernet1/0/16-qs", DESCR: "CVR 10GE SFP "
PID: CVR-QSFP-SFP10G   , VID: V01  , SN: DTY204604UN

NAME: "FortyGigabitEthernet1/0/16", DESCR: "10GE CU3M"
PID: SFP-H10GB-CU3M    , VID: R    , SN: TED1739B9HY

NAME: "FortyGigabitEthernet1/0/18", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M    , VID: D    , SN: TED2047K10U-A

NAME: "FortyGigabitEthernet1/0/19", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M    , VID: D    , SN: TED2030K4U6-B

NAME: "FortyGigabitEthernet1/0/22", DESCR: "QSFP 40GE CU5M"
PID: QSFP-H40G-CU5M    , VID: A0   , SN: JPC203508YN-B

NAME: "FortyGigabitEthernet1/0/24", DESCR: "QSFP 40GE CU3M"
```

```
PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2047K13Y-A

NAME: "FortyGigabitEthernet1/0/25", DESCR: "QSFP 100GE CU3M"
PID: QSFP-100G-CU3M      , VID: A      , SN: APF20412069-A

NAME: "FortyGigabitEthernet1/0/28", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: A0     , SN: JPC214402J7-A

NAME: "FortyGigabitEthernet1/0/30", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2047K13Z-B

NAME: "FortyGigabitEthernet1/0/32", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: 01     , SN: LCC1922G2E8-A

NAME: "HundredGigE1/0/33",  DESCR: "QSFP 100GE CU3M"
PID: QSFP-100G-CU3M      , VID: A      , SN: APF20412159-A

NAME: "HundredGigE1/0/47",  DESCR: "QSFP 100GE CU3M"
PID: QSFP-100G-CU3M      , VID: A      , SN: APF21010360-B

NAME: "HundredGigE1/0/48",  DESCR: "QSFP 100GE CU1M"
PID: QSFP-100G-CU1M      , VID: A      , SN: APF21450009-A

NAME: "Switch 2 Chassis",   DESCR: "Cisco Catalyst 9500 Series Chassis"
PID: C9500-32QC          , VID: V00    , SN: CAT2144L10L

NAME: "Switch 2 Power Supply Module 0", DESCR: "Cisco Catalyst 9500 Series 650W AC Power
Supply"
PID: C9K-PWR-650WAC-R   , VID: V00    , SN: ART2141FAZ4

NAME: "Switch 2 Fan Tray 4", DESCR: "Cisco Catalyst 9500 Series Fan Tray"
PID: C9K-T1-FANTRAY     , VID:        , SN:

NAME: "Switch 2 Fan Tray 5", DESCR: "Cisco Catalyst 9500 Series Fan Tray"
PID: C9K-T1-FANTRAY     , VID:        , SN:

NAME: "Switch 2 Slot 1 Supervisor", DESCR: "Cisco Catalyst 9500 Series Router"
PID: C9500-32QC          , VID: V00    , SN: CAT2144L10L

NAME: "SATA disk",         DESCR: "disk0 Drive"
PID: C9K-F1-SSD-240G     , VID: V00    , SN: CAT2144L1J0

NAME: "FortyGigabitEthernet2/0/4", DESCR: "QSFP 40GE SR4"
PID: QSFP-40G-SR4        , VID: 03     , SN: AVP1824S0YS

NAME: "FortyGigabitEthernet2/0/6", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2047K0ZN-B

NAME: "FortyGigabitEthernet2/0/7", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2047K0ZN-A

NAME: "FortyGigabitEthernet2/0/8", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2030K4U6-A

NAME: "FortyGigabitEthernet2/0/9", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: A0     , SN: JPC2144034J-B

NAME: "FortyGigabitEthernet2/0/10", DESCR: "QSFP 40GE AOC10M"
PID: QSFP-H40G-AOC10M    , VID: A      , SN: DTS2101A050-B

NAME: "FortyGigabitEthernet2/0/11", DESCR: "QSFP 40GE CU5M"
PID: QSFP-H40G-CU5M      , VID: A0     , SN: JPC203508R1-B

NAME: "FortyGigabitEthernet2/0/13", DESCR: "QSFP 40GE CU3M"
```

```

PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2047K13Y-B

NAME: "FortyGigabitEthernet2/0/14", DESCR: "QSFP 40GE CU2M"
PID: QSFP-H40G-CU2M      , VID: A0     , SN: JPC2039000Z-A

NAME: "FortyGigabitEthernet2/0/15", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M     , VID: A      , SN: DTS2045A271-A

NAME: "FortyGigabitEthernet2/0/17", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M     , VID: D      , SN: FIW211101N6-A

NAME: "FortyGigabitEthernet2/0/18", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2047K013-A

NAME: "FortyGigabitEthernet2/0/19", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M     , VID: D      , SN: FIW211101UL-A

NAME: "FortyGigabitEthernet2/0/20", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M     , VID: D      , SN: FIS1922011T-A

NAME: "FortyGigabitEthernet2/0/21-qls", DESCR: "CVR 10GE SFP "
PID: CVR-QSFP-SFP10G     , VID: V01    , SN: DTY20460528

NAME: "FortyGigabitEthernet2/0/21", DESCR: "10GE CU3M"
PID: SFP-H10GB-CU3M      , VID: B2     , SN: LRM204581VA

NAME: "FortyGigabitEthernet2/0/28", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: A0     , SN: JPC214402J7-B

NAME: "FortyGigabitEthernet2/0/30", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2047K13Z-A

NAME: "FortyGigabitEthernet2/0/32", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M      , VID: 01     , SN: LCC1922G2E8-B

NAME: "HundredGigE2/0/33", DESCR: "QSFP 100GE CU3M"
PID: QSFP-100G-CU3M      , VID: A      , SN: APF21010653-B

NAME: "HundredGigE2/0/47", DESCR: "QSFP 100GE CU3M"
PID: QSFP-100G-CU3M      , VID: A      , SN: APF21010360-A

NAME: "HundredGigE2/0/48", DESCR: "QSFP 100GE CU1M"
PID: QSFP-100G-CU1M      , VID: A      , SN: APF21450009-B

```

**Table 9: show inventory Field Descriptions**

Field	Description
NAME	Physical name (text string) assigned to the Cisco entity. For example, console or a simple component number (port or module number), such as "1," depending on the physical component naming syntax of the device.
DESCR	Physical description of the Cisco entity that characterizes the object. The physical description includes the hardware serial number and the hardware revision.
PID	Entity product identifier. Equivalent to the entPhysicalModelName MIB variable in RFC 2737.
VID	Entity version identifier. Equivalent to the entPhysicalHardwareRev MIB variable in RFC 2737.
SN	Entity serial number. Equivalent to the entPhysicalSerialNum MIB variable in RFC 2737.

For diagnostic purposes, the **show inventory** command can be used with the **raw** keyword to display every RFC 2737 entity including those without a PID, UDI, or other physical identification.



**Note** The **raw** keyword option is primarily intended for troubleshooting problems with the **show inventory** command itself.

Enter the **show inventory** command with an *entity* argument value to display the UDI information for a specific type of Cisco entity installed in the networking device. In this example, a list of Cisco entities that match the sfslot argument string is displayed.

```
Device#show inventory "Switch 1 Chassis"
NAME: "Switch 1 Chassis", DESCR: "Cisco Catalyst 9500 Series Chassis"
PID: C9500-32QC      , VID: V00  , SN: CAT2144L10V

NAME: "Switch 1 Power Supply Module 0", DESCR: "Cisco Catalyst 9500 Series 650W AC Power
Supply"
PID: C9K-PWR-650WAC-R  , VID: V00  , SN: ART2148F53T

NAME: "Switch 1 Power Supply Module 1", DESCR: "Cisco Catalyst 9500 Series 650W AC Power
Supply"
PID: C9K-PWR-650WAC-R  , VID: V01  , SN: ART2151FC04

NAME: "Switch 1 Fan Tray 0", DESCR: "Cisco Catalyst 9500 Series Fan Tray"
PID: C9K-T1-FANTRAY    , VID:      , SN:

NAME: "Switch 1 Fan Tray 1", DESCR: "Cisco Catalyst 9500 Series Fan Tray"
PID: C9K-T1-FANTRAY    , VID:      , SN:

NAME: "Switch 1 Slot 1 Supervisor", DESCR: "Cisco Catalyst 9500 Series Router"
PID: C9500-32QC      , VID: V00  , SN: CAT2144L10V

NAME: "FortyGigabitEthernet1/0/2", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M    , VID: A0   , SN: JPC2144034J-A

NAME: "FortyGigabitEthernet1/0/4", DESCR: "QSFP 40GE SR4"
PID: QSFP-40G-SR4      , VID: 03   , SN: AVP1824S0YQ

NAME: "FortyGigabitEthernet1/0/5", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M   , VID: D    , SN: FIW211101UL-B

NAME: "FortyGigabitEthernet1/0/8", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M   , VID: D    , SN: FIW211101N6-B

NAME: "FortyGigabitEthernet1/0/10", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M   , VID: A    , SN: DTS2045A271-B

NAME: "FortyGigabitEthernet1/0/11", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M    , VID: D    , SN: TED2047K013-B

NAME: "FortyGigabitEthernet1/0/15", DESCR: "QSFP 40GE AOC3M"
PID: QSFP-H40G-AOC3M   , VID: D    , SN: FIS1922011T-B

NAME: "FortyGigabitEthernet1/0/16-qla", DESCR: "CVR 10GE SFP "
PID: CVR-QSFP-SFP10G   , VID: V01  , SN: DTY204604UN

NAME: "FortyGigabitEthernet1/0/16", DESCR: "10GE CU3M"
PID: SFP-H10GB-CU3M     , VID: R    , SN: TED1739B9HY

NAME: "FortyGigabitEthernet1/0/18", DESCR: "QSFP 40GE CU3M"
PID: QSFP-H40G-CU3M    , VID: D    , SN: TED2047K10U-A
```

## show inventory

```
NAME: "FortyGigabitEthernet1/0/19", DESCR: "QSFP 40GE CU3M"  
PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2030K4U6-B  
  
NAME: "FortyGigabitEthernet1/0/22", DESCR: "QSFP 40GE CU5M"  
PID: QSFP-H40G-CU5M      , VID: A0     , SN: JPC203508YN-B  
  
NAME: "FortyGigabitEthernet1/0/24", DESCR: "QSFP 40GE CU3M"  
PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2047K13Y-A  
  
NAME: "FortyGigabitEthernet1/0/25", DESCR: "QSFP 100GE CU3M"  
PID: QSFP-100G-CU3M      , VID: A      , SN: APF20412069-A  
  
NAME: "FortyGigabitEthernet1/0/28", DESCR: "QSFP 40GE CU3M"  
PID: QSFP-H40G-CU3M      , VID: A0     , SN: JPC214402J7-A  
  
NAME: "FortyGigabitEthernet1/0/30", DESCR: "QSFP 40GE CU3M"  
PID: QSFP-H40G-CU3M      , VID: D      , SN: TED2047K13Z-B  
  
NAME: "FortyGigabitEthernet1/0/32", DESCR: "QSFP 40GE CU3M"  
PID: QSFP-H40G-CU3M      , VID: 01     , SN: LCC1922G2E8-A  
  
NAME: "HundredGigE1/0/33", DESCR: "QSFP 100GE CU3M"  
PID: QSFP-100G-CU3M      , VID: A      , SN: APF20412159-A  
  
NAME: "HundredGigE1/0/47", DESCR: "QSFP 100GE CU3M"  
PID: QSFP-100G-CU3M      , VID: A      , SN: APF21010360-B  
  
NAME: "HundredGigE1/0/48", DESCR: "QSFP 100GE CU1M"  
PID: QSFP-100G-CU1M      , VID: A      , SN: APF21450009-A
```

You can request even more specific UDI information with the *entity* argument value enclosed in quotation marks.

# show memory platform

To display memory statistics of a platform, use the **show memory platform** command in privileged EXEC mode.

**show memory platform** [**compressed-swap** | **information** | **page-merging**]

Syntax Description	
<b>compressed-swap</b>	(Optional) Displays platform memory compressed-swap information.
<b>information</b>	(Optional) Displays general information about the platform.
<b>page-merging</b>	(Optional) Displays platform memory page-merging information.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Free memory is accurately computed and displayed in the Free Memory field of the command output.

## Examples

The following is sample output from the **show memory platform** command:

```
Switch# show memory platform

Virtual memory   : 12874653696
Pages resident  : 627041
Major page faults: 2220
Minor page faults: 2348631

Architecture    : mips64
Memory (kB)
  Physical      : 3976852
  Total         : 3976852
  Used          : 2761276
  Free          : 1215576
  Active        : 2128196
  Inactive      : 1581856
  Inact-dirty   : 0
  Inact-clean   : 0
  Dirty         : 0
  AnonPages     : 1294984
  Bounce        : 0
  Cached        : 1978168
  Commit Limit  : 1988424
  Committed As  : 3343324
  High Total    : 0
  High Free     : 0
  Low Total     : 3976852
  Low Free      : 1215576
  Mapped        : 516316
  NFS Unstable  : 0
  Page Tables   : 17124
  Slab          : 0
```

## show memory platform

```

VMmalloc Chunk : 1069542588
VMmalloc Total : 1069547512
VMmalloc Used  : 2588
Writeback      : 0
HugePages Total: 0
HugePages Free : 0
HugePages Rsvd : 0
HugePage Size  : 2048

Swap (kB)
Total          : 0
Used           : 0
Free           : 0
Cached        : 0

Buffers (kB)   : 437136

Load Average
1-Min          : 1.04
5-Min          : 1.16
15-Min         : 0.94

```

The following is sample output from the **show memory platform information** command:

```
Device# show memory platform information
```

```

Virtual memory   : 12870438912
Pages resident  : 626833
Major page faults: 2222
Minor page faults: 2362455

Architecture    : mips64
Memory (kB)
Physical        : 3976852
Total           : 3976852
Used            : 2761224
Free            : 1215628
Active          : 2128060
Inactive        : 1584444
Inact-dirty     : 0
Inact-clean     : 0
Dirty           : 284
AnonPages       : 1294656
Bounce          : 0
Cached          : 1979644
Commit Limit    : 1988424
Committed As    : 3342184
High Total      : 0
High Free       : 0
Low Total       : 3976852
Low Free        : 1215628
Mapped          : 516212
NFS Unstable    : 0
Page Tables     : 17096
Slab            : 0
VMmalloc Chunk : 1069542588
VMmalloc Total : 1069547512
VMmalloc Used  : 2588
Writeback      : 0
HugePages Total: 0
HugePages Free : 0
HugePages Rsvd : 0
HugePage Size  : 2048

```



```
Swap (kB)
  Total      : 0
  Used       : 0
  Free       : 0
  Cached     : 0

Buffers (kB) : 438228

Load Average
  1-Min      : 1.54
  5-Min      : 1.27
  15-Min     : 0.99
```

# show module

To display module information such as switch number, model number, serial number, hardware revision number, software version, MAC address and so on, use this command in user EXEC or privileged EXEC mode.

```
show module [switch-num]
```

<b>Syntax Description</b>	<i>switch-num</i>	(Optional) Number of the switch.
<b>Command Default</b>	None	
<b>Command Modes</b>	User EXEC (>) Privileged EXEC (#)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	Entering the <b>show module</b> command without the <i>switch-num</i> argument is the same as entering the show module all command.	

# show mgmt-infra trace messages ilpower

To display inline power messages within a trace buffer, use the **show mgmt-infra trace messages ilpower** command in privileged EXEC mode.

**show mgmt-infra trace messages ilpower** [**switch** *stack-member-number*]

<b>Syntax Description</b>	<b>switch</b> <i>stack-member-number</i> (Optional) Specifies the stack member number for which to display inline power messages within a trace buffer.				
<b>Command Default</b>	None				
<b>Command Modes</b>	Privileged EXEC				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

This is an output example from the **show mgmt-infra trace messages ilpower** command:

```
Device# show mgmt-infra trace messages ilpower
[10/23/12 14:05:10.984 UTC 1 3] Initialized inline power system configuration fo
r slot 1.
[10/23/12 14:05:10.984 UTC 2 3] Initialized inline power system configuration fo
r slot 2.
[10/23/12 14:05:10.984 UTC 3 3] Initialized inline power system configuration fo
r slot 3.
[10/23/12 14:05:10.984 UTC 4 3] Initialized inline power system configuration fo
r slot 4.
[10/23/12 14:05:10.984 UTC 5 3] Initialized inline power system configuration fo
r slot 5.
[10/23/12 14:05:10.984 UTC 6 3] Initialized inline power system configuration fo
r slot 6.
[10/23/12 14:05:10.984 UTC 7 3] Initialized inline power system configuration fo
r slot 7.
[10/23/12 14:05:10.984 UTC 8 3] Initialized inline power system configuration fo
r slot 8.
[10/23/12 14:05:10.984 UTC 9 3] Initialized inline power system configuration fo
r slot 9.
[10/23/12 14:05:10.984 UTC a 3] Inline power subsystem initialized.
[10/23/12 14:05:18.908 UTC b 264] Create new power pool for slot 1
[10/23/12 14:05:18.909 UTC c 264] Set total inline power to 450 for slot 1
[10/23/12 14:05:20.273 UTC d 3] PoE is not supported on .
[10/23/12 14:05:20.288 UTC e 3] PoE is not supported on .
[10/23/12 14:05:20.299 UTC f 3] PoE is not supported on .
[10/23/12 14:05:20.311 UTC 10 3] PoE is not supported on .
[10/23/12 14:05:20.373 UTC 11 98] Inline power process post for switch 1
[10/23/12 14:05:20.373 UTC 12 98] PoE post passed on switch 1
[10/23/12 14:05:20.379 UTC 13 3] Slot #1: PoE initialization for board id 16387
[10/23/12 14:05:20.379 UTC 14 3] Set total inline power to 450 for slot 1
[10/23/12 14:05:20.379 UTC 15 3] Gi1/0/1 port config Initialized
[10/23/12 14:05:20.379 UTC 16 3] Interface Gi1/0/1 initialization done.
[10/23/12 14:05:20.380 UTC 17 3] Gi1/0/24 port config Initialized
[10/23/12 14:05:20.380 UTC 18 3] Interface Gi1/0/24 initialization done.
[10/23/12 14:05:20.380 UTC 19 3] Slot #1: initialization done.
```

```
show mgmt-infra trace messages ilpower
```

```
[10/23/12 14:05:50.440 UTC 1a 3] Slot #1: PoE initialization for board id 16387  
[10/23/12 14:05:50.440 UTC 1b 3] Duplicate init event
```

## show mgmt-infra trace messages ilpower-ha

To display inline power high availability messages within a trace buffer, use the **show mgmt-infra trace messages ilpower-ha** command in privileged EXEC mode.

```
show mgmt-infra trace messages ilpower-ha [switch stack-member-number]
```

<b>Syntax Description</b>	<b>switch</b> <i>stack-member-number</i> (Optional) Specifies the stack member number for which to display inline power messages within a trace buffer.				
<b>Command Default</b>	None				
<b>Command Modes</b>	Privileged EXEC				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

This is an output example from the **show mgmt-infra trace messages ilpower-ha** command:

```
Device# show mgmt-infra trace messages ilpower-ha
[10/23/12 14:04:48.087 UTC 1 3] NG3K_ILPOWER_HA: Created NGWC ILP CF client successfully.
```

# show mgmt-infra trace messages platform-mgr-poe

To display platform manager Power over Ethernet (PoE) messages within a trace buffer, use the **show mgmt-infra trace messages platform-mgr-poe** privileged EXEC command.

**show mgmt-infra trace messages platform-mgr-poe** [**switch** *stack-member-number*]

<b>Syntax Description</b>	<b>switch</b> <i>stack-member-number</i> (Optional) Specifies the stack member number for which to display messages within a trace buffer.				
<b>Command Default</b>	None				
<b>Command Modes</b>	Privileged EXEC				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

This is an example of partial output from the **show mgmt-infra trace messages platform-mgr-poe** command:

```
Device# show mgmt-infra trace messages platform-mgr-poe
[10/23/12 14:04:06.431 UTC 1 5495] PoE Info: get power controller param sent:
[10/23/12 14:04:06.431 UTC 2 5495] PoE Info: POE_SHUT sent for port 1 (0:0)
[10/23/12 14:04:06.431 UTC 3 5495] PoE Info: POE_SHUT sent for port 2 (0:1)
[10/23/12 14:04:06.431 UTC 4 5495] PoE Info: POE_SHUT sent for port 3 (0:2)
[10/23/12 14:04:06.431 UTC 5 5495] PoE Info: POE_SHUT sent for port 4 (0:3)
[10/23/12 14:04:06.431 UTC 6 5495] PoE Info: POE_SHUT sent for port 5 (0:4)
[10/23/12 14:04:06.431 UTC 7 5495] PoE Info: POE_SHUT sent for port 6 (0:5)
[10/23/12 14:04:06.431 UTC 8 5495] PoE Info: POE_SHUT sent for port 7 (0:6)
[10/23/12 14:04:06.431 UTC 9 5495] PoE Info: POE_SHUT sent for port 8 (0:7)
[10/23/12 14:04:06.431 UTC a 5495] PoE Info: POE_SHUT sent for port 9 (0:8)
[10/23/12 14:04:06.431 UTC b 5495] PoE Info: POE_SHUT sent for port 10 (0:9)
[10/23/12 14:04:06.431 UTC c 5495] PoE Info: POE_SHUT sent for port 11 (0:10)
[10/23/12 14:04:06.431 UTC d 5495] PoE Info: POE_SHUT sent for port 12 (0:11)
[10/23/12 14:04:06.431 UTC e 5495] PoE Info: POE_SHUT sent for port 13 (e:0)
[10/23/12 14:04:06.431 UTC f 5495] PoE Info: POE_SHUT sent for port 14 (e:1)
[10/23/12 14:04:06.431 UTC 10 5495] PoE Info: POE_SHUT sent for port 15 (e:2)
[10/23/12 14:04:06.431 UTC 11 5495] PoE Info: POE_SHUT sent for port 16 (e:3)
[10/23/12 14:04:06.431 UTC 12 5495] PoE Info: POE_SHUT sent for port 17 (e:4)
[10/23/12 14:04:06.431 UTC 13 5495] PoE Info: POE_SHUT sent for port 18 (e:5)
[10/23/12 14:04:06.431 UTC 14 5495] PoE Info: POE_SHUT sent for port 19 (e:6)
[10/23/12 14:04:06.431 UTC 15 5495] PoE Info: POE_SHUT sent for port 20 (e:7)
[10/23/12 14:04:06.431 UTC 16 5495] PoE Info: POE_SHUT sent for port 21 (e:8)
[10/23/12 14:04:06.431 UTC 17 5495] PoE Info: POE_SHUT sent for port 22 (e:9)
[10/23/12 14:04:06.431 UTC 18 5495] PoE Info: POE_SHUT sent for port 23 (e:10)
```

# show network-policy profile

To display the network-policy profiles, use the **show network policy profile** command in privileged EXEC mode.

**show network-policy profile** [*profile-number*] [**detail**]

<b>Syntax Description</b>	<i>profile-number</i> (Optional) Displays the network-policy profile number. If no profile is entered, all network-policy profiles appear.	
	<b>detail</b> (Optional) Displays detailed status and statistics information.	
<b>Command Default</b>	None	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This is an example of output from the **show network-policy profile** command:

```
Device# show network-policy profile
Network Policy Profile 10
  voice vlan 17 cos 4
  Interface:
  none
Network Policy Profile 30
  voice vlan 30 cos 5
  Interface:
  none
Network Policy Profile 36
  voice vlan 4 cos 3
  Interface:
  Interface_id
```

# show platform hardware capacity



**Note** This command is not supported on the C9500-12Q-E, C9500-12Q-A, C9500-24Q-E, C9500-24Q-A, C9500-40X-E, and C9500-40X-A models of the Cisco Catalyst 9500 Series Switches.



**Note** The existing **show platform hardware capacity** command is currently supported, but is going to be deprecated. Use the **show tech-support resource** command instead.

To determine system hardware capacity, use the **show platform hardware capacity** command in privileged EXEC mode.

## show platform hardware capacity

**Syntax Description** This command has no arguments or keywords.

**Command Default** This command has no default settings.

**Command Modes** Privileged EXEC (#)

**Command History**

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

## Example

This example shows how to determine the system hardware capacity

```
Device# show platform hardware capacity
```

```
Module           Model           Operational Status
-----
subslot 1/0      C9500H-32QC      ok
```

```
Load Average
Slot Status 1-Min 5-Min 15-Min
RP0 Healthy 0.07 0.16 0.13
```

```
Memory (kB)
Slot Status Total Used (Pct) Free (Pct) Committed (Pct)
RP0 Healthy 15958108 3060492 (19%) 12897616 (81%) 25941080 (163%)
```

```
CPU Utilization
Slot CPU User System Nice Idle IRQ SIRQ IOWait
RP0 0 0.70 0.20 0.00 99.10 0.00 0.00 0.00
1 0.39 0.09 0.00 99.50 0.00 0.00 0.00
2 0.80 0.40 0.00 98.80 0.00 0.00 0.00
3 1.10 0.20 0.00 98.69 0.00 0.00 0.00
4 0.00 0.00 0.00 100.00 0.00 0.00 0.00
5 2.20 0.00 0.00 97.80 0.00 0.00 0.00
```



```

6 0.10 3.20 0.00 96.70 0.00 0.00 0.00
7 0.00 0.00 0.00 100.00 0.00 0.00 0.00

```

```

*: interface is up
IHQ: pkts in input hold queue      IQD: pkts dropped from input queue
OHQ: pkts in output hold queue     OQD: pkts dropped from output queue
RXBS: rx rate (bits/sec)           RXPS: rx rate (pkts/sec)
TXBS: tx rate (bits/sec)           TXPS: tx rate (pkts/sec)
TRTL: throttle count

```

Interface			IHQ	IQD	OHQ	OQD	RXBS	RXPS
TXBS	TXPS	TRTL						
Vlan1			0	0	0	0	0	0
0	0	0						
* GigabitEthernet0/0			0	0	0	0	0	0
0	0	0						
Fo1/0/1			0	0	0	0	0	0
0	0	0						
Fo1/0/2			0	0	0	0	0	0
0	0	0						
Fo1/0/3			0	0	0	0	0	0
0	0	0						
Fo1/0/4			0	0	0	0	0	0
0	0	0						
Fo1/0/5			0	0	0	0	0	0
0	0	0						
Fo1/0/6			0	0	0	0	0	0
0	0	0						
Fo1/0/7			0	0	0	0	0	0
0	0	0						
Fo1/0/8			0	0	0	0	0	0
0	0	0						
Fo1/0/9			0	0	0	0	0	0
0	0	0						
Fo1/0/10			0	0	0	0	0	0
0	0	0						
Fo1/0/11			0	0	0	0	0	0
0	0	0						
Fo1/0/12			0	0	0	0	0	0
0	0	0						
Fo1/0/13			0	0	0	0	0	0
0	0	0						
Fo1/0/14			0	0	0	0	0	0
0	0	0						
Fo1/0/15			0	0	0	0	0	0
0	0	0						
Fo1/0/16			0	0	0	0	0	0
0	0	0						
Fo1/0/17			0	0	0	0	0	0
0	0	0						
Fo1/0/18			0	0	0	0	0	0
0	0	0						
Fo1/0/19			0	0	0	0	0	0
0	0	0						
Fo1/0/20			0	0	0	0	0	0
0	0	0						
Fo1/0/21			0	0	0	0	0	0
0	0	0						
Fo1/0/22			0	0	0	0	0	0
0	0	0						

## show platform hardware capacity

```

Fo1/0/23          0      0      0      0      0      0
0                0      0
* Fo1/0/24        0      0      0      0      0      0
0                0      0
* Fo1/0/25        0      0      0      0      0      0
0                0      0
* Fo1/0/26        0      0      0      0      0      0
0                0      0
* Fo1/0/27        0      0      0      0      0      0
0                0      0
* Fo1/0/28        0      0      0      0      0      0
0                0      0
* Fo1/0/29        0      0      0      0      0      0
0                0      0
* Fo1/0/30        0      0      0      0      0      0
0                0      0
* Fo1/0/31        0      0      0      0      0      0
0                0      0
Fo1/0/32          0      0      0      0      0      0
0                0      0
HundredGigE1/0/33 0      0      0      0      0      0
0                0      0
HundredGigE1/0/34 0      0      0      0      0      0
0                0      0
HundredGigE1/0/35 0      0      0      0      0      0
0                0      0
HundredGigE1/0/36 0      0      0      0      0      0
0                0      0
HundredGigE1/0/37 0      0      0      0      0      0
0                0      0
HundredGigE1/0/38 0      0      0      0      0      0
0                0      0
HundredGigE1/0/39 0      0      0      0      0      0
0                0      0
HundredGigE1/0/40 0      0      0      0      0      0
0                0      0
HundredGigE1/0/41 0      0      0      0      0      0
0                0      0
HundredGigE1/0/42 0      0      0      0      0      0
0                0      0
HundredGigE1/0/43 0      0      0      0      0      0
0                0      0
HundredGigE1/0/44 0      0      0      0      0      0
0                0      0
HundredGigE1/0/45 0      0      0      0      0      0
0                0      0
HundredGigE1/0/46 0      0      0      0      0      0
0                0      0
HundredGigE1/0/47 0      0      0      0      0      0
0                0      0
HundredGigE1/0/48 0      0      0      0      0      0
0                0      0

```

## ASIC 0 Info

-----

```

ASIC 0 HSN Table 0 Software info:      FSE 255
    TILE 0: (null)      srip
    TILE 1: (null)      srip
ASIC 0 HSN Table 1 Software info:      FSE 255
    TILE 0: (null)      srip
    TILE 1: (null)      srip
ASIC 0 HSN Table 2 Software info:      FSE 0
    TILE 0: Unicast MAC addresses srip 0 1 2 3
    TILE 1: Unicast MAC addresses srip 0 1 2 3
ASIC 0 HSN Table 3 Software info:      FSE 0

```

```

        TILE 0: Unicast MAC addresses srip 0 1 2 3
        TILE 1: Unicast MAC addresses srip 0 1 2 3
ASIC 0 HSN Table 4 Software info:      FSE 255
        TILE 0: (null)                srip
        TILE 1: (null)                srip
ASIC 0 HSN Table 5 Software info:      FSE 255
        TILE 0: (null)                srip
        TILE 1: (null)                srip
ASIC 0 HSN Table 6 Software info:      FSE 1
        TILE 0: Directly or indirectly connected routes srip 0 1 2 3
        TILE 1: Directly or indirectly connected routes srip 0 1 2 3
ASIC 0 HSN Table 7 Software info:      FSE 2
        TILE 0: SGT_DGT                srip 0 1 2 3
        TILE 1: SGT_DGT                srip 0 1 2 3
ASIC 0 HSF Table 0 Software info:      FSE 1
        TILE 0: Directly or indirectly connected routes srip 0 1 2 3
        TILE 1: Directly or indirectly connected routes srip 0 1 2 3
        TILE 2: Directly or indirectly connected routes srip 0 1 2 3
        TILE 3: Directly or indirectly connected routes srip 0 1 2 3
        TILE 4: Directly or indirectly connected routes srip 0 1 2 3
        TILE 5: Directly or indirectly connected routes srip 0 1 2 3
        TILE 6: Directly or indirectly connected routes srip 0 1 2 3
        TILE 7: Directly or indirectly connected routes srip 0 1 2 3
ASIC 0 HSF Table 1 Software info:      FSE 1
        TILE 0: Directly or indirectly connected routes srip 0 1 2 3
        TILE 1: Directly or indirectly connected routes srip 0 1 2 3
        TILE 2: Directly or indirectly connected routes srip 0 1 2 3
        TILE 3: Directly or indirectly connected routes srip 0 1 2 3
        TILE 4: Directly or indirectly connected routes srip 0 1 2 3
        TILE 5: Directly or indirectly connected routes srip 0 1 2 3
        TILE 6: Directly or indirectly connected routes srip 0 1 2 3
        TILE 7: Directly or indirectly connected routes srip 0 1 2 3
ASIC 0 HSF Table 2 Software info:      FSE 1
        TILE 0: Directly or indirectly connected routes srip 0 1 2 3
        TILE 1: Directly or indirectly connected routes srip 0 1 2 3
        TILE 2: Directly or indirectly connected routes srip 0 1 2 3
        TILE 3: Directly or indirectly connected routes srip 0 1 2 3
        TILE 4: Directly or indirectly connected routes srip 0 1 2 3
        TILE 5: Directly or indirectly connected routes srip 0 1 2 3
        TILE 6: Directly or indirectly connected routes srip 0 1 2 3
        TILE 7: Directly or indirectly connected routes srip 0 1 2 3
ASIC 0 HSF Table 3 Software info:      FSE 1
        TILE 0: Directly or indirectly connected routes srip 0 1 2 3
        TILE 1: Directly or indirectly connected routes srip 0 1 2 3
        TILE 2: Directly or indirectly connected routes srip 0 1 2 3
        TILE 3: Directly or indirectly connected routes srip 0 1 2 3
        TILE 4: Directly or indirectly connected routes srip 0 1 2 3
        TILE 5: Directly or indirectly connected routes srip 0 1 2 3
        TILE 6: Directly or indirectly connected routes srip 0 1 2 3
        TILE 7: Directly or indirectly connected routes srip 0 1 2 3
ASIC 0 HSF Table 4 Software info:      FSE 1
        TILE 0: Directly or indirectly connected routes srip 0 1 2 3
        TILE 1: Directly or indirectly connected routes srip 0 1 2 3
        TILE 2: Directly or indirectly connected routes srip 0 1 2 3
        TILE 3: Directly or indirectly connected routes srip 0 1 2 3
        TILE 4: Directly or indirectly connected routes srip 0 1 2 3
        TILE 5: Directly or indirectly connected routes srip 0 1 2 3
        TILE 6: Directly or indirectly connected routes srip 0 1 2 3
        TILE 7: Directly or indirectly connected routes srip 0 1 2 3
OVF Info
-----
Table 0 info:  FSE0: 0, FSE1: 255      #hwmabs: 24, #swmabs: 24
        MAB 0: Unicast MAC addresses srip 0 1 2 3      MAB 1: Unicast MAC addresses srip
0 1 2 3

```

## show platform hardware capacity

```

MAB 2: Unicast MAC addresses srip 0 1 2 3      MAB 3: Unicast MAC addresses srip
0 1 2 3
MAB 4: Unicast MAC addresses srip 0 1 2 3      MAB 5: Unicast MAC addresses srip
0 1 2 3
MAB 6: Unicast MAC addresses srip 0 1 2 3      MAB 7: Unicast MAC addresses srip
0 1 2 3
MAB 8: Unicast MAC addresses srip 0 1 2 3      MAB 9: Unicast MAC addresses srip
0 1 2 3
MAB 10: Unicast MAC addresses srip 0 1 2 3     MAB 11: Unicast MAC addresses srip
0 1 2 3
MAB 12: Unicast MAC addresses srip 0 1 2 3     MAB 13: Unicast MAC addresses srip
0 1 2 3
MAB 14: Unicast MAC addresses srip 0 1 2 3     MAB 15: Unicast MAC addresses srip
0 1 2 3
MAB 16: Unicast MAC addresses srip 0 1 2 3     MAB 17: Unicast MAC addresses srip
0 1 2 3
MAB 18: Unicast MAC addresses srip 0 1 2 3     MAB 19: Unicast MAC addresses srip
0 1 2 3
MAB 20: Unicast MAC addresses srip 0 1 2 3     MAB 21: Unicast MAC addresses srip
0 1 2 3
MAB 22: Unicast MAC addresses srip 0 1 2 3     MAB 23: Unicast MAC addresses srip
0 1 2 3
Table 1 info:  FSE0: 1, FSE1: 255      #hwmabs: 24, #swmabs: 24
MAB 0: Directly or indirectly connected routes srip 0 1 2 3      MAB 1: Directly
or indirectly connected routes srip 0 1 2 3
MAB 2: Directly or indirectly connected routes srip 0 1 2 3      MAB 3: Directly
or indirectly connected routes srip 0 1 2 3
MAB 4: Directly or indirectly connected routes srip 0 1 2 3      MAB 5: Directly
or indirectly connected routes srip 0 1 2 3
MAB 6: Directly or indirectly connected routes srip 0 1 2 3      MAB 7: Directly
or indirectly connected routes srip 0 1 2 3
MAB 8: Directly or indirectly connected routes srip 0 1 2 3      MAB 9: Directly
or indirectly connected routes srip 0 1 2 3
MAB 10: Directly or indirectly connected routes srip 0 1 2 3     MAB 11: Directly
or indirectly connected routes srip 0 1 2 3
MAB 12: Directly or indirectly connected routes srip 0 1 2 3     MAB 13: Directly
or indirectly connected routes srip 0 1 2 3
MAB 14: Directly or indirectly connected routes srip 0 1 2 3     MAB 15: Directly
or indirectly connected routes srip 0 1 2 3
MAB 16: Directly or indirectly connected routes srip 0 1 2 3     MAB 17: Directly
or indirectly connected routes srip 0 1 2 3
MAB 18: Directly or indirectly connected routes srip 0 1 2 3     MAB 19: Directly
or indirectly connected routes srip 0 1 2 3
MAB 20: Directly or indirectly connected routes srip 0 1 2 3     MAB 21: Directly
or indirectly connected routes srip 0 1 2 3
MAB 22: Directly or indirectly connected routes srip 0 1 2 3     MAB 23: Directly
or indirectly connected routes srip 0 1 2 3
Table 2 info:  FSE0: 1, FSE1: 255      #hwmabs: 24, #swmabs: 24
MAB 0: Directly or indirectly connected routes srip 0 1 2 3      MAB 1: Directly
or indirectly connected routes srip 0 1 2 3
MAB 2: Directly or indirectly connected routes srip 0 1 2 3      MAB 3: Directly
or indirectly connected routes srip 0 1 2 3
MAB 4: Directly or indirectly connected routes srip 0 1 2 3      MAB 5: Directly
or indirectly connected routes srip 0 1 2 3
MAB 6: Directly or indirectly connected routes srip 0 1 2 3      MAB 7: Directly
or indirectly connected routes srip 0 1 2 3
MAB 8: Directly or indirectly connected routes srip 0 1 2 3      MAB 9: Directly
or indirectly connected routes srip 0 1 2 3
MAB 10: Directly or indirectly connected routes srip 0 1 2 3     MAB 11: Directly
or indirectly connected routes srip 0 1 2 3
MAB 12: Directly or indirectly connected routes srip 0 1 2 3     MAB 13: Directly
or indirectly connected routes srip 0 1 2 3
MAB 14: Directly or indirectly connected routes srip 0 1 2 3     MAB 15: Directly
or indirectly connected routes srip 0 1 2 3

```

```

MAB 16: Directly or indirectly connected routes srip 0 1 2 3 MAB 17: Directly
or indirectly connected routes srip 0 1 2 3
MAB 18: Directly or indirectly connected routes srip 0 1 2 3 MAB 19: Directly
or indirectly connected routes srip 0 1 2 3
MAB 20: Directly or indirectly connected routes srip 0 1 2 3 MAB 21: Directly
or indirectly connected routes srip 0 1 2 3
MAB 22: Directly or indirectly connected routes srip 0 1 2 3 MAB 23: Directly
or indirectly connected routes srip 0 1 2 3
Table 3 info: FSE0: 2, FSE1: 255 #hwmabs: 24, #swmabs: 24
MAB 0: SGT_DGT srip 0 1 2 3 MAB 1: SGT_DGT srip 0 1 2 3
MAB 2: SGT_DGT srip 0 1 2 3 MAB 3: SGT_DGT srip 0 1 2 3
MAB 4: SGT_DGT srip 0 1 2 3 MAB 5: SGT_DGT srip 0 1 2 3
MAB 6: SGT_DGT srip 0 1 2 3 MAB 7: SGT_DGT srip 0 1 2 3
MAB 8: SGT_DGT srip 0 1 2 3 MAB 9: SGT_DGT srip 0 1 2 3
MAB 10: SGT_DGT srip 0 1 2 3 MAB 11: SGT_DGT srip 0 1 2 3
MAB 12: SGT_DGT srip 0 1 2 3 MAB 13: SGT_DGT srip 0 1 2 3
MAB 14: SGT_DGT srip 0 1 2 3 MAB 15: SGT_DGT srip 0 1 2 3
MAB 16: SGT_DGT srip 0 1 2 3 MAB 17: SGT_DGT srip 0 1 2 3
MAB 18: SGT_DGT srip 0 1 2 3 MAB 19: SGT_DGT srip 0 1 2 3
MAB 20: SGT_DGT srip 0 1 2 3 MAB 21: SGT_DGT srip 0 1 2 3
MAB 22: SGT_DGT srip 0 1 2 3 MAB 23: SGT_DGT srip 0 1 2 3

TLQ Info
-----
Table 0 info: FSE0: 255, FSE1: 255 #hwmabs: 4, #swmabs: 4
MAB 0: (null) srip MAB 1: (null) srip
MAB 2: (null) srip MAB 3: (null) srip
Table 1 info: FSE0: 255, FSE1: 255 #hwmabs: 4, #swmabs: 4
MAB 0: (null) srip MAB 1: (null) srip
MAB 2: (null) srip MAB 3: (null) srip

TAQ Info
-----
Table 0 (TAQ) info: ASE: 0 #hwmabs: 4
MAB 0: Input Ipv4 Security Access Control Entries srip 0 2 MAB 1: Input Ipv4
Security Access Control Entries srip 0 2
MAB 2: Input Ipv4 Security Access Control Entries srip 0 2 MAB 3: Input Ipv4
Security Access Control Entries srip 0 2
Table 1 (TAQ) info: ASE: 0 #hwmabs: 4
MAB 0: Input Ipv4 Security Access Control Entries srip 0 2 MAB 1: Input Ipv4
Security Access Control Entries srip 0 2
MAB 2: Input Ipv4 Security Access Control Entries srip 0 2 MAB 3: Input Ipv4
Security Access Control Entries srip 0 2
Table 2 (TAQ) info: ASE: 0 #hwmabs: 4
MAB 0: Output Ipv4 Security Access Control Entries srip 1 3 MAB 1: Output Ipv4
Security Access Control Entries srip 1 3
MAB 2: Output Ipv4 Security Access Control Entries srip 1 3 MAB 3: Output Ipv4
Security Access Control Entries srip 1 3
Table 3 (TAQ) info: ASE: 0 #hwmabs: 4
MAB 0: Output Ipv4 Security Access Control Entries srip 1 3 MAB 1: Output Ipv4
Security Access Control Entries srip 1 3
MAB 2: Output Ipv4 Security Access Control Entries srip 1 3 MAB 3: Output Ipv4
Security Access Control Entries srip 1 3
Table 4 (TAQ) info: ASE: 0 #hwmabs: 4
MAB 0: Output Ipv4 Security Access Control Entries srip 1 3 MAB 1: Output Ipv4
Security Access Control Entries srip 1 3
MAB 2: Output Ipv4 Security Access Control Entries srip 1 3 MAB 3: Output Ipv4
Security Access Control Entries srip 1 3
Table 5 (TAQ) info: ASE: 0 #hwmabs: 4
MAB 0: Output Non Ipv4 Security Access Control Entries srip 1 3 MAB 1:
Output Non Ipv4 Security Access Control Entries srip 1 3
MAB 2: Output Non Ipv4 Security Access Control Entries srip 1 3 MAB 3:
Output Non Ipv4 Security Access Control Entries srip 1 3
Table 6 (TAQ) info: ASE: 0 #hwmabs: 4
MAB 0: Output Non Ipv4 Security Access Control Entries srip 1 3 MAB 1:
Output Non Ipv4 Security Access Control Entries srip 1 3

```

## show platform hardware capacity

```

MAB 2: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 3:
Output Non Ipv4 Security Access Control Entries srip 1 3
Table 7 (TAQ) info:      ASE: 0 #hwmabs: 4
MAB 0: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 1:
Output Non Ipv4 Security Access Control Entries srip 1 3
MAB 2: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 3:
Output Non Ipv4 Security Access Control Entries srip 1 3
Table 8 (TAQ) info:      ASE: 0 #hwmabs: 4
MAB 0: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 1:
Output Non Ipv4 Security Access Control Entries srip 1 3
MAB 2: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 3:
Output Non Ipv4 Security Access Control Entries srip 1 3
Table 9 (TAQ) info:      ASE: 0 #hwmabs: 32
MAB 0: Input Ipv4 Security Access Control Entries srip 0 2      MAB 1: Input Ipv4
Security Access Control Entries srip 0 2
MAB 2: Input Ipv4 Security Access Control Entries srip 0 2      MAB 3: Input Ipv4
Security Access Control Entries srip 0 2
MAB 4: Input Ipv4 Security Access Control Entries srip 0 2      MAB 5: Input Ipv4
Security Access Control Entries srip 0 2
MAB 6: Input Ipv4 Security Access Control Entries srip 0 2      MAB 7: Input Ipv4
Security Access Control Entries srip 0 2
MAB 8: Input Ipv4 Security Access Control Entries srip 0 2      MAB 9: Input Ipv4
Security Access Control Entries srip 0 2
MAB 10: Input Ipv4 Security Access Control Entries srip 0 2      MAB 11: Input Ipv4
Security Access Control Entries srip 0 2
MAB 12: Input Ipv4 Security Access Control Entries srip 0 2      MAB 13: Input Ipv4
Security Access Control Entries srip 0 2
MAB 14: Input Ipv4 Security Access Control Entries srip 0 2      MAB 15: Input Ipv4
Security Access Control Entries srip 0 2
MAB 16: Input Ipv4 Security Access Control Entries srip 0 2      MAB 17: Input Ipv4
Security Access Control Entries srip 0 2
MAB 18: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 19:
Input Non Ipv4 Security Access Control Entries srip 0 2
MAB 20: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 21:
Input Non Ipv4 Security Access Control Entries srip 0 2
MAB 22: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 23:
Input Non Ipv4 Security Access Control Entries srip 0 2
MAB 24: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 25:
Input Non Ipv4 Security Access Control Entries srip 0 2
MAB 26: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 27:
Input Non Ipv4 Security Access Control Entries srip 0 2
MAB 28: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 29:
Input Non Ipv4 Security Access Control Entries srip 0 2
MAB 30: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 31:
Input Non Ipv4 Security Access Control Entries srip 0 2
Table 10 (TAQ) info:      ASE: 0 #hwmabs: 32
MAB 0: Output Ipv4 Security Access Control Entries srip 1 3      MAB 1: Output Ipv4
Security Access Control Entries srip 1 3
MAB 2: Output Ipv4 Security Access Control Entries srip 1 3      MAB 3: Output Ipv4
Security Access Control Entries srip 1 3
MAB 4: Output Ipv4 Security Access Control Entries srip 1 3      MAB 5: Output Ipv4
Security Access Control Entries srip 1 3
MAB 6: Output Ipv4 Security Access Control Entries srip 1 3      MAB 7: Output Ipv4
Security Access Control Entries srip 1 3
MAB 8: Output Ipv4 Security Access Control Entries srip 1 3      MAB 9: Output Ipv4
Security Access Control Entries srip 1 3
MAB 10: Output Ipv4 Security Access Control Entries srip 1 3      MAB 11: Output Ipv4
Security Access Control Entries srip 1 3
MAB 12: Output Ipv4 Security Access Control Entries srip 1 3      MAB 13: Output Ipv4
Security Access Control Entries srip 1 3
MAB 14: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 15:
Output Non Ipv4 Security Access Control Entries srip 1 3
MAB 16: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 17:
Output Non Ipv4 Security Access Control Entries srip 1 3

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MAB 18: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 19:
Output Non Ipv4 Security Access Control Entries srip 1 3
MAB 20: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 21:
Output Non Ipv4 Security Access Control Entries srip 1 3
MAB 22: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 23:
Output Non Ipv4 Security Access Control Entries srip 1 3
MAB 24: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 25:
Output Non Ipv4 Security Access Control Entries srip 1 3
MAB 26: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 27:
Output Non Ipv4 Security Access Control Entries srip 1 3
MAB 28: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 29:
Output Non Ipv4 Security Access Control Entries srip 1 3
MAB 30: Output Non Ipv4 Security Access Control Entries srip 1 3      MAB 31:
Output Non Ipv4 Security Access Control Entries srip 1 3
Table 11 (TAQ) info:      ASE: 0 #hwmabs: 4
MAB 0: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 1: Input Non
Ipv4 Security Access Control Entries srip 0 2
MAB 2: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 3: Input Non
Ipv4 Security Access Control Entries srip 0 2
Table 12 (TAQ) info:      ASE: 0 #hwmabs: 4
MAB 0: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 1: Input Non
Ipv4 Security Access Control Entries srip 0 2
MAB 2: Input Non Ipv4 Security Access Control Entries srip 0 2      MAB 3: Input Non
Ipv4 Security Access Control Entries srip 0 2
ASIC 1 Info
-----
ASIC 1 HSN Table 0 Software info:      FSE 255
TILE 0: (null)      srip
TILE 1: (null)      srip
ASIC 1 HSN Table 1 Software info:      FSE 255
TILE 0: (null)      srip
TILE 1: (null)      srip
ASIC 1 HSN Table 2 Software info:      FSE 2
TILE 0: L3 Multicast entries srip 0 1 2 3
TILE 1: L3 Multicast entries srip 0 1 2 3
ASIC 1 HSN Table 3 Software info:      FSE 2
TILE 0: L3 Multicast entries srip 0 1 2 3
TILE 1: L3 Multicast entries srip 0 1 2 3
ASIC 1 HSN Table 4 Software info:      FSE 255
TILE 0: (null)      srip
TILE 1: (null)      srip
ASIC 1 HSN Table 5 Software info:      FSE 255
TILE 0: (null)      srip
TILE 1: (null)      srip
ASIC 1 HSN Table 6 Software info:      FSE 1
TILE 0: Directly or indirectly connected routes srip 0 1 2 3
TILE 1: Directly or indirectly connected routes srip 0 1 2 3
ASIC 1 HSN Table 7 Software info:      FSE 1
TILE 0: Directly or indirectly connected routes srip 0 1 2 3
TILE 1: Directly or indirectly connected routes srip 0 1 2 3
ASIC 1 HSF Table 0 Software info:      FSE 1
TILE 0: Directly or indirectly connected routes srip 0 1 2 3
TILE 1: Directly or indirectly connected routes srip 0 1 2 3
TILE 2: Directly or indirectly connected routes srip 0 1 2 3
TILE 3: Directly or indirectly connected routes srip 0 1 2 3
TILE 4: Directly or indirectly connected routes srip 0 1 2 3
TILE 5: Directly or indirectly connected routes srip 0 1 2 3
TILE 6: Directly or indirectly connected routes srip 0 1 2 3
TILE 7: Directly or indirectly connected routes srip 0 1 2 3
ASIC 1 HSF Table 1 Software info:      FSE 1
TILE 0: Directly or indirectly connected routes srip 0 1 2 3
TILE 1: Directly or indirectly connected routes srip 0 1 2 3
TILE 2: Directly or indirectly connected routes srip 0 1 2 3
TILE 3: Directly or indirectly connected routes srip 0 1 2 3

```

## show platform hardware capacity

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TILE 4: Directly or indirectly connected routes srip 0 1 2 3
TILE 5: Directly or indirectly connected routes srip 0 1 2 3
TILE 6: Directly or indirectly connected routes srip 0 1 2 3
TILE 7: Directly or indirectly connected routes srip 0 1 2 3
ASIC 1 HSF Table 2 Software info:      FSE 1
TILE 0: Directly or indirectly connected routes srip 0 1 2 3
TILE 1: Directly or indirectly connected routes srip 0 1 2 3
TILE 2: Directly or indirectly connected routes srip 0 1 2 3
TILE 3: Directly or indirectly connected routes srip 0 1 2 3
TILE 4: Directly or indirectly connected routes srip 0 1 2 3
TILE 5: Directly or indirectly connected routes srip 0 1 2 3
TILE 6: Directly or indirectly connected routes srip 0 1 2 3
TILE 7: Directly or indirectly connected routes srip 0 1 2 3
ASIC 1 HSF Table 3 Software info:      FSE 1
TILE 0: Directly or indirectly connected routes srip 0 1 2 3
TILE 1: Directly or indirectly connected routes srip 0 1 2 3
TILE 2: Directly or indirectly connected routes srip 0 1 2 3
TILE 3: Directly or indirectly connected routes srip 0 1 2 3
TILE 4: Directly or indirectly connected routes srip 0 1 2 3
TILE 5: Directly or indirectly connected routes srip 0 1 2 3
TILE 6: Directly or indirectly connected routes srip 0 1 2 3
TILE 7: Directly or indirectly connected routes srip 0 1 2 3
ASIC 1 HSF Table 4 Software info:      FSE 1
TILE 0: Directly or indirectly connected routes srip 0 1 2 3
TILE 1: Directly or indirectly connected routes srip 0 1 2 3
TILE 2: Directly or indirectly connected routes srip 0 1 2 3
TILE 3: Directly or indirectly connected routes srip 0 1 2 3
TILE 4: Directly or indirectly connected routes srip 0 1 2 3
TILE 5: Directly or indirectly connected routes srip 0 1 2 3
TILE 6: Directly or indirectly connected routes srip 0 1 2 3
TILE 7: Directly or indirectly connected routes srip 0 1 2 3
OVF Info
-----
Table 0 info:  FSE0: 2, FSE1: 255      #hwmabs: 24, #swmabs: 24
MAB  0: L3 Multicast entries srip 0 1 2 3      MAB  1: L3 Multicast entries srip
0 1 2 3
MAB  2: L3 Multicast entries srip 0 1 2 3      MAB  3: L3 Multicast entries srip
0 1 2 3
MAB  4: L3 Multicast entries srip 0 1 2 3      MAB  5: L3 Multicast entries srip
0 1 2 3
MAB  6: L3 Multicast entries srip 0 1 2 3      MAB  7: L3 Multicast entries srip
0 1 2 3
MAB  8: L3 Multicast entries srip 0 1 2 3      MAB  9: L3 Multicast entries srip
0 1 2 3
MAB 10: L3 Multicast entries srip 0 1 2 3      MAB 11: L3 Multicast entries srip
0 1 2 3
MAB 12: L3 Multicast entries srip 0 1 2 3      MAB 13: L3 Multicast entries srip
0 1 2 3
MAB 14: L3 Multicast entries srip 0 1 2 3      MAB 15: L3 Multicast entries srip
0 1 2 3
MAB 16: L3 Multicast entries srip 0 1 2 3      MAB 17: L3 Multicast entries srip
0 1 2 3
MAB 18: L3 Multicast entries srip 0 1 2 3      MAB 19: L3 Multicast entries srip
0 1 2 3
MAB 20: L3 Multicast entries srip 0 1 2 3      MAB 21: L3 Multicast entries srip
0 1 2 3
MAB 22: L3 Multicast entries srip 0 1 2 3      MAB 23: L3 Multicast entries srip
0 1 2 3
Table 1 info:  FSE0: 1, FSE1: 255      #hwmabs: 24, #swmabs: 24
MAB  0: L2 Multicast entries srip 1 3      MAB  1: L2 Multicast entries srip 1 3
MAB  2: L2 Multicast entries srip 1 3      MAB  3: L2 Multicast entries srip 1 3
MAB  4: L2 Multicast entries srip 1 3      MAB  5: L2 Multicast entries srip 1 3
MAB  6: L2 Multicast entries srip 1 3      MAB  7: L2 Multicast entries srip 1 3
MAB  8: L2 Multicast entries srip 1 3      MAB  9: L2 Multicast entries srip 1 3

```



```

MAB 10: L2 Multicast entries srip 1 3 MAB 11: L2 Multicast entries srip 1 3
MAB 12: L2 Multicast entries srip 1 3 MAB 13: L2 Multicast entries srip 1 3
MAB 14: L2 Multicast entries srip 1 3 MAB 15: L2 Multicast entries srip 1 3
MAB 16: L2 Multicast entries srip 1 3 MAB 17: L2 Multicast entries srip 1 3
MAB 18: L2 Multicast entries srip 1 3 MAB 19: L2 Multicast entries srip 1 3
MAB 20: L2 Multicast entries srip 1 3 MAB 21: L2 Multicast entries srip 1 3
MAB 22: L2 Multicast entries srip 1 3 MAB 23: L2 Multicast entries srip 1 3
Table 2 info: FSE0: 1, FSE1: 255 #hwmabs: 24, #swmabs: 24
MAB 0: L2 Multicast entries srip 1 3 MAB 1: L2 Multicast entries srip 1 3
MAB 2: L2 Multicast entries srip 1 3 MAB 3: L2 Multicast entries srip 1 3
MAB 4: L2 Multicast entries srip 1 3 MAB 5: L2 Multicast entries srip 1 3
MAB 6: L2 Multicast entries srip 1 3 MAB 7: L2 Multicast entries srip 1 3
MAB 8: L2 Multicast entries srip 1 3 MAB 9: L2 Multicast entries srip 1 3
MAB 10: L2 Multicast entries srip 1 3 MAB 11: L2 Multicast entries srip 1 3
MAB 12: L2 Multicast entries srip 1 3 MAB 13: L2 Multicast entries srip 1 3
MAB 14: L2 Multicast entries srip 1 3 MAB 15: L2 Multicast entries srip 1 3
MAB 16: L2 Multicast entries srip 1 3 MAB 17: L2 Multicast entries srip 1 3
MAB 18: L2 Multicast entries srip 1 3 MAB 19: L2 Multicast entries srip 1 3
MAB 20: L2 Multicast entries srip 1 3 MAB 21: L2 Multicast entries srip 1 3
MAB 22: L2 Multicast entries srip 1 3 MAB 23: L2 Multicast entries srip 1 3
Table 3 info: FSE0: 1, FSE1: 255 #hwmabs: 24, #swmabs: 24
MAB 0: L2 Multicast entries srip 1 3 MAB 1: L2 Multicast entries srip 1 3
MAB 2: L2 Multicast entries srip 1 3 MAB 3: L2 Multicast entries srip 1 3
MAB 4: L2 Multicast entries srip 1 3 MAB 5: L2 Multicast entries srip 1 3
MAB 6: L2 Multicast entries srip 1 3 MAB 7: L2 Multicast entries srip 1 3
MAB 8: L2 Multicast entries srip 1 3 MAB 9: L2 Multicast entries srip 1 3
MAB 10: L2 Multicast entries srip 1 3 MAB 11: L2 Multicast entries srip 1 3
MAB 12: L2 Multicast entries srip 1 3 MAB 13: L2 Multicast entries srip 1 3
MAB 14: L2 Multicast entries srip 1 3 MAB 15: L2 Multicast entries srip 1 3
MAB 16: L2 Multicast entries srip 1 3 MAB 17: L2 Multicast entries srip 1 3
MAB 18: L2 Multicast entries srip 1 3 MAB 19: L2 Multicast entries srip 1 3
MAB 20: L2 Multicast entries srip 1 3 MAB 21: L2 Multicast entries srip 1 3
MAB 22: L2 Multicast entries srip 1 3 MAB 23: L2 Multicast entries srip 1 3
TLQ Info
-----
Table 0 info: FSE0: 255, FSE1: 255 #hwmabs: 4, #swmabs: 4
MAB 0: (null) srip MAB 1: (null) srip
MAB 2: (null) srip MAB 3: (null) srip
Table 1 info: FSE0: 255, FSE1: 255 #hwmabs: 4, #swmabs: 4
MAB 0: (null) srip MAB 1: (null) srip
MAB 2: (null) srip MAB 3: (null) srip
TAQ Info
-----
Table 0 (TAQ) info: ASE: 1 #hwmabs: 4
MAB 0: Ingress Netflow ACEs srip 0 2 MAB 1: Ingress Netflow ACEs srip 0 2
MAB 2: Ingress Netflow ACEs srip 0 2 MAB 3: Ingress Netflow ACEs srip 0 2
Table 1 (TAQ) info: ASE: 0 #hwmabs: 4
MAB 0: Policy Based Routing ACEs srip 0 2 MAB 1: Policy Based Routing ACEs
srip 0 2
MAB 2: Policy Based Routing ACEs srip 0 2 MAB 3: Policy Based Routing ACEs
srip 0 2
Table 2 (TAQ) info: ASE: 0 #hwmabs: 4
MAB 0: Policy Based Routing ACEs srip 0 2 MAB 1: Policy Based Routing ACEs
srip 0 2
MAB 2: Policy Based Routing ACEs srip 0 2 MAB 3: Policy Based Routing ACEs
srip 0 2
Table 3 (TAQ) info: ASE: 0 #hwmabs: 4
MAB 0: Policy Based Routing ACEs srip 0 2 MAB 1: Policy Based Routing ACEs
srip 0 2
MAB 2: Policy Based Routing ACEs srip 0 2 MAB 3: Policy Based Routing ACEs
srip 0 2
Table 4 (TAQ) info: ASE: 1 #hwmabs: 4
MAB 0: Egress Netflow ACEs srip 1 3 MAB 1: Egress Netflow ACEs srip 1 3
MAB 2: Egress Netflow ACEs srip 1 3 MAB 3: Egress Netflow ACEs srip 1 3

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## show platform hardware capacity

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Table 5 (TAQ) info:      ASE: 2 #hwmabs: 4
MAB 0: Flow SPAN ACEs srip 0 2      MAB 1: Flow SPAN ACEs srip 0 2
MAB 2: Flow Egress SPAN ACEs srip 1 3  MAB 3: Flow Egress SPAN ACEs srip 1 3
Table 6 (TAQ) info:      ASE: 7 #hwmabs: 4
MAB 0: Control Plane Entries srip 1 3  MAB 1: Control Plane Entries srip 1 3
MAB 2: Control Plane Entries srip 1 3  MAB 3: Control Plane Entries srip 1 3
Table 7 (TAQ) info:      ASE: 6 #hwmabs: 4
MAB 0: Tunnels srip 0 2      MAB 1: Tunnels srip 0 2
MAB 2: Tunnels srip 0 2      MAB 3: Tunnels srip 0 2
Table 8 (TAQ) info:      ASE: 6 #hwmabs: 4
MAB 0: Tunnels srip 0 2      MAB 1: Tunnels srip 0 2
MAB 2: Tunnels srip 0 2      MAB 3: Tunnels srip 0 2
Table 9 (TAQ) info:      ASE: 3 #hwmabs: 32
MAB 0: Input Ipv4 QoS Access Control Entries srip 0 2  MAB 1: Input Ipv4 QoS Access
Control Entries srip 0 2
MAB 2: Input Ipv4 QoS Access Control Entries srip 0 2  MAB 3: Input Ipv4 QoS Access
Control Entries srip 0 2
MAB 4: Input Ipv4 QoS Access Control Entries srip 0 2  MAB 5: Input Ipv4 QoS Access
Control Entries srip 0 2
MAB 6: Input Ipv4 QoS Access Control Entries srip 0 2  MAB 7: Input Ipv4 QoS Access
Control Entries srip 0 2
MAB 8: Input Ipv4 QoS Access Control Entries srip 0 2  MAB 9: Input Ipv4 QoS Access
Control Entries srip 0 2
MAB 10: Input Ipv4 QoS Access Control Entries srip 0 2  MAB 11: Input Ipv4 QoS
Access Control Entries srip 0 2
MAB 12: Input Ipv4 QoS Access Control Entries srip 0 2  MAB 13: Input Ipv4 QoS
Access Control Entries srip 0 2
MAB 14: Input Ipv4 QoS Access Control Entries srip 0 2  MAB 15: Input Ipv4 QoS
Access Control Entries srip 0 2
MAB 16: Input Ipv4 QoS Access Control Entries srip 0 2  MAB 17: Input Ipv4 QoS
Access Control Entries srip 0 2
MAB 18: Input Non Ipv4 QoS Access Control Entries srip 0 2  MAB 19: Input Non
Ipv4 QoS Access Control Entries srip 0 2
MAB 20: Input Non Ipv4 QoS Access Control Entries srip 0 2  MAB 21: Input Non
Ipv4 QoS Access Control Entries srip 0 2
MAB 22: Input Non Ipv4 QoS Access Control Entries srip 0 2  MAB 23: Input Non
Ipv4 QoS Access Control Entries srip 0 2
MAB 24: Input Non Ipv4 QoS Access Control Entries srip 0 2  MAB 25: Input Non
Ipv4 QoS Access Control Entries srip 0 2
MAB 26: Input Non Ipv4 QoS Access Control Entries srip 0 2  MAB 27: Input Non
Ipv4 QoS Access Control Entries srip 0 2
MAB 28: Input Non Ipv4 QoS Access Control Entries srip 0 2  MAB 29: Input Non
Ipv4 QoS Access Control Entries srip 0 2
MAB 30: Input Non Ipv4 QoS Access Control Entries srip 0 2  MAB 31: Input Non
Ipv4 QoS Access Control Entries srip 0 2
Table 10 (TAQ) info:      ASE: 3 #hwmabs: 32
MAB 0: Output Ipv4 QoS Access Control Entries srip 1 3  MAB 1: Output Ipv4 QoS
Access Control Entries srip 1 3
MAB 2: Output Ipv4 QoS Access Control Entries srip 1 3  MAB 3: Output Ipv4 QoS
Access Control Entries srip 1 3
MAB 4: Output Ipv4 QoS Access Control Entries srip 1 3  MAB 5: Output Ipv4 QoS
Access Control Entries srip 1 3
MAB 6: Output Ipv4 QoS Access Control Entries srip 1 3  MAB 7: Output Ipv4 QoS
Access Control Entries srip 1 3
MAB 8: Output Ipv4 QoS Access Control Entries srip 1 3  MAB 9: Output Ipv4 QoS
Access Control Entries srip 1 3
MAB 10: Output Ipv4 QoS Access Control Entries srip 1 3  MAB 11: Output Ipv4
QoS Access Control Entries srip 1 3
MAB 12: Output Ipv4 QoS Access Control Entries srip 1 3  MAB 13: Output Ipv4
QoS Access Control Entries srip 1 3
MAB 14: Output Ipv4 QoS Access Control Entries srip 1 3  MAB 15: Output Ipv4
QoS Access Control Entries srip 1 3
MAB 16: Output Ipv4 QoS Access Control Entries srip 1 3  MAB 17: Output Ipv4
QoS Access Control Entries srip 1 3

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MAB 18: Output Non Ipv4 QoS Access Control Entries srip 1 3      MAB 19: Output Non
Ipv4 QoS Access Control Entries srip 1 3
MAB 20: Output Non Ipv4 QoS Access Control Entries srip 1 3      MAB 21: Output Non
Ipv4 QoS Access Control Entries srip 1 3
MAB 22: Output Non Ipv4 QoS Access Control Entries srip 1 3      MAB 23: Output Non
Ipv4 QoS Access Control Entries srip 1 3
MAB 24: Output Non Ipv4 QoS Access Control Entries srip 1 3      MAB 25: Output Non
Ipv4 QoS Access Control Entries srip 1 3
MAB 26: Output Non Ipv4 QoS Access Control Entries srip 1 3      MAB 27: Output Non
Ipv4 QoS Access Control Entries srip 1 3
MAB 28: Output Non Ipv4 QoS Access Control Entries srip 1 3      MAB 29: Output Non
Ipv4 QoS Access Control Entries srip 1 3
MAB 30: Output Non Ipv4 QoS Access Control Entries srip 1 3      MAB 31: Output Non
Ipv4 QoS Access Control Entries srip 1 3
Table 11 (TAQ) info:      ASE: 6 #hwmabs: 4
MAB 0: Tunnels           srip 0 2          MAB 1: Tunnels           srip 0 2
MAB 2: Tunnels           srip 0 2          MAB 3: Macsec SPD       srip 1 3
Table 12 (TAQ) info:      ASE: 5 #hwmabs: 4
MAB 0: Lisp Instance Mapping Entries srip 0 2  MAB 1: Lisp Instance Mapping Entries
srip 0 2
MAB 2: Lisp Instance Mapping Entries srip 0 2  MAB 3: Lisp Instance Mapping Entries
srip 0 2

```

# show platform hardware fed switch forward

To display device-specific hardware information, use the **show platform hardware fed switch** *switch\_number* command.

This topic elaborates only the forwarding-specific options, that is, the options available with the **show platform hardware fed switch** {*switch\_num* | **active** | **standby** } **forward summary** command.

The output of the **show platform hardware fed switch** *switch\_number* **forward summary** displays all the details about the forwarding decision taken for the packet.

**show platform hardware fed switch** *switch\_num* | **active** | **standby** **forward summary**

## Syntax Description

<b>switch</b> { <i>switch_num</i>   <b>active</b>   <b>standby</b> }	The switch for which you want to display information. You have the following options :
--	--

- *switch\_num*—ID of the switch.
- **active**—Displays information relating to the active switch.
- **standby**—Displays information relating to the standby switch, if available.

<b>forward summary</b>	Displays packet forwarding information.
------------------------	---

**Note** Support for the keyword **summary** has been discontinued in the Cisco IOS XE Everest 16.6.1 release and later releases.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.
Cisco IOS XE Everest 16.6.1 and later releases	Support for the keyword <b>summary</b> was discontinued.

## Usage Guidelines

Do not use this command unless a technical support representative asks you to. Use this command only when you are working directly with a technical support representative while troubleshooting a problem.

Fields displayed in the command output are explained below.

- **Station Index** : The Station Index is the result of the layer 2 lookup and points to a station descriptor which provides the following:
  - **Destination Index** : Determines the egress port(s) to which the packets should be sent to. Global Port Number(GPN) can be used as the destination index. A destination index with 15 down to 12 bits set indicates the GPN to be used. For example, destination index - 0xF04E corresponds to GPN - 78 (0x4e).
  - **Rewrite Index** : Determines what needs to be done with the packets. For layer 2 switching, this is typically a bridging action

- Flexible Lookup Pipeline Stages(FPS) : Indicates the forwarding decision that was taken for the packet - routing or bridging
- Replication Bit Map : Determines if the packets should be sent to CPU or stack
  - Local Data Copy = 1
  - Remote Data copy = 0
  - Local CPU Copy = 0
  - Remote CPU Copy = 0

### Example

This is an example of output from the **show platform hardware fed switch** {*switch\_num* | **active** | **standby** } **forward summary** command.

```
Device#show platform hardware fed switch 1 forward summary
Time: Fri Sep 16 08:25:00 PDT 2016
```

Incomming Packet Details:

```
###[ Ethernet ]###
  dst      = 00:51:0f:f2:0e:11
  src      = 00:1d:01:85:ba:22
  type     = ARP
###[ ARP ]###
  hwtype   = 0x1
  ptype    = IPv4
  hwlen    = 6
  plen     = 4
  op       = is-at
  hwsrc    = 00:1d:01:85:ba:22
  psrc     = 10.10.1.33
  hwdst    = 00:51:0f:f2:0e:11
  pdst     = 10.10.1.1
```

```
Ingress:
Switch      : 1
Port        : GigabitEthernet1/0/1
Global Port Number : 1
Local Port Number : 1
Asic Port Number : 21
ASIC Number : 0
STP state   :
              blkLrn31to0: 0xffdffffd
              blkFwd31to0: 0xffdffffd
Vlan        : 1
Station Descriptor : 170
DestIndex   : 0xF009
DestModIndex : 2
RewriteIndex : 2
Forwarding Decision: FPS 2A L2 Destination
```

```
Replication Bitmap:
Local CPU copy   : 0
Local Data copy  : 1
Remote CPU copy  : 0
Remote Data copy : 0
```

**show platform hardware fed switch forward**

```
Egress:  
Switch          : 1  
Outgoing Port   : GigabitEthernet1/0/9  
Global Port Number : 9  
ASIC Number     : 0  
Vlan            : 1
```

# show platform resources

To display platform resource information, use the **show platform resources** command in privileged EXEC mode.

## show platform resources

This command has no arguments or keywords.

---

**Command Modes** Privileged EXEC (#)

---

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---



---

**Usage Guidelines** The output of this command displays the used memory, which is total memory minus the accurate free memory.

## Example

The following is sample output from the **show platform resources** command:

```
Switch# show platform resources
```

```
**State Acronym: H - Healthy, W - Warning, C - Critical
```

Resource State	Usage	Max	Warning	Critical
Control Processor H	7.20%	100%	90%	95%
DRAM H	2701MB (69%)	3883MB	90%	95%

# show platform software ilpower

To display the inline power details of all the PoE ports on the device, use the **show platform software ilpower** command in privileged EXEC mode.

**show platform software ilpower** { **details** | **port** { **GigabitEthernet** *interface-number* } | **system** *slot-number* }

Syntax Description		
<b>details</b>		Displays inline power details for all the interfaces.
<b>port</b>		Displays inline power port configuration.
<b>GigabitEthernet</b> <i>interface-number</i>		The GigabitEthernet interface number. Values range from 0 to 9.
<b>system</b> <i>slot-number</i>		Displays inline power system configuration.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	The command was introduced.

## Examples

The following is sample output from the **show platform software ilpower details** command:

```
Device# show platform software ilpower details
ILP Port Configuration for interface Gi1/0/1
  Initialization Done:   Yes
  ILP Supported:        Yes
  ILP Enabled:          Yes
  POST:                 Yes
  Detect On:            No
  Powered Device Detected           No
  Powered Device Class Done         No
  Cisco Powered Device:             No
  Power is On:                      No
  Power Denied:                     No
  Powered Device Type:               Null
  Powerd Device Class:               Null
  Power State:                       NULL
  Current State:                     NGWC_ILP_DETECTING_S
  Previous State:                    NGWC_ILP_SHUT_OFF_S
  Requested Power in milli watts:    0
  Short Circuit Detected:             0
  Short Circuit Count:                0
  Cisco Powerd Device Detect Count: 0
  Spare Pair mode:                   0
    IEEE Detect:                      Stopped
    IEEE Short:                       Stopped
    Link Down:                        Stopped
    Voltage sense:                    Stopped
  Spare Pair Architecture:           1
  Signal Pair Power allocation in milli watts: 0
  Spare Pair Power On:               0
  Powered Device power state:        0
  Timer:
```



```
Power Good:          Stopped
Power Denied:        Stopped
Cisco Powered Device Detect:  Stopped
```

# show platform software process list

To display the list of running processes on a platform, use the **show platform software process list** command in privileged EXEC mode.

**show platform software process list switch** *switch-number* | **active** | **standby 0** | **F0** | **R0** [**name** *process-name* | **process-id** *process-ID* | **sort memory** | **summary**]

## Syntax Description

<b>switch</b> <i>switch-number</i>	Displays information about the switch. Valid values for <i>switch-number</i> argument are from 0 to 9.
<b>active</b>	Displays information about the active instance of the switch.
<b>standby</b>	Displays information about the standby instance of the switch.
<b>0</b>	Displays information about the shared port adapters (SPA) Interface Processor slot 0.
<b>F0</b>	Displays information about the Embedded Service Processor (ESP) slot 0.
<b>R0</b>	Displays information about the Route Processor (RP) slot 0.
<b>name</b> <i>process-name</i>	(Optional) Displays information about the specified process. Enter the process name.
<b>process-id</b> <i>process-ID</i>	(Optional) Displays information about the specified process ID. Enter the process ID.
<b>sort</b>	(Optional) Displays information sorted according to processes.
<b>memory</b>	(Optional) Displays information sorted according to memory.
<b>summary</b>	(Optional) Displays a summary of the process memory of the host device.

## Command Modes

Privileged EXE (#)

## Command History

Release	Modification
Cisco IOS XE Gibraltar 16.10.1	The Size column in the output was modified to display Resident Set Size (RSS) in KB.
Cisco IOS XE Everest 16.5.1a	The command was introduced.

## Examples

The following is sample output from the **show platform software process list switch active R0** command:

```
Switch# show platform software process list switch active R0 summary

Total number of processes: 278
  Running           : 2
  Sleeping          : 276
  Disk sleeping     : 0
  Zombies           : 0
```

```

Stopped          : 0
Paging          : 0

Up time         : 8318
Idle time       : 0
User time       : 216809
Kernel time    : 78931

Virtual memory  : 12933324800
Pages resident  : 634061
Major page faults: 2228
Minor page faults: 3491744

Architecture   : mips64
Memory (kB)
  Physical      : 3976852
  Total         : 3976852
  Used          : 2766952
  Free          : 1209900
  Active        : 2141344
  Inactive      : 1589672
  Inact-dirty   : 0
  Inact-clean   : 0
  Dirty         : 4
  AnonPages     : 1306800
  Bounce        : 0
  Cached        : 1984688
  Commit Limit  : 1988424
  Committed As  : 3358528
  High Total    : 0
  High Free     : 0
  Low Total     : 3976852
  Low Free      : 1209900
  Mapped        : 520528
  NFS Unstable  : 0
  Page Tables   : 17328
  Slab          : 0
  VMmalloc Chunk : 1069542588
  VMmalloc Total : 1069547512
  VMmalloc Used  : 2588
  Writeback     : 0
  HugePages Total: 0
  HugePages Free : 0
  HugePages Rsvd : 0
  HugePage Size : 2048

Swap (kB)
  Total         : 0
  Used          : 0
  Free          : 0
  Cached        : 0

Buffers (kB)    : 439528

Load Average
  1-Min         : 1.13
  5-Min         : 1.18
  15-Min        : 0.92

```

The following is sample output from the **show platform software process list switch active R0** command:

## show platform software process list

```

Device# show platform software process list switch active R0
Name                               Pid   PPid  Group Id  Status  Priority  Size
-----
systemd                             1     0      1   S           20  7892
kthreadd                             2     0      0   S           20   0
ksoftirqd/0                          3     2      0   S           20   0
kworker/0:0H                          5     2      0   S            0   0
rcu_sched                             7     2      0   S           20   0
rcu_bh                                8     2      0   S           20   0
migration/0                           9     2      0   S      4294967196  0
migration/1                          10    2      0   S      4294967196  0
ksoftirqd/1                          11    2      0   S           20   0
kworker/1:0H                          13    2      0   S            0   0
migration/2                           14    2      0   S      4294967196  0
ksoftirqd/2                          15    2      0   S           20   0
kworker/2:0H                          17    2      0   S            0   0
systemd-journal                      221    1     221   S           20  4460
kworker/1:3                          246    2      0   S           20   0
systemd-udevd                        253    1     253   S           20  5648
kvm-irqfd-clean                      617    2      0   S            0   0
scsi_eh_6                             620    2      0   S           20   0
scsi_tmf_6                            621    2      0   S            0   0
usb-storage                          622    2      0   S           20   0
scsi_eh_7                             625    2      0   S           20   0
scsi_tmf_7                            626    2      0   S            0   0
usb-storage                          627    2      0   S           20   0
kworker/7:1                          630    2      0   S           20   0
bioset                                631    2      0   S            0   0
kworker/3:1H                         648    2      0   S            0   0
kworker/0:1H                         667    2      0   S            0   0
kworker/1:1H                         668    2      0   S            0   0
bioset                                669    2      0   S            0   0
kworker/6:2                          698    2      0   S           20   0
kworker/2:2                          699    2      0   S           20   0
kworker/2:1H                         703    2      0   S            0   0
kworker/7:1H                         748    2      0   S            0   0
kworker/5:1H                         749    2      0   S            0   0
kworker/6:1H                         754    2      0   S            0   0
kworker/7:2                          779    2      0   S           20   0
auditd                               838    1     838   S           16  2564
.
.
.

```

The table below describes the significant fields shown in the displays.

**Table 10: show platform software process list Field Descriptions**

Field	Description
Name	Displays the command name associated with the process. Different threads in the same process may have different command values.
Pid	Displays the process ID that is used by the operating system to identify and keep track of the processes.
PPid	Displays process ID of the parent process.
Group Id	Displays the group ID

Field	Description
Status	Displays the process status in human readable form.
Priority	Displays the negated scheduling priority.
Size	Prior to Cisco IOS XE Gibraltar 16.10.1: Displays Virtual Memory size. From Cisco IOS XE Gibraltar 16.10.1 onwards: Displays the Resident Set Size (RSS) that shows how much memory is allocated to that process in the RAM.

# show platform software process slot switch

To display platform software process switch information, use the **show platform software process slot switch** command in privileged EXEC mode.

**show platform software process slot switch** *switch-number* | **active** | **standby 0** | **F0** | **R0** **monitor** [*cycles no-of-times* [*interval delay* [*lines number*]]]

## Syntax Description

<i>switch-number</i>	Switch number.
<b>active</b>	Specifies the active instance.
<b>standby</b>	Specifies the standby instance.
<b>0</b>	Specifies the shared port adapter (SPA) interface processor slot 0.
<b>F0</b>	Specifies the Embedded Service Processor (ESP) slot 0.
<b>R0</b>	Specifies the Route Processor (RP) slot 0.
<b>monitor</b>	Monitors the running processes.
<i>cycles no-of-times</i>	(Optional) Sets the number of times to run monitor command. Valid values are from 1 to 4294967295. The default is 5.
<i>interval delay</i>	(Optional) Sets a delay after each . Valid values are from 0 to 300. The default is 3.
<i>lines number</i>	(Optional) Sets the number of lines of output displayed. Valid values are from 0 to 512. The default is 0.

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The output of the **show platform software process slot switch** and **show processes cpu platform monitor location** commands display the output of the Linux **top** command. The output of these commands display Free memory and Used memory as displayed by the Linux **top** command. The values displayed for the Free memory and Used memory by these commands do not match the values displayed by the output of other platform-memory related CLIs.

## Examples

The following is sample output from the **show platform software process slot switch active R0 monitor** command:

```
Switch# show platform software process slot switch active R0 monitor
```

```
top - 00:01:52 up 1 day, 11:20, 0 users, load average: 0.50, 0.68, 0.83
Tasks: 311 total, 2 running, 309 sleeping, 0 stopped, 0 zombie
Cpu(s): 7.4%us, 3.3%sy, 0.0%ni, 89.2%id, 0.0%wa, 0.0%hi, 0.1%si, 0.0%st
Mem: 3976844k total, 3955036k used, 21808k free, 419312k buffers
Swap: 0k total, 0k used, 0k free, 1946764k cached
```

```

PID USER      PR  NI  VIRT  RES  SHR  S  %CPU  %MEM   TIME+  COMMAND
 5693 root       20   0  3448 1368  912  R   7   0.0   0:00.07 top
17546 root       20   0 2044m 244m  79m  S   7   6.3 186:49.08 fed main event
18662 root       20   0 1806m 678m 263m  S   5  17.5 215:32.38 linux_iosd-imag
30276 root       20   0  171m  42m  33m  S   5   1.1 125:06.77 repm
17835 root       20   0  935m  74m  63m  S   4   1.9  82:28.31 sif_mgr
18534 root       20   0  182m 150m  10m  S   2   3.9   8:12.08 smand
   1 root       20   0  8440 4740 2184  S   0   0.1   0:09.52 systemd
   2 root       20   0    0    0    0  S   0   0.0   0:00.00 kthreadd
   3 root       20   0    0    0    0  S   0   0.0   0:02.86 ksoftirqd/0
   5 root        0 -20    0    0    0  S   0   0.0   0:00.00 kworker/0:0H
   7 root       RT   0    0    0    0  S   0   0.0   0:01.44 migration/0
   8 root       20   0    0    0    0  S   0   0.0   0:00.00 rcu_bh
   9 root       20   0    0    0    0  S   0   0.0   0:23.08 rcu_sched
  10 root       20   0    0    0    0  S   0   0.0   0:58.04 rcuc/0
  11 root       20   0    0    0    0  S   0   0.0 21:35.60 rcuc/1
  12 root       RT   0    0    0    0  S   0   0.0   0:01.33 migration/1

```

#### Related Commands

Command	Description
<b>show processes cpu platform monitor location</b>	Displays information about the CPU utilization of the IOS-XE processes.

# show platform software status control-processor

To display platform software control-processor status, use the **show platform software status control-processor** command in privileged EXEC mode.

**show platform software status control-processor [brief]**

<b>Syntax Description</b>	<b>brief</b> (Optional) Displays a summary of the platform control-processor status.
---------------------------	--

<b>Command Modes</b>	Privileged EXEC (#)
----------------------	---------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following is sample output from the **show platform memory software status control-processor** command:

```
Switch# show platform software status control-processor

2-RP0: online, statistics updated 7 seconds ago
Load Average: healthy
  1-Min: 1.00, status: healthy, under 5.00
  5-Min: 1.21, status: healthy, under 5.00
 15-Min: 0.90, status: healthy, under 5.00
Memory (kb): healthy
  Total: 3976852
  Used: 2766284 (70%), status: healthy
  Free: 1210568 (30%)
  Committed: 3358008 (84%), under 95%
Per-core Statistics
CPU0: CPU Utilization (percentage of time spent)
  User: 4.40, System: 1.70, Nice: 0.00, Idle: 93.80
  IRQ: 0.00, SIRQ: 0.10, IOWait: 0.00
CPU1: CPU Utilization (percentage of time spent)
  User: 3.80, System: 1.20, Nice: 0.00, Idle: 94.90
  IRQ: 0.00, SIRQ: 0.10, IOWait: 0.00
CPU2: CPU Utilization (percentage of time spent)
  User: 7.00, System: 1.10, Nice: 0.00, Idle: 91.89
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU3: CPU Utilization (percentage of time spent)
  User: 4.49, System: 0.69, Nice: 0.00, Idle: 94.80
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00

3-RP0: unknown, statistics updated 2 seconds ago
Load Average: healthy
  1-Min: 0.24, status: healthy, under 5.00
  5-Min: 0.27, status: healthy, under 5.00
 15-Min: 0.32, status: healthy, under 5.00
Memory (kb): healthy
  Total: 3976852
  Used: 2706768 (68%), status: healthy
  Free: 1270084 (32%)
  Committed: 3299332 (83%), under 95%
Per-core Statistics
CPU0: CPU Utilization (percentage of time spent)
```



```

User: 4.50, System: 1.20, Nice: 0.00, Idle: 94.20
IRQ: 0.00, SIRQ: 0.10, IOWait: 0.00
CPU1: CPU Utilization (percentage of time spent)
User: 5.20, System: 0.50, Nice: 0.00, Idle: 94.29
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU2: CPU Utilization (percentage of time spent)
User: 3.60, System: 0.70, Nice: 0.00, Idle: 95.69
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU3: CPU Utilization (percentage of time spent)
User: 3.00, System: 0.60, Nice: 0.00, Idle: 96.39
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00

4-RP0: unknown, statistics updated 2 seconds ago
Load Average: healthy
  1-Min: 0.21, status: healthy, under 5.00
  5-Min: 0.24, status: healthy, under 5.00
 15-Min: 0.24, status: healthy, under 5.00
Memory (kb): healthy
Total: 3976852
Used: 1452404 (37%), status: healthy
Free: 2524448 (63%)
Committed: 1675120 (42%), under 95%
Per-core Statistics
CPU0: CPU Utilization (percentage of time spent)
User: 2.30, System: 0.40, Nice: 0.00, Idle: 97.30
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU1: CPU Utilization (percentage of time spent)
User: 4.19, System: 0.69, Nice: 0.00, Idle: 95.10
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU2: CPU Utilization (percentage of time spent)
User: 4.79, System: 0.79, Nice: 0.00, Idle: 94.40
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU3: CPU Utilization (percentage of time spent)
User: 2.10, System: 0.40, Nice: 0.00, Idle: 97.50
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00

9-RP0: unknown, statistics updated 4 seconds ago
Load Average: healthy
  1-Min: 0.20, status: healthy, under 5.00
  5-Min: 0.35, status: healthy, under 5.00
 15-Min: 0.35, status: healthy, under 5.00
Memory (kb): healthy
Total: 3976852
Used: 1451328 (36%), status: healthy
Free: 2525524 (64%)
Committed: 1675932 (42%), under 95%
Per-core Statistics
CPU0: CPU Utilization (percentage of time spent)
User: 1.90, System: 0.50, Nice: 0.00, Idle: 97.60
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU1: CPU Utilization (percentage of time spent)
User: 4.39, System: 0.19, Nice: 0.00, Idle: 95.40
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU2: CPU Utilization (percentage of time spent)
User: 5.70, System: 1.00, Nice: 0.00, Idle: 93.30
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU3: CPU Utilization (percentage of time spent)
User: 1.30, System: 0.60, Nice: 0.00, Idle: 98.00
IRQ: 0.00, SIRQ: 0.10, IOWait: 0.00

```

The following is sample output from the **show platform memory software status control-processor brief** command:

## show platform software status control-processor

Switch# show platform software status control-processor brief

## Load Average

Slot	Status	1-Min	5-Min	15-Min
2-RP0	Healthy	1.10	1.21	0.91
3-RP0	Healthy	0.23	0.27	0.31
4-RP0	Healthy	0.11	0.21	0.22
9-RP0	Healthy	0.10	0.30	0.34

## Memory (kB)

Slot	Status	Total	Used (Pct)	Free (Pct)	Committed (Pct)
2-RP0	Healthy	3976852	2766956 (70%)	1209896 (30%)	3358352 (84%)
3-RP0	Healthy	3976852	2706824 (68%)	1270028 (32%)	3299276 (83%)
4-RP0	Healthy	3976852	1451888 (37%)	2524964 (63%)	1675076 (42%)
9-RP0	Healthy	3976852	1451580 (37%)	2525272 (63%)	1675952 (42%)

## CPU Utilization

Slot	CPU	User	System	Nice	Idle	IRQ	SIRQ	IOWait
2-RP0	0	4.10	2.00	0.00	93.80	0.00	0.10	0.00
	1	4.60	1.00	0.00	94.30	0.00	0.10	0.00
	2	6.50	1.10	0.00	92.40	0.00	0.00	0.00
	3	5.59	1.19	0.00	93.20	0.00	0.00	0.00
3-RP0	0	2.80	1.20	0.00	95.90	0.00	0.10	0.00
	1	4.49	1.29	0.00	94.20	0.00	0.00	0.00
	2	5.30	1.60	0.00	93.10	0.00	0.00	0.00
4-RP0	3	5.80	1.20	0.00	93.00	0.00	0.00	0.00
	0	1.30	0.80	0.00	97.89	0.00	0.00	0.00
	1	1.30	0.20	0.00	98.50	0.00	0.00	0.00
9-RP0	2	5.60	0.80	0.00	93.59	0.00	0.00	0.00
	3	5.09	0.19	0.00	94.70	0.00	0.00	0.00
	0	3.99	0.69	0.00	95.30	0.00	0.00	0.00
	1	2.60	0.70	0.00	96.70	0.00	0.00	0.00
	2	4.49	0.89	0.00	94.60	0.00	0.00	0.00
	3	2.60	0.20	0.00	97.20	0.00	0.00	0.00

# show processes cpu platform monitor

To displays information about the CPU utilization of the IOS-XE processes, use the **show processes cpu platform monitor** command in privileged EXEC mode.

**show processes cpu platform monitor location switch *switch-number* | active | standby 0 | F0 | R0**

Syntax	Description
<b>location</b>	Displays information about the Field Replaceable Unit (FRU) location.
<b>switch</b>	Specifies the switch.
<i>switch-number</i>	Switch number.
<b>active</b>	Specifies the active instance.
<b>standby</b>	Specifies the standby instance.
<b>0</b>	Specifies the shared port adapter (SPA) interface processor slot 0.
<b>F0</b>	Specifies the Embedded Service Processor (ESP) slot 0.
<b>R0</b>	Specifies the Route Processor (RP) slot 0.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The output of the **show platform software process slot switch** and **show processes cpu platform monitor location** commands display the output of the Linux **top** command. The output of these commands display Free memory and Used memory as displayed by the Linux **top** command. The values displayed for the Free memory and Used memory by these commands do not match the values displayed by the output of other platform-memory related CLIs.

## Examples

The following is sample output from the **show processes cpu monitor location switch active R0** command:

```
Switch# show processes cpu platform monitor location switch active R0

top - 00:04:21 up 1 day, 11:22, 0 users, load average: 0.42, 0.60, 0.78
Tasks: 312 total, 4 running, 308 sleeping, 0 stopped, 0 zombie
Cpu(s): 7.4%us, 3.3%sy, 0.0%ni, 89.2%id, 0.0%wa, 0.0%hi, 0.1%si, 0.0%st
Mem: 3976844k total, 3956928k used, 19916k free, 419312k buffers
Swap: 0k total, 0k used, 0k free, 1947036k cached

  PID USER      PR  NI  VIRT  RES  SHR  S  %CPU  %MEM    TIME+  COMMAND
  6294 root        20   0  3448  1368  912  R   9.0   0.0   0:00.07 top
 17546 root        20   0 2044m 244m  79m  S   6.3  187:02.07 fed main event
 30276 root        20   0  171m  42m   33m  S   7.1   1.1 125:15.54 repm
    16 root        20   0     0     0     0  S   5.0   0.0  22:07.92 rcuc/2
    21 root        20   0     0     0     0  R   5.0   0.0  22:13.24 rcuc/3
 18662 root        20   0 1806m 678m 263m  R   5.0  17.5 215:47.59 linux_iods-imag
```

**show processes cpu platform monitor**

```

 11 root      20   0   0   0   0 S    4  0.0  21:37.41 rcuc/1
10333 root      20   0 6420 3916 1492 S    4  0.1   4:47.03 btrace_rotate.s
 10 root      20   0   0   0   0 S    2  0.0   0:58.13 rcuc/0
 6304 root      20   0  776  12   0 R    2  0.0   0:00.01 ls
17835 root      20   0 935m  74m  63m S    2  1.9  82:34.07 sif_mgr
   1 root      20   0 8440 4740 2184 S    0  0.1   0:09.52 systemd
   2 root      20   0   0   0   0 S    0  0.0   0:00.00 kthreadd
   3 root      20   0   0   0   0 S    0  0.0   0:02.86 ksoftirqd/0
   5 root       0 -20   0   0   0 S    0  0.0   0:00.00 kworker/0:0H
   7 root      RT    0   0   0   0 S    0  0.0   0:01.44 migration/0

```

**Related Commands**

Command	Description
<b>show platform software process slot switch</b>	Displays platform software process switch information.

# show processes memory

To display the amount of memory used by each system process, use the **show processes memory** command in privileged EXEC mode.

**show processes memory** [*process-id* | **sorted** [ **allocated** | **getbufs** | **holding** ] ]

## Syntax Description

<b><i>process-id</i></b>	(Optional) Process ID (PID) of a specific process. When you specify a process ID, only details for the specified process will be shown.
<b>sorted</b>	(Optional) Displays memory data sorted by the Allocated, Get Buffers, or Holding column. If the <b>sorted</b> keyword is used by itself, data is sorted by the Holding column by default.
<b>allocated</b>	(Optional) Displays memory data sorted by the Allocated column.
<b>getbufs</b>	(Optional) Displays memory data sorted by the Getbufs (Get Buffers) column.
<b>holding</b>	(Optional) Displays memory data sorted by the Holding column. This keyword is the default.

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **show processes memory** command and the **show processes memory sorted** command displays a summary of total, used, and free memory, followed by a list of processes and their memory impact.

If the standard **show processes memory process-id** command is used, processes are sorted by their PID. If the **show processes memory sorted** command is used, the default sorting is by the Holding value.



## Note

Holding memory of a particular process can be allocated by other processes also, and so it can be greater than the allocated memory.

The following is sample output from the **show processes memory** command:

```
Device# show processes memory

Processor Pool Total: 25954228 Used: 8368640 Free: 17585588
PID TTY Allocated Freed Holding Getbufs Retbufs Process
0 0 8629528 689900 6751716 0 0 *Init*
0 0 24048 12928 24048 0 0 *Sched*
0 0 260 328 68 350080 0 *Dead*
1 0 0 0 12928 0 0 Chunk Manager
2 0 192 192 6928 0 0 Load Meter
3 0 214664 304 227288 0 0 Exec
4 0 0 0 12928 0 0 Check heaps
5 0 0 0 12928 0 0 Pool Manager
6 0 192 192 12928 0 0 Timers
7 0 192 192 12928 0 0 Serial Backgroun
```

## show processes memory

```

 8 0      192      192      12928      0      0 AAA high-capacit
 9 0      0        0        24928      0      0 Policy Manager
10 0      0        0        12928      0      0 ARP Input
11 0      192      192      12928      0      0 DDR Timers
12 0      0        0        12928      0      0 Entity MIB API
13 0      0        0        12928      0      0 MPLS HC Counter
14 0      0        0        12928      0      0 SERIAL A'detect
.
.
.
78 0      0        0        12992      0      0 DHCPD Timer
79 0      160      0        13088      0      0 DHCPD Database
      8329440 Total

```

The table below describes the significant fields shown in the display.

**Table 11: show processes memory Field Descriptions**

Field	Description
Processor Pool Total	Total amount of memory, in kilobytes (KB), held for the Processor memory pool.
Used	Total amount of used memory, in KB, in the Processor memory pool.
Free	Total amount of free memory, in KB, in the Processor memory pool.
PID	Process ID.
TTY	Terminal that controls the process.
Allocated	Bytes of memory allocated by the process.
Freed	Bytes of memory freed by the process, regardless of who originally allocated it.
Holding	Amount of memory, in KB, currently allocated to the process. This includes memory allocated by the process and assigned to the process.
Getbufs	Number of times the process has requested a packet buffer.
Retbufs	Number of times the process has relinquished a packet buffer.
Process	Process name.
*Init*	System initialization process.
*Sched*	The scheduler process.
*Dead*	Processes as a group that are now dead.
<value> Total	Total amount of memory, in KB, held by all processes (sum of the “Holding” column).

The following is sample output from the **show processes memory** command when the **sorted** keyword is used. In this case, the output is sorted by the Holding column, from largest to smallest.

```

Device# show processes memory sorted

Processor Pool Total: 25954228 Used: 8371280 Free: 17582948
PID TTY Allocated Freed Holding Getbufs Retbufs Process
 0 0 8629528 689900 6751716 0 0 *Init*

```

```

 3  0  217304  304  229928  0  0 Exec
53  0  109248  192  96064  0  0 DHCPD Receive
56  0  0  0  32928  0  0 COPS
19  0  39048  0  25192  0  0 Net Background
42  0  0  0  24960  0  0 L2X Data Daemon
58  0  192  192  24928  0  0 X.25 Background
43  0  192  192  24928  0  0 PPP IP Route
49  0  0  0  24928  0  0 TCP Protocols
48  0  0  0  24928  0  0 TCP Timer
17  0  192  192  24928  0  0 XML Proxy Client
 9  0  0  0  24928  0  0 Policy Manager
40  0  0  0  24928  0  0 L2X SSS manager
29  0  0  0  24928  0  0 IP Input
44  0  192  192  24928  0  0 PPP IPCP
32  0  192  192  24928  0  0 PPP Hooks
34  0  0  0  24928  0  0 SSS Manager
41  0  192  192  24928  0  0 L2TP mgmt daemon
16  0  192  192  24928  0  0 Dialer event
35  0  0  0  24928  0  0 SSS Test Client
--More--

```

The following is sample output from the **show processes memory** command when a process ID (*process-id*) is specified:

```
Device# show processes memory 1
```

```

Process ID: 1
Process Name: Chunk Manager
Total Memory Held: 8428 bytes
Processor memory holding = 8428 bytes
pc = 0x60790654, size = 6044, count = 1
pc = 0x607A5084, size = 1544, count = 1
pc = 0x6076DBC4, size = 652, count = 1
pc = 0x6076FF18, size = 188, count = 1
I/O memory holding = 0 bytes

```

```
Device# show processes memory 2
```

```

Process ID: 2
Process Name: Load Meter
Total Memory Held: 3884 bytes
Processor memory holding = 3884 bytes
pc = 0x60790654, size = 3044, count = 1
pc = 0x6076DBC4, size = 652, count = 1
pc = 0x6076FF18, size = 188, count = 1
I/O memory holding = 0 bytes

```

#### Related Commands

Command	Description
<b>show memory</b>	Displays statistics about memory, including memory-free pool statistics.
<b>show processes</b>	Displays information about the active processes.

# show processes memory platform

To display memory usage per Cisco IOS XE process, use the **show processes memory platform** command in privileged EXEC mode.

**show processes memory platform** [**detailed name** *process-name* | **process-id** *process-ID* | **location** | **maps** [*location*] | **smaps** [*location*]] | **location** | **sorted** [*location*]] **switch** *switch-number* | **active** | **standby** **0** | **F0** | **R0**

Syntax Description		
<b>detailed</b> <i>process-name</i>		(Optional) Displays detailed memory information for a specified Cisco IOS XE process.
<b>name</b> <i>process-name</i>		(Optional) Matches the Cisco IOS XE process name.
<b>process-id</b> <i>process-ID</i>		(Optional) Matches the Cisco IOS XE process ID.
<b>location</b>		(Optional) Displays information about the FRU location.
<b>maps</b>		(Optional) Displays memory maps of a process.
<b>smaps</b>		(Optional) Displays smaps of a process.
<b>sorted</b>		(Optional) Displays the sorted output based on the total memory used by Cisco IOS XE processes.
<b>switch</b> <i>switch-number</i>		Displays information about the device.
<b>active</b>		Displays information about the active instance of the switch.
<b>standby</b>		Displays information about the standby instance of the switch.
<b>0</b>		Displays information about the SPA-Inter-Processor slot 0.
<b>F0</b>		Displays information about the Embedded Service Processor (ESP) slot 0.
<b>R0</b>		Displays information about the Route Processor (RP) slot 0.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	The command was introduced.

## Examples

The following is sample output from the **show processes memory platform** command:



```
Switch# show processes memory platform
```

```
System memory: 3976852K total, 2761580K used, 1215272K free,
Lowest: 1215272K
```

Pid	Text	Data	Stack	Dynamic	RSS	Total	Name
1	1246	4400	132	1308	4400	8328	systemd
96	233	2796	132	132	2796	12436	systemd-journal
105	284	1796	132	176	1796	5208	systemd-udev
707	52	2660	132	172	2660	11688	in.telnetd
744	968	3264	132	1700	3264	5800	brelay.sh
835	52	2660	132	172	2660	11688	in.telnetd
863	968	3264	132	1700	3264	5800	brelay.sh
928	968	3996	132	2312	3996	6412	reflector.sh
933	968	3976	132	2312	3976	6412	droputil.sh
934	968	2140	132	528	2140	4628	oom.sh
936	173	936	132	132	936	3068	xinetd
945	968	1472	132	132	1472	4168	libvirtd.sh
947	592	43164	132	3096	43164	154716	repm
954	45	932	132	132	932	3132	rpcbind
986	482	3476	132	132	3476	169288	libvirtd
988	66	940	132	132	940	2724	rpc.statd
993	968	928	132	132	928	4232	boothelper_evt.
1017	21	640	132	132	640	2500	inotifywait
1089	102	1200	132	132	1200	3328	rpc.mountd
1328	9	2940	132	148	2940	13844	rotee
1353	39	532	132	132	532	2336	sleep

```
!
!
!
```

The following is sample output from the **show processes memory platform information** command:

```
Switch# show processes memory platform location switch active R0
```

```
System memory: 3976852K total, 2762844K used, 1214008K free,
Lowest: 1214008K
```

Pid	Text	Data	Stack	Dynamic	RSS	Total	Name
1	1246	4400	132	1308	4400	8328	systemd
96	233	2796	132	132	2796	12436	systemd-journal
105	284	1796	132	176	1796	5208	systemd-udev
707	52	2660	132	172	2660	11688	in.telnetd
744	968	3264	132	1700	3264	5800	brelay.sh
835	52	2660	132	172	2660	11688	in.telnetd
863	968	3264	132	1700	3264	5800	brelay.sh
928	968	3996	132	2312	3996	6412	reflector.sh
933	968	3976	132	2312	3976	6412	droputil.sh

```
!
!
!
```

The following is sample output from the **show processes memory platform sorted** command:

```
Switch# show processes memory platform sorted
```

```
System memory: 3976852K total, 2762884K used, 1213968K free,
Lowest: 1213968K
```

Pid	Text	Data	Stack	Dynamic	RSS	Total	Name
9655	3787	264964	136	18004	264964	2675968	wcm
17261	324	248588	132	103908	248588	2093076	fed main event

## show processes memory platform

```

7885 149848 684864 136      80 684864 1853548 linux_iosd-imag
17891 398 75772 136 1888 75772 958240   sif_mgr
17067 1087 77912 136 1796 77912 702184   platform_mgr
4268 391 102084 136 5596 102084 482656   cli_agent
4856 357 93388 132 3680 93388 340052   dbm
29842 8722 64428 132 8056 64428 297068   fman_fp_image
5960 9509 76088 136 3200 76088 287156   fman_rp
!
!
!
```

The following is sample output from the **show processes memory platform sorted location switch active R0** command:

```
Switch# show processes memory platform sorted location switch active R0
```

```
System memory: 3976852K total, 2763584K used, 1213268K free,
Lowest: 1213268K
```

Pid	Text	Data	Stack	Dynamic	RSS	Total	Name
9655	3787	264968	136	18004	264968	2675968	wcm
17261	324	249020	132	103908	249020	2093076	fed main event
7885	149848	684912	136	80	684912	1853548	linux_iosd-imag
17891	398	75884	136	1888	75884	958240	sif_mgr
17067	1087	77820	136	1796	77820	702184	platform_mgr
4268	391	102084	136	5596	102084	482656	cli_agent
4856	357	93388	132	3680	93388	340052	dbm
29842	8722	64428	132	8056	64428	297068	fman_fp_image
5960	9509	76088	136	3200	76088	287156	fman_rp

```

!
!
!
```

# show system mtu

To display the global maximum transmission unit (MTU) or maximum packet size set for the switch, use the **show system mtu** command in privileged EXEC mode.

```
show system mtu
```

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** None

---

**Command Modes** Privileged EXEC

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

**Usage Guidelines** For information about the MTU values and the stack configurations that affect the MTU values, see the **system mtu** command.

---

**Examples** This is an example of output from the **show system mtu** command:

# show tech-support

To automatically run **show** commands that display system information, use the **show tech-support** command in the privilege EXEC mode.

## show tech-support

[**cef** | **cft** | **eigrp** | **evc** | **fnf** | | **ipc** | **ipmulticast** | **ipsec** | **mfib** | **nat** | **nbar** | **onep** | **ospf** | **page** | **password** | **rsvp** | **subscriber** | **vrrp** | **wccp**

### Syntax Description

<b>cef</b>	(Optional) Displays CEF related information.
<b>cft</b>	(Optional) Displays CFT related information.
<b>eigrp</b>	(Optional) Displays EIGRP related information.
<b>evc</b>	(Optional) Displays EVC related information.
<b>fnf</b>	(Optional) Displays flexible netflow related information.
<b>ipc</b>	(Optional) Displays IPC related information.
<b>ipmulticast</b>	(Optional) Displays IP multicast related information.
<b>ipsec</b>	(Optional) Displays IPSEC related information.
<b>mfib</b>	(Optional) Displays MFIB related information.
<b>nat</b>	(Optional) Displays NAT related information.
<b>nbar</b>	(Optional) Displays NBAR related information.
<b>onep</b>	(Optional) Displays ONEP related information.
<b>ospf</b>	(Optional) Displays OSPF related information.
<b>page</b>	(Optional) Displays the command output on a single page at a time. Use the Return key to display the next line of output or use the space bar to display the next page of information. If not used, the output scrolls (that is, it does not stop for page breaks).  Press the <b>Ctrl-C</b> keys to stop the command output.
<b>password</b>	(Optional) Leaves passwords and other security information in the output. If not used, passwords and other security-sensitive information in the output are replaced with the label "<removed>".
<b>rsvp</b>	(Optional) Displays IP RSVP related information.
<b>subscriber</b>	(Optional) Displays subscriber related information.
<b>vrrp</b>	(Optional) Displays VRRP related information.
<b>wccp</b>	(Optional) Displays WCCP related information.

### Command Modes

Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Gibraltar 16.10.1	This command was enhanced to display the output of the <b>show logging onboard uptime</b> command
	Cisco IOS XE Everest 16.5.1a	This command was implemented on the Cisco Catalyst 9500 Series Switches

### Usage Guidelines

The output from the **show tech-support** command is very long. To better manage this output, you can redirect the output to a file (for example, **show tech-support > filename** ) in the local writable storage file system or the remote file system. Redirecting the output to a file also makes sending the output to your Cisco Technical Assistance Center (TAC) representative easier.

You can use one of the following redirection methods:

- **> filename** - Redirects the output to a file.
- **>> filename** - Redirects the output to a file in append mode.

# speed

To specify the speed of a 10/100/1000/2500/5000 Mbps port, use the **speed** command in interface configuration mode. To return to the default value, use the **no** form of this command.

**speed** **10** | **100** | **1000** | **2500** | **5000** | **auto** [**10** | **100** | **1000** | **2500** | **5000**] | **nonegotiate**  
**no speed**

## Syntax Description

<b>10</b>	Specifies that the port runs at 10 Mbps.
<b>100</b>	Specifies that the port runs at 100 Mbps.
<b>1000</b>	Specifies that the port runs at 1000 Mbps. This option is valid and visible only on 10/100/1000 Mb/s ports.
<b>2500</b>	Specifies that the port runs at 2500 Mbps. This option is valid and visible only on multi-Gigabit-supported Ethernet ports.
<b>5000</b>	Specifies that the port runs at 5000 Mbps. This option is valid and visible only on multi-Gigabit-supported Ethernet ports.
<b>auto</b>	Detects the speed at which the port should run, automatically, based on the port at the other end of the link. If you use the <b>10</b> , <b>100</b> , <b>1000</b> , <b>1000</b> , <b>2500</b> , or <b>5000</b> keyword with the <b>auto</b> keyword, the port autonegotiates only at the specified speeds.
<b>nonegotiate</b>	Disables autonegotiation, and the port runs at 1000 Mbps.

## Command Default

The default is **auto**.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

You cannot configure speed on 10-Gigabit Ethernet ports.

Except for the 1000BASE-T small form-factor pluggable (SFP) modules, you can configure the speed to not negotiate (**nonegotiate**) when an SFP module port is connected to a device that does not support autonegotiation.

The new keywords, **2500** and **5000** are visible only on multi-Gigabit (m-Gig) Ethernet supporting devices.

If the speed is set to **auto**, the switch negotiates with the device at the other end of the link for the speed setting, and then forces the speed setting to the negotiated value. The duplex setting remains configured on each end of the link, which might result in a duplex setting mismatch.

If both ends of the line support autonegotiation, we highly recommend the default autonegotiation settings. If one interface supports autonegotiation and the other end does not, use the auto setting on the supported side, but set the duplex and speed on the other side.

**Caution**

Changing the interface speed and duplex mode configuration might shut down and re-enable the interface during the reconfiguration.

For guidelines on setting the switch speed and duplex parameters, see the “Configuring Interface Characteristics” chapter in the software configuration guide for this release.

Verify your settings using the **show interfaces** privileged EXEC command.

**Examples**

The following example shows how to set speed on a port to 100 Mbps:

```
Device(config)# interface gigabitethernet1/0/1  
Device(config-if)# speed 100
```

The following example shows how to set a port to autonegotiate at only 10 Mbps:

```
Device(config)# interface gigabitethernet1/0/1  
Device(config-if)# speed auto 10
```

The following example shows how to set a port to autonegotiate at only 10 or 100 Mbps:

```
Device(config)# interface gigabitethernet1/0/1  
Device(config-if)# speed auto 10 100
```

# switchport block

To prevent unknown multicast or unicast packets from being forwarded, use the **switchport block** command in interface configuration mode. To allow forwarding unknown multicast or unicast packets, use the **no** form of this command.

**switchport block multicast | unicast**  
**no switchport block multicast | unicast**

<b>Syntax Description</b>	<p><b>multicast</b> Specifies that unknown multicast traffic should be blocked.</p> <p><b>Note</b> Only pure Layer 2 multicast traffic is blocked. Multicast packets that contain IPv4 or IPv6 information in the header are not blocked.</p>				
	<p><b>unicast</b> Specifies that unknown unicast traffic should be blocked.</p>				
<b>Command Default</b>	Unknown multicast and unicast traffic is not blocked.				
<b>Command Modes</b>	Interface configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	<p>By default, all traffic with unknown MAC addresses is sent to all ports. You can block unknown multicast or unicast traffic on protected or nonprotected ports. If unknown multicast or unicast traffic is not blocked on a protected port, there could be security issues.</p> <p>With multicast traffic, the port blocking feature blocks only pure Layer 2 packets. Multicast packets that contain IPv4 or IPv6 information in the header are not blocked.</p> <p>Blocking unknown multicast or unicast traffic is not automatically enabled on protected ports; you must explicitly configure it.</p> <p>For more information about blocking packets, see the software configuration guide for this release.</p> <p>This example shows how to block unknown unicast traffic on an interface:</p> <pre>Device(config-if)# <b>switchport block unicast</b></pre> <p>You can verify your setting by entering the <b>show interfaces interface-id switchport</b> privileged EXEC command.</p>				



## system mtu

---

**Syntax Description**     *bytes*

---

---

**Command Default**     The default MTU size for all ports is 1500 bytes.

---

---

**Command Modes**     Global configuration

---

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

**Usage Guidelines**     You can verify your setting by entering the **show system mtu** privileged EXEC command.

                                 The switch does not support the MTU on a per-interface basis.

                                 If you enter a value that is outside the allowed range for the specific type of interface, the value is not accepted.

## voice-signaling vlan (network-policy configuration)

To create a network-policy profile for the voice-signaling application type, use the **voice-signaling vlan** command in network-policy configuration mode. To delete the policy, use the **no** form of this command.

**voice-signaling vlan** *vlan-id* [**cos** *cos-value* | **dscp** *dscp-value*] | **dot1p** [**cos** *l2-priority* | **dscp** *dscp*] | **none** | **untagged**

Syntax Description	
<b>vlan-id</b>	(Optional) The VLAN for voice traffic. The range is 1 to 4094.
<b>cos</b> <i>cos-value</i>	(Optional) Specifies the Layer 2 priority class of service (CoS) for the configured VLAN. The range is 0 to 7; the default is 5.
<b>dscp</b> <i>dscp-value</i>	(Optional) Specifies the differentiated services code point (DSCP) value for the configured VLAN. The range is 0 to 63; the default is 46.
<b>dot1p</b>	(Optional) Configures the phone to use IEEE 802.1p priority tagging and to use VLAN 0 (the native VLAN).
<b>none</b>	(Optional) Does not instruct the Cisco IP phone about the voice VLAN. The phone uses the configuration from the phone key pad.
<b>untagged</b>	(Optional) Configures the phone to send untagged voice traffic. This is the default for the phone.

**Command Default** No network-policy profiles for the voice-signaling application type are defined.

The default CoS value is 5.

The default DSCP value is 46.

The default tagging mode is untagged.

**Command Modes** Network-policy profile configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **network-policy profile** global configuration command to create a profile and to enter network-policy profile configuration mode.

The voice-signaling application type is for network topologies that require a different policy for voice signaling than for voice media. This application type should not be advertised if all of the same network policies apply as those advertised in the voice policy TLV.

When you are in network-policy profile configuration mode, you can create the profile for voice-signaling by specifying the values for VLAN, class of service (CoS), differentiated services code point (DSCP), and tagging mode.

These profile attributes are contained in the Link Layer Discovery Protocol for Media Endpoint Devices (LLDP-MED) network-policy time-length-value (TLV).

To return to privileged EXEC mode from the network-policy profile configuration mode, enter the **exit** command.

This example shows how to configure voice-signaling for VLAN 200 with a priority 2 CoS:

```
Device(config)# network-policy profile 1  
Device(config-network-policy)# voice-signaling vlan 200 cos 2
```

This example shows how to configure voice-signaling for VLAN 400 with a DSCP value of 45:

```
Device(config)# network-policy profile 1  
Device(config-network-policy)# voice-signaling vlan 400 dscp 45
```

This example shows how to configure voice-signaling for the native VLAN with priority tagging:

```
Device(config-network-policy)# voice-signaling vlan dot1p cos 4
```

## voice vlan (network-policy configuration)

To create a network-policy profile for the voice application type, use the **voice vlan** command in network-policy configuration mode. To delete the policy, use the **no** form of this command.

**voice vlan** *vlan-id* [**cos** *cos-value* | **dscp** *dscp-value*] | **dot1p** [**cos** *l2-priority* | **dscp** *dscp*] | **none** | **untagged**

### Syntax Description

<b>vlan-id</b>	(Optional) The VLAN for voice traffic. The range is 1 to 4094.
<b>cos</b> <i>cos-value</i>	(Optional) Specifies the Layer 2 priority class of service (CoS) for the configured VLAN. The range is 0 to 7; the default is 5.
<b>dscp</b> <i>dscp-value</i>	(Optional) Specifies the differentiated services code point (DSCP) value for the configured VLAN. The range is 0 to 63; the default is 46.
<b>dot1p</b>	(Optional) Configures the phone to use IEEE 802.1p priority tagging and to use VLAN 0 (the native VLAN).
<b>none</b>	(Optional) Does not instruct the Cisco IP phone about the voice VLAN. The phone uses the configuration from the phone key pad.
<b>untagged</b>	(Optional) Configures the phone to send untagged voice traffic. This is the default for the phone.

### Command Default

No network-policy profiles for the voice application type are defined.

The default CoS value is 5.

The default DSCP value is 46.

The default tagging mode is untagged.

### Command Modes

Network-policy profile configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **network-policy profile** global configuration command to create a profile and to enter network-policy profile configuration mode.

The voice application type is for dedicated IP telephones and similar devices that support interactive voice services. These devices are typically deployed on a separate VLAN for ease of deployment and enhanced security through isolation from data applications.

When you are in network-policy profile configuration mode, you can create the profile for voice by specifying the values for VLAN, class of service (CoS), differentiated services code point (DSCP), and tagging mode.

These profile attributes are contained in the Link Layer Discovery Protocol for Media Endpoint Devices (LLDP-MED) network-policy time-length-value (TLV).

To return to privileged EXEC mode from the network-policy profile configuration mode, enter the **exit** command.

This example shows how to configure the voice application type for VLAN 100 with a priority 4 CoS:

```
Device(config)# network-policy profile 1
Device(config-network-policy)# voice vlan 100 cos 4
```

This example shows how to configure the voice application type for VLAN 100 with a DSCP value of 34:

```
Device(config)# network-policy profile 1
Device(config-network-policy)# voice vlan 100 dscp 34
```

This example shows how to configure the voice application type for the native VLAN with priority tagging:

```
Device(config-network-policy)# voice vlan dot1p cos 4
```





## PART **III**

# IP Addressing Services

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## IP Addressing Services Commands

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# clear ip nhrp

To clear all dynamic entries from the Next Hop Resolution Protocol (NHRP) cache, use the **clear ip nhrp** command in user EXEC or privileged EXEC mode.

**clear ip nhrp**[*vrf vrf-name* | **global**] [*dest-ip-address* [*dest-mask*] | **tunnel number** | **counters** [**interface tunnel number**] | **stats** [**tunnel number** [*vrf vrf-name* | **global**]]]

## Syntax Description

<b>vrf</b>	(Optional) Deletes entries from the NHRP cache for the specified virtual routing and forwarding (VRF) instance.
<i>vrf-name</i>	(Optional) Name of the VRF address family to which the command is applied.
<b>global</b>	(Optional) Specifies the global VRF instance.
<i>dest-ip-address</i>	(Optional) Destination IP address. Specifying this argument clears NHRP mapping entries for the specified destination IP address.
<i>dest-mask</i>	(Optional) Destination network mask.
<b>counters</b>	(Optional) Clears the NHRP counters.
<b>interface</b>	(Optional) Clears the NHRP mapping entries for all interfaces.
<b>tunnel number</b>	(Optional) Removes the specified interface from the NHRP cache.
<b>stats</b>	(Optional) Clears all IPv4 statistic information for all interfaces.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

## Usage Guidelines

The **clear ip nhrp** command does not clear any static (configured) IP-to-NBMA address mappings from the NHRP cache.

## Examples

The following example shows how to clear all dynamic entries from the NHRP cache for an interface:

```
Switch# clear ip nhrp
```

## Related Commands

Command	Description
<b>show ip nhrp</b>	Displays NHRP mapping information.

# debug nhrp

To enable Next Hop Resolution Protocol (NHRP) debugging, use the **debug nhrp** command in privileged EXEC mode. To disable debugging output, use the **no** form of this command.

**debug nhrp** [**attribute** | **cache** | **condition interface tunnel number** | **peer nbma ipv4-nbma-address nbma-name ipv6-nbma-address** | **unmatched** | **vrf vrf-name** | **detail** | **error** | **extension** | **group** | **packet** | **rate**]

**no debug nhrp** [**attribute** | **cache** | **condition interface tunnel number** | **peer nbma ipv4-nbma-address nbma-name ipv6-nbma-address** | **unmatched** | **vrf vrf-name** | **detail** | **error** | **extension** | **group** | **packet** | **rate**]

## Syntax Description

<b>attribute</b>	(Optional) Enables NHRP attribute debugging operations.
<b>cache</b>	(Optional) Enables NHRP cache debugging operations.
<b>condition</b>	(Optional) Enables NHRP conditional debugging operations.
<b>interface tunnel number</b>	(Optional) Enables debugging operations for the tunnel interface.
<b>nbma</b>	(Optional) Enables debugging operations for the non-broadcast multiple access (NBMA) network.
<i>ipv4-nbma-address</i>	(Optional) Enables debugging operations based on the IPv4 address of the NBMA network.
<i>nbma-name</i>	(Optional) NBMA network name.
<i>IPv6-address</i>	(Optional) Enables debugging operations based on the IPv6 address of the NBMA network. <b>Note</b> The <i>IPv6-address</i> argument is not supported in Cisco IOS XE Denali 16.3.1.
<b>vrf vrf-name</b>	(Optional) Enables debugging operations for the virtual routing and forwarding instance.
<b>detail</b>	(Optional) Displays detailed logs of NHRP debugs.
<b>error</b>	(Optional) Enables NHRP error debugging operations.
<b>extension</b>	(Optional) Enables NHRP extension processing debugging operations.
<b>group</b>	(Optional) Enables NHRP group debugging operations.
<b>packet</b>	(Optional) Enables NHRP activity debugging.
<b>rate</b>	(Optional) Enables NHRP rate limiting.
<b>routing</b>	(Optional) Enables NHRP routing debugging operations.

## Command Default

NHRP debugging is not enabled.

**Command Modes** Privileged EXEC (#)

**Command History**

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

**Usage Guidelines**



**Note** In Cisco IOS XE Denali 16.3.1, this command supports only IPv4; the *IPv6-nbma-address* argument although available on the switch, will not work if configured.

Use the **debug nhrp detail** command to view the NHRP attribute logs.

The **Virtual-Access number** keyword-argument pair is visible only if the virtual access interface is available on the device.

**Examples**

The following sample output from the **debug nhrp** command displays NHRP debugging output for IPv4:

```
Switch# debug nhrp

Aug  9 13:13:41.486: NHRP: Attempting to send packet via DEST 10.1.1.99
Aug  9 13:13:41.486: NHRP: Encapsulation succeeded. Tunnel IP addr 10.11.11.99
Aug  9 13:13:41.486: NHRP: Send Registration Request via Tunnel0 vrf 0, packet size: 105
Aug  9 13:13:41.486:      src: 10.1.1.11, dst: 10.1.1.99
Aug  9 13:13:41.486: NHRP: 105 bytes out Tunnel0
Aug  9 13:13:41.486: NHRP: Receive Registration Reply via Tunnel0 vrf 0, packet size: 125
Aug  9 13:13:41.486: NHRP: netid_in = 0, to_us = 1
```

**Related Commands**

Command	Description
<b>show ip nhrp</b>	Displays NHRP mapping information.

# fhrp delay

To specify the delay period for the initialization of First Hop Redundancy Protocol (FHRP) clients, use the **fhrp delay** command in interface configuration mode. To remove the delay period specified, use the **no** form of this command.

```
fhrp delay {[minimum] [reload] seconds}
no fhrp delay {[minimum] [reload] seconds}
```

Syntax Description	minimum	(Optional) Configures the delay period after an interface becomes available.
	reload	(Optional) Configures the delay period after the device reloads.
	seconds	Delay period in seconds. The range is from 0 to 3600.

**Command Default** None

**Command Modes** Interface configuration (config-if)

**Examples** This example shows how to specify the delay period for the initialization of FHRP clients:

```
Device(config-if)# fhrp delay minimum 90
```

Related Commands	Command	Description
	<b>show fhrp</b>	Displays First Hop Redundancy Protocol (FHRP) information.

## fhrp version vrrp v3

To enable Virtual Router Redundancy Protocol version 3 (VRRPv3) and Virtual Router Redundancy Service (VRRS) configuration on a device, use the **fhrp version vrrp v3** command in global configuration mode. To disable the ability to configure VRRPv3 and VRRS on a device, use the **no** form of this command.

```
fhrp version vrrp v3
no fhrp version vrrp v3
```

<b>Syntax Description</b>	This command has no keywords or arguments.
<b>Command Default</b>	VRRPv3 and VRRS configuration on a device is not enabled.
<b>Command Modes</b>	Global configuration (config)
<b>Usage Guidelines</b>	When VRRPv3 is in use, VRRP version 2 (VRRPv2) is unavailable.

### Examples

In the following example, a tracking process is configured to track the state of an IPv6 object using a VRRPv3 group. VRRP on GigabitEthernet interface 0/0/0 then registers with the tracking process to be informed of any changes to the IPv6 object on the VRRPv3 group. If the IPv6 object state on serial interface VRRPv3 goes down, then the priority of the VRRP group is reduced by 20:

```
Device(config)# fhrp version vrrp v3
Device(config)# interface GigabitEthernet 0/0/0
Device(config-if)# vrrp 1 address-family ipv6
Device(config-if-vrrp)# track 1 decrement 20
```

### Related Commands

Command	Description
<b>track (VRRP)</b>	Enables an object to be tracked using a VRRPv3 group.

# ip address

To set a primary or secondary IP address for an interface, use the **ip address** command in interface configuration mode. To remove an IP address or disable IP processing, use the no form of this command.

```
ip address ip-address mask [secondary [vrf vrf-name]]
no ip address ip-address mask [secondary [vrf vrf-name]]
```

Syntax Description	
<i>ip-address</i>	IP address.
<i>mask</i>	Mask for the associated IP subnet.
<b>secondary</b>	(Optional) Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.  <b>Note</b> If the secondary address is used for a VRF table configuration with the <b>vrf</b> keyword, the <b>vrf</b> keyword must be specified also.
<b>vrf</b>	(Optional) Name of the VRF table. The <i>vrf-name</i> argument specifies the VRF name of the ingress interface.

**Command Default** No IP address is defined for the interface.

**Command Modes** Interface configuration (config-if)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** An interface can have one primary IP address and multiple secondary IP addresses. Packets generated by the Cisco IOS software always use the primary IP address. Therefore, all devices and access servers on a segment should share the same primary network number.

Hosts can determine subnet masks using the Internet Control Message Protocol (ICMP) mask request message. Devices respond to this request with an ICMP mask reply message.

You can disable IP processing on a particular interface by removing its IP address with the **no ip address** command. If the software detects another host using one of its IP addresses, it will print an error message on the console.

The optional **secondary** keyword allows you to specify an unlimited number of secondary addresses. Secondary addresses are treated like primary addresses, except the system never generates datagrams other than routing updates with secondary source addresses. IP broadcasts and Address Resolution Protocol (ARP) requests are handled properly, as are interface routes in the IP routing table.

Secondary IP addresses can be used in a variety of situations. The following are the most common applications:

- There may not be enough host addresses for a particular network segment. For example, your subnetting allows up to 254 hosts per logical subnet, but on one physical subnet you need 300 host addresses. Using

secondary IP addresses on the devices or access servers allows you to have two logical subnets using one physical subnet.

- Many older networks were built using Level 2 bridges. The judicious use of secondary addresses can aid in the transition to a subnetted, device-based network. Devices on an older, bridged segment can be easily made aware that many subnets are on that segment.
- Two subnets of a single network might otherwise be separated by another network. This situation is not permitted when subnets are in use. In these instances, the first network is *extended*, or layered on top of the second network using secondary addresses.



#### Note

- If any device on a network segment uses a secondary address, all other devices on that same segment must also use a secondary address from the same network or subnet. Inconsistent use of secondary addresses on a network segment can very quickly cause routing loops.
- When you are routing using the Open Shortest Path First (OSPF) algorithm, ensure that all secondary addresses of an interface fall into the same OSPF area as the primary addresses.
- If you configure a secondary IP address, you must disable sending ICMP redirect messages by entering the **no ip redirects** command, to avoid high CPU utilization.

To transparently bridge IP on an interface, you must perform the following two tasks:

- Disable IP routing (specify the **no ip routing** command).
- Add the interface to a bridge group, see the **bridge-group** command.

To concurrently route and transparently bridge IP on an interface, see the **bridge crb** command.

#### Examples

In the following example, 192.108.1.27 is the primary address and 192.31.7.17 is the secondary address for GigabitEthernet interface 1/0/1:

```
Device> enable
Device# configure terminal
Device(config)# interface GigabitEthernet 1/0/1
Device(config-if)# ip address 192.108.1.27 255.255.255.0
Device(config-if)# ip address 192.31.7.17 255.255.255.0 secondary
```

#### Related Commands

Command	Description
<b>match ip route-source</b>	Specifies a source IP address to match to required route maps that have been set up based on VRF connected routes.
<b>route-map</b>	Defines the conditions for redistributing routes from one routing protocol into another, or to enable policy routing.
<b>set vrf</b>	Enables VPN VRF selection within a route map for policy-based routing VRF selection.
<b>show ip arp</b>	Displays the ARP cache, in which SLIP addresses appear as permanent ARP table entries.



Command	Description
show ip interface	Displays the usability status of interfaces configured for IP.
show route-map	Displays static and dynamic route maps.

## ip address dhcp

To acquire an IP address on an interface from the DHCP, use the **ip address dhcp** command in interface configuration mode. To remove any address that was acquired, use the **no** form of this command.

```
ip address dhcp [client-id interface-type number] [hostname hostname]  
no ip address dhcp [client-id interface-type number] [hostname hostname]
```

### Syntax Description

<b>client-id</b>	(Optional) Specifies the client identifier. By default, the client identifier is an ASCII value. The <b>client-id</b> <i>interface-type number</i> option sets the client identifier to the hexadecimal MAC address of the named interface.
<i>interface-type</i>	(Optional) Interface type. For more information, use the question mark (?) online help function.
<i>number</i>	(Optional) Interface or subinterface number. For more information about the numbering syntax for your networking device, use the question mark (?) online help function.
<b>hostname</b>	(Optional) Specifies the hostname.
<i>hostname</i>	(Optional) Name of the host to be placed in the DHCP option 12 field. This name need not be the same as the hostname entered in global configuration mode.

### Command Default

The hostname is the globally configured hostname of the device. The client identifier is an ASCII value.

### Command Modes

Interface configuration (config-if)

### Usage Guidelines

The **ip address dhcp** command allows any interface to dynamically learn its IP address by using the DHCP protocol. It is especially useful on Ethernet interfaces that dynamically connect to an Internet service provider (ISP). Once assigned a dynamic address, the interface can be used with the Port Address Translation (PAT) of Cisco IOS Network Address Translation (NAT) to provide Internet access to a privately addressed network attached to the device.

The **ip address dhcp** command also works with ATM point-to-point interfaces and will accept any encapsulation type. However, for ATM multipoint interfaces you must specify Inverse ARP via the **protocol ip inarp** interface configuration command and use only the aa15snap encapsulation type.

Some ISPs require that the DHCPDISCOVER message have a specific hostname and client identifier that is the MAC address of the interface. The most typical usage of the **ip address dhcp client-id interface-type number hostname hostname** command is when *interface-type* is the Ethernet interface where the command is configured and *interface-type number* is the hostname provided by the ISP.

A client identifier (DHCP option 61) can be a hexadecimal or an ASCII value. By default, the client identifier is an ASCII value. The **client-id interface-type number** option overrides the default and forces the use of the hexadecimal MAC address of the named interface.

If a Cisco device is configured to obtain its IP address from a DHCP server, it sends a DHCPDISCOVER message to provide information about itself to the DHCP server on the network.

If you use the **ip address dhcp** command with or without any of the optional keywords, the DHCP option 12 field (hostname option) is included in the DISCOVER message. By default, the hostname specified in option 12 will be the globally configured hostname of the device. However, you can use the **ip address dhcp hostname**

*hostname* command to place a different name in the DHCP option 12 field than the globally configured hostname of the device.

The **no ip address dhcp** command removes any IP address that was acquired, thus sending a DHCPRELEASE message.

You might need to experiment with different configurations to determine the one required by your DHCP server. The table below shows the possible configuration methods and the information placed in the DISCOVER message for each method.

**Table 12: Configuration Method and Resulting Contents of the DISCOVER Message**

Configuration Method	Contents of DISCOVER Messages
<b>ip address dhcp</b>	The DISCOVER message contains “cisco- <i>mac-address</i> -Eth1” in the client ID field. The <i>mac-address</i> is the MAC address of the Ethernet 1 interface and contains the default hostname of the device in the option 12 field.
<b>ip address dhcp hostname</b> <i>hostname</i>	The DISCOVER message contains “cisco- <i>mac-address</i> -Eth1” in the client ID field. The <i>mac-address</i> is the MAC address of the Ethernet 1 interface, and contains <i>hostname</i> in the option 12 field.
<b>ip address dhcp client-id ethernet 1</b>	The DISCOVER message contains the MAC address of the Ethernet 1 interface in the client ID field and contains the default hostname of the device in the option 12 field.
<b>ip address dhcp client-id ethernet 1 hostname</b> <i>hostname</i>	The DISCOVER message contains the MAC address of the Ethernet 1 interface in the client ID field and contains <i>hostname</i> in the option 12 field.

## Examples

In the examples that follow, the command **ip address dhcp** is entered for Ethernet interface 1. The DISCOVER message sent by a device configured as shown in the following example would contain “cisco- *mac-address* -Eth1” in the client-ID field, and the value abc in the option 12 field.

```
hostname abc
!
interface GigabitEthernet 1/0/1
 ip address dhcp
```

The DISCOVER message sent by a device configured as shown in the following example would contain “cisco- *mac-address* -Eth1” in the client-ID field, and the value def in the option 12 field.

```
hostname abc
!
interface GigabitEthernet 1/0/1
 ip address dhcp hostname def
```

The DISCOVER message sent by a device configured as shown in the following example would contain the MAC address of Ethernet interface 1 in the client-id field, and the value abc in the option 12 field.

```
hostname abc
!
```

```
interface Ethernet 1
 ip address dhcp client-id GigabitEthernet 1/0/1
```

The DISCOVER message sent by a device configured as shown in the following example would contain the MAC address of Ethernet interface 1 in the client-id field, and the value def in the option 12 field.

```
hostname abc
!
interface Ethernet 1
 ip address dhcp client-id GigabitEthernet 1/0/1 hostname def
```

**Related Commands**

Command	Description
<b>ip dhcp pool</b>	Configures a DHCP address pool on a Cisco IOS DHCP server and enters DHCP pool configuration mode.

## ip address pool (DHCP)

To enable the IP address of an interface to be automatically configured when a Dynamic Host Configuration Protocol (DHCP) pool is populated with a subnet from IP Control Protocol (IPCP) negotiation, use the **ip address pool** command in interface configuration mode. To disable autoconfiguring of the IP address of the interface, use the **no** form of this command.

**ip address pool** *name*  
**no ip address pool**

### Syntax Description

<i>name</i>	Name of the DHCP pool. The IP address of the interface will be automatically configured from the DHCP pool specified in <i>name</i> .
-------------	---

### Command Default

IP address pooling is disabled.

### Command Modes

Interface configuration

### Usage Guidelines

Use this command to automatically configure the IP address of a LAN interface when there are DHCP clients on the attached LAN that should be serviced by the DHCP pool on the device. The DHCP pool obtains its subnet dynamically through IPCP subnet negotiation.

### Examples

The following example specifies that the IP address of GigabitEthernet interface 1/0/1 will be automatically configured from the address pool named abc:

```
ip dhcp pool abc
  import all
  origin ipcp
!
interface GigabitEthernet 1/0/1
  ip address pool abc
```

### Related Commands

Command	Description
<b>show ip interface</b>	Displays the usability status of interfaces configured for IP.

## ip nhrp authentication

To configure the authentication string for an interface using the Next Hop Resolution Protocol (NHRP), use the **ip nhrp authentication** command in interface configuration mode. To remove the authentication string, use the **no** form of this command.

**ip nhrp authentication** *string*  
**no ip nhrp authentication** [*string*]

### Syntax Description

<i>string</i>	Authentication string configured for the source and destination stations that controls whether NHRP stations allow intercommunication. The string can be up to eight characters long.
---------------	---

### Command Default

No authentication string is configured; the Cisco IOS software adds no authentication option to NHRP packets it generates.

### Command Modes

Interface configuration (config-if)

### Command History

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

### Usage Guidelines

All devices configured with NHRP within one logical nonbroadcast multiaccess (NBMA) network must share the same authentication string.

### Examples

In the following example, the authentication string named specialxx must be configured in all devices using NHRP on the interface before NHRP communication occurs:

```
Device(config-if)# ip nhrp authentication specialxx
```

## ip nhrp holdtime

To change the number of seconds that Next Hop Resolution Protocol (NHRP) nonbroadcast multiaccess (NBMA) addresses are advertised as valid in authoritative NHRP responses, use the **ip nhrp holdtime** command in interface configuration mode. To restore the default value, use the **no** form of this command.

**ip nhrp holdtime** *seconds*  
**no ip nhrp holdtime** [*seconds*]

<b>Syntax Description</b>	<p><i>seconds</i> Time in seconds that NBMA addresses are advertised as valid in positive authoritative NHRP responses.</p> <p><b>Note</b> The recommended NHRP hold time value ranges from 300 to 600 seconds. Although a higher value can be used when required, we recommend that you do not use a value less than 300 seconds; and if used, it should be used with extreme caution.</p>
---------------------------	---

**Command Default** 7200 seconds (2 hours)

**Command Modes** Interface configuration (config-if)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines** The **ip nhrp holdtime** command affects authoritative responses only. The advertised holding time is the length of time the Cisco IOS software tells other routers to keep information that it is providing in authoritative NHRP responses. The cached IP-to-NBMA address mapping entries are discarded after the holding time expires.

The NHRP cache can contain static and dynamic entries. The static entries never expire. Dynamic entries expire regardless of whether they are authoritative or nonauthoritative.

### Examples

In the following example, NHRP NBMA addresses are advertised as valid in positive authoritative NHRP responses for 1 hour:

```
Device(config-if)# ip nhrp holdtime 3600
```

## ip nhrp map

To statically configure the IP-to-nonbroadcast multiaccess (NBMA) address mapping of IP destinations connected to an NBMA network, use the **ip nhrp map** interface configuration command. To remove the static entry from Next Hop Resolution Protocol (NHRP) cache, use the **no** form of this command.

**ip nhrp map** *ip-address* [*nbma-ip-address*][*dest-mask*][*nbma-ipv6-address*] | **multicast** *nbma-ip-address* *nbma-ipv6-address* | **dynamic**  
**no ip nhrp map** *ip-address* [*nbma-ip-address*][*dest-mask*][*nbma-ipv6-address*] | **multicast** *nbma-ip-address* *nbma-ipv6-address* | **dynamic**

### Syntax Description

<i>ip-address</i>	IP address of the destinations reachable through the Nonbroadcast multiaccess (NBMA) network. This address is mapped to the NBMA address.
<i>nbma-ip-address</i>	NBMA IP address.
<i>dest-mask</i>	Destination network address for which a mask is required.
<i>nbma-ipv6-address</i>	NBMA IPv6 address.
<b>dynamic</b>	Dynamically learns destinations from client registrations on hub.
<b>multicast</b>	NBMA address that is directly reachable through the NBMA network. The address format varies depending on the medium you are using. For example, ATM has a Network Service Access Point (NSAP) address, Ethernet has a MAC address, and Switched Multimegabit Data Service (SMDS) has an E.164 address. This address is mapped to the IP address.

### Command Default

No static IP-to-NBMA cache entries exist.

### Command Modes

Interface configuration (config-if)

### Command History

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

### Usage Guidelines

You will probably need to configure at least one static mapping in order to reach the next-hop server. Repeat this command to statically configure multiple IP-to-NBMA address mappings.

### Examples

In the following example, this station in a multipoint tunnel network is statically configured to be served by two next-hop servers 10.0.0.1 and 10.0.1.3. The NBMA address for 10.0.0.1 is statically configured to be 192.0.0.1 and the NBMA address for 10.0.1.3 is 192.2.7.8.

```
Device(config)# interface tunnel 0
Device(config-if)# ip nhrp nhs 10.0.0.1
Device(config-if)# ip nhrp nhs 10.0.1.3
Device(config-if)# ip nhrp map 10.0.0.1 192.0.0.1
Device(config-if)# ip nhrp map 10.0.1.3 192.2.7.8
```



## Examples

In the following example, if a packet is sent to 10.255.255.255, it is replicated to destinations 10.0.0.1 and 10.0.0.2. Addresses 10.0.0.1 and 10.0.0.2 are the IP addresses of two other routers that are part of the tunnel network, but those addresses are their addresses in the underlying network, not the tunnel network. They would have tunnel addresses that are in network 10.0.0.0.

```
Device(config)# interface tunnel 0
Device(config-if)# ip address 10.0.0.3 255.0.0.0
Device(config-if)# ip nhrp map multicast 10.0.0.1
Device(config-if)# ip nhrp map multicast 10.0.0.2
```

## Related Commands

Command	Description
<code>clear ip nhrp</code>	Clears all dynamic entries from the NHRP cache.

# ip nhrp map multicast

To configure nonbroadcast multiaccess (NBMA) addresses used as destinations for broadcast or multicast packets to be sent over a tunnel network, use the **ip nhrp map multicast** command in interface configuration mode. To remove the destinations, use the **no** form of this command.

**ip nhrp map multicast** *ip-nbma-address* *ipv6-nbma-address* | **dynamic**  
**no ip nhrp map multicast** *ip-nbma-address* *ipv6-nbma-address* | **dynamic**

## Syntax Description

<i>ip-nbma-address</i>	NBMA address that is directly reachable through the NBMA network. The address format varies depending on the medium that you are using.
<i>ipv6-nbma-address</i>	IPv6 NBMA address. <b>Note</b> This argument is not supported in Cisco IOS XE Denali 16.3.1.
<b>dynamic</b>	Dynamically learns destinations from client registrations on the hub.

## Command Default

No NBMA addresses are configured as destinations for broadcast or multicast packets.

## Command Modes

Interface configuration (config-if)

## Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

## Usage Guidelines



**Note** In Cisco IOS XE Denali 16.3.1, this command supports only IPv4; the *ipv6-nbma-address* argument although available on the switch, will not work if configured.

This command applies only to tunnel interfaces. This command is useful for supporting broadcasts over a tunnel network when the underlying network does not support IP multicast. If the underlying network does support IP multicast, you should use the **tunnel destination** command to configure a multicast destination for transmission of tunnel broadcasts or multicasts.

When multiple NBMA addresses are configured, the system replicates the broadcast packet for each address.

## Examples

In the following example, if a packet is sent to 10.255.255.255, it is replicated to destinations 10.0.0.1 and 10.0.0.2:

```
Switch(config)# interface tunnel 0
Switch(config-if)# ip address 10.0.0.3 255.0.0.0
Switch(config-if)# ip nhrp map multicast 10.0.0.1
Switch(config-if)# ip nhrp map multicast 10.0.0.2
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>debug nhrp</b>	Enables NHRP debugging.
<b>interface</b>	Configures an interface and enters interface configuration mode.
<b>tunnel destination</b>	Specifies the destination for a tunnel interface.

## ip nhrp network-id

To enable the Next Hop Resolution Protocol (NHRP) on an interface, use the **ip nhrp network-id** command in interface configuration mode. To disable NHRP on the interface, use the **no** form of this command.

**ip nhrp network-id** *number*  
**no ip nhrp network-id** [*number*]

### Syntax Description

<i>number</i>	Globally unique, 32-bit network identifier from a nonbroadcast multiaccess (NBMA) network. The range is from 1 to 4294967295.
---------------	---

### Command Default

NHRP is disabled on the interface.

### Command Modes

Interface configuration (config-if)

### Command History

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

### Usage Guidelines

In general, all NHRP stations within one logical NBMA network must be configured with the same network identifier.

### Examples

The following example enables NHRP on the interface:

```
Device(config-if)# ip nhrp network-id 1
```

## ip nhrp nhs

To specify the address of one or more Next Hop Resolution Protocol (NHRP) servers, use the **ip nhrp nhs** command in interface configuration mode. To remove the address, use the **no** form of this command.

**ip nhrp nhs** *nhs-address* [**nbma** *nbma-addressFQDN-string*] [**multicast**] [**priority** *value*] [**cluster** *value*] | **cluster** *value* **max-connections** *value* | **dynamic** **nbma** *nbma-addressFQDN-string* [**multicast**] [**priority** *value*] [**cluster** *value*]

**no ip nhrp nhs** *nhs-address* [**nbma** *nbma-addressFQDN-string*] [**multicast**] [**priority** *value*] [**cluster** *value*] | **cluster** *value* **max-connections** *value* | **dynamic** **nbma** *nbma-addressFQDN-string* [**multicast**] [**priority** *value*] [**cluster** *value*]

### Syntax Description

<i>nhs-address</i>	Address of the next-hop server being specified.
<i>net-address</i>	(Optional) IP address of a network served by the next-hop server.
<i>netmask</i>	(Optional) IP network mask to be associated with the IP address. The IP address is logically ANDed with the mask.
<b>nbma</b>	(Optional) Specifies the nonbroadcast multiple access (NBMA) address or FQDN.
<i>nbma-address</i>	NBMA address.
<i>FQDN-string</i>	Next hop server (NHS) fully qualified domain name (FQDN) string.
<b>multicast</b>	(Optional) Specifies to use NBMA mapping for broadcasts and multicasts.
<b>priority</b> <i>value</i>	(Optional) Assigns a priority to hubs to control the order in which spokes select hubs to establish tunnels. The range is from 0 to 255; 0 is the highest and 255 is the lowest priority.
<b>cluster</b> <i>value</i>	(Optional) Specifies NHS groups. The range is from 0 to 10; 0 is the highest and 10 is the lowest. The default value is 0.
<b>max-connections</b> <i>value</i>	Specifies the number of NHS elements from each NHS group that needs to be active. The range is from 0 to 255.
<b>dynamic</b>	Configures the spoke to learn the NHS protocol address dynamically.

### Command Default

No next-hop servers are explicitly configured, so normal network layer routing decisions are used to forward NHRP traffic.

### Command Modes

Interface configuration (config-if)

### Command History

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines**

Use the **ip nhrp nhs** command to specify the address of a next hop server and the networks it serves. Normally, NHRP consults the network layer forwarding table to determine how to forward NHRP packets. When next hop servers are configured, these next hop addresses override the forwarding path that would otherwise be used for NHRP traffic.

When the **ip nhrp nhs dynamic** command is configured on a DMVPN tunnel and the **shut** command is issued to the tunnel interface, the crypto socket does not receive shut message, thereby not bringing up a DMVPN session with the hub.

For any next hop server that is configured, you can specify multiple networks by repeating this command with the same *nhs-address* argument, but with different IP network addresses.

**Examples**

The following example shows how to register a hub to a spoke using NBMA and FQDN:

```
Device# configure terminal
Device(config)# interface tunnel 1
Device(config-if)# ip nhrp nhs 192.0.2.1 nbma examplehub.example1.com
```

The following example shows how to configure the desired **max-connections** value:

```
Device# configure terminal
Device(config)# interface tunnel 1
Device(config-if)# ip nhrp nhs cluster 5 max-connections 100
```

The following example shows how to configure NHS priority and group values:

```
Device# configure terminal
Device(config)# interface tunnel 1
Device(config-if)# ip nhrp nhs 192.0.2.1 priority 1 cluster 2
```

**Related Commands**

Command	Description
<b>ip nhrp map</b>	Statically configures the IP-to-NBMA address mapping of IP destinations connected to an NBMA network.
<b>show ip nhrp</b>	Displays NHRP mapping information.

## ip nhrp registration

To set the time between periodic registration messages in the Next Hop Resolution Protocol (NHRP) request and reply packets, use the **ip nhrp registration** command in interface configuration mode. To disable this functionality, use the **no** form of this command.

**ip nhrp registration timeout** *seconds*  
**no ip nhrp registration timeout** *seconds*

<b>Syntax Description</b>	<table border="1"> <tr> <td><b>timeout</b>    <i>seconds</i></td> <td>(Optional) Time between periodic registration messages. <ul style="list-style-type: none"> <li><i>seconds</i>—Number of seconds. The range is from 1 through the value of the NHRP hold timer.</li> <li>If the <b>timeout</b> keyword is not specified, NHRP registration messages are sent every number of seconds equal to 1/3 the value of the NHRP hold timer.</li> </ul> </td> </tr> </table>	<b>timeout</b> <i>seconds</i>	(Optional) Time between periodic registration messages. <ul style="list-style-type: none"> <li><i>seconds</i>—Number of seconds. The range is from 1 through the value of the NHRP hold timer.</li> <li>If the <b>timeout</b> keyword is not specified, NHRP registration messages are sent every number of seconds equal to 1/3 the value of the NHRP hold timer.</li> </ul>
<b>timeout</b> <i>seconds</i>	(Optional) Time between periodic registration messages. <ul style="list-style-type: none"> <li><i>seconds</i>—Number of seconds. The range is from 1 through the value of the NHRP hold timer.</li> <li>If the <b>timeout</b> keyword is not specified, NHRP registration messages are sent every number of seconds equal to 1/3 the value of the NHRP hold timer.</li> </ul>		

**Command Default**      This command is not enabled.

**Command Modes**      Interface configuration (config-if)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines**      Use this command to set the time between periodic registration in the Next Hop Resolution Protocol (NHRP) request and reply packets.

**Examples**                The following example shows that the registration timeout is set to 120 seconds:

```
Device(config)# interface tunnel 4
Device(config-if)# ip nhrp registration timeout 120
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>ip nhrp holdtime</b>	Changes the number of seconds that NHRP NBMA addresses are advertised as valid in authoritative NHRP responses

## ip tcp adjust-mss

To adjust the maximum segment size (MSS) value of TCP synchronize/start (SYN) packets that go through a router, use the **ip tcp adjust-mss** command in interface configuration mode. To return the MSS value to the default setting, use the **no** form of this command.

**ip tcp adjust-mss** *max-segment-size*  
**no ip tcp adjust-mss** *max-segment-size*

<b>Syntax Description</b>	<i>max-segment-size</i>	Maximum segment size, in bytes. The range is from 500 to 1460.
---------------------------	-------------------------	--

**Command Default** The MSS is determined by the originating host.

**Command Modes** Interface configuration (config-if)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines** When a host (usually a PC) initiates a TCP session with a server, the host negotiates the IP segment size by using the MSS option field in the TCP SYN packet. The value of the MSS field is determined by the maximum transmission unit (MTU) configuration on the host. The default MSS size is 1460 bytes, when the default MTU of the containing IP datagram is 1500 bytes.

The PPP over Ethernet (PPPoE) standard supports an MTU of only 1492 bytes. The disparity between the host and PPPoE MTU size can cause the router in between the host and the server to drop 1500-byte packets and terminate TCP sessions over the PPPoE network. Even if path MTU (which detects the correct MTU across the path) is enabled on the host, sessions may be dropped because system administrators sometimes disable the Internet Control Message Protocol (ICMP) error messages that must be relayed from the host for path MTU to work.

The **ip tcp adjust-mss** command helps prevent TCP sessions from being dropped by adjusting the MSS value of the TCP SYN packets.

The **ip tcp adjust-mss** command is effective only for TCP connections that pass through the router.

In most cases, the optimum value for the *max-segment-size* argument is 1452 bytes. This value and the 20-byte IP header, the 20-byte TCP header, and the 8-byte PPPoE header add up to a 1500-byte IP datagram that matches the MTU size of the Ethernet link.

If you are configuring the **ip mtu** command on the same interface as the **ip tcp adjust-mss** command, we recommend that you use the following commands and values:

- **ip tcp adjust-mss 1452**
- **ip mtu 1492**

### Examples

The following example shows the configuration of a PPPoE client with the MSS value set to 1452:

```
vpdn enable
no vpdn logging
```



```

!
vpdn-group 1
request-dialin
protocol pppoe
!
interface Ethernet0
 ip address 192.168.100.1 255.255.255.0
 ip tcp adjust-mss 1452
 ip nat inside
!
interface ATM0
 no ip address
 no atm ilmi-keepalive
 pvc 8/35
  pppoe client dial-pool-number 1
!
dsl equipment-type CPE
dsl operating-mode GSHDSL symmetric annex B
dsl linerate AUTO
!
interface Dialer1
 ip address negotiated
 ip mtu 1492
 ip nat outside
 encapsulation ppp
 dialer pool 1
 dialer-group 1
 ppp authentication pap callin
 ppp pap sent-username sohodyn password 7 141B1309000528
!
ip nat inside source list 101 interface Dialer1 overload
ip route 0.0.0.0 0.0.0.0 Dialer1
access-list 101 permit ip 192.168.100.0 0.0.0.255 any

```

**Related Commands**

Command	Description
<b>ip mtu</b>	Sets the MTU size of IP packets sent on an interface.

# ipv6 nd cache expire

To configure the duration of time before an IPv6 neighbor discovery cache entry expires, use the **ipv6 nd cache expire** command in the interface configuration mode. To remove this configuration, use the **no** form of this command.

```
ipv6 nd cache expire expire-time-in-seconds [refresh]
no ipv6 nd cache expire expire-time-in-seconds [refresh]
```

<b>Syntax Description</b>	<i>expire-time-in-seconds</i>	The time range is from 1 through 65536 seconds. The default is 14400 seconds or 4 hours.
	<b>refresh</b>	(Optional) Automatically refreshes the neighbor discovery cache entry.
<b>Command Modes</b>	Interface configuration (config-if)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced for the Cisco Catalyst 9500 Series Switches.

**Usage Guidelines** By default, a neighbor discovery cache entry is expired and deleted if it remains in the STALE state for 14,400 seconds or 4 hours. The **ipv6 nd cache expire** command allows the expiry time to vary and to trigger auto refresh of an expired entry before the entry is deleted.

When the **refresh** keyword is used, a neighbor discovery cache entry is auto refreshed. The entry moves into the DELAY state and the neighbor unreachability detection process occurs, in which the entry transitions from the DELAY state to the PROBE state after 5 seconds. When the entry reaches the PROBE state, a neighbor solicitation is sent and then retransmitted as per the configuration.

## Examples

The following example shows that the neighbor discovery cache entry is configured to expire in 7200 seconds or 2 hours:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 1/1/4
Device(config-if)# ipv6 nd cache expire 7200
```

## Related Commands

Command	Description
<b>ipv6 nd na glean</b>	Configures neighbor discovery to glean an entry from an unsolicited neighbor advertisement.
<b>ipv6 nd nud retry</b>	Configures the number of times neighbor unreachability detection resends neighbor solicitations.
<b>show ipv6 interface</b>	Displays the usability status of interfaces that are configured for IPv6.

## ipv6 nd na glean

To configure the neighbor discovery to glean an entry from an unsolicited neighbor advertisement, use the **ipv6 nd na glean** command in the interface configuration mode. To disable this feature, use the **no** form of this command.

**ipv6 nd na glean**  
**no ipv6 nd na glean**

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced for the Cisco Catalyst 9500 Series Switches.

**Usage Guidelines** IPv6 nodes may emit a multicast unsolicited neighbor advertisement packet following the successful completion of duplicate address detection (DAD). By default, other IPv6 nodes ignore these unsolicited neighbor advertisement packets. The **ipv6 nd na glean** command configures the router to create a neighbor advertisement entry on receipt of an unsolicited neighbor advertisement packet (assuming no such entry already exists and the neighbor advertisement has the link-layer address option). Use of this command allows a device to populate its neighbor advertisement cache with an entry for a neighbor before data traffic exchange with the neighbor.

### Examples

The following example shows how to configure neighbor discovery to glean an entry from an unsolicited neighbor advertisement:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 1/1/4
Device(config-if)# ipv6 nd na glean
```

### Related Commands

Command	Description
<b>ipv6 nd cache expire</b>	Configures the duration of time before an IPv6 neighbor discovery cache entry expires.
<b>ipv6 nd nud retry</b>	Configures the number of times neighbor unreachability detection resends neighbor solicitations.
<b>show ipv6 interface</b>	Displays the usability status of interfaces that are configured for IPv6.

## ipv6 nd nud retry

To configure the number of times the neighbor unreachability detection process resends neighbor solicitations, use the **ipv6 nd nud retry** command in the interface configuration mode. To disable this feature, use the **no** form of this command.

**ipv6 nd nud retry** *base interval max-attempts final-wait-time*

**no ipv6 nd nud retry** *base interval max-attempts final-wait-time*

Syntax Description		
	<i>base</i>	The neighbor unreachability detection process base value.
	<i>interval</i>	The time interval, in milliseconds, between retries. The range is from 1000 to 32000.
	<i>max-attempts</i>	The maximum number of retry attempts, depending on the base value. The range is from 1 to 128.
	<i>final-wait-time</i>	The waiting time, in milliseconds, on the last probe. The range is from 1000 to 32000.

**Command Modes** Interface configuration (config-if)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced for the Cisco Catalyst 9500 Series Switches.

**Usage Guidelines** When a device runs neighbor unreachability detection to resolve the neighbor detection entry for a neighbor again, it sends three neighbor solicitation packets 1 second apart. In certain situations, for example, spanning-tree events, or high-traffic events, or end-host reloads), three neighbor solicitation packets that are sent at an interval of 1 second may not be sufficient. To help maintain the neighbor cache in such situations, use the **ipv6 nd nud retry** command to configure exponential timers for neighbor solicitation retransmits.

The maximum number of retry attempts is configured using the *max-attempts* argument. The retransmit interval is calculated with the following formula:

$tm^n$

here,

- t = Time interval
- m = Base (1, 2, or 3)
- n = Current neighbor solicitation number (where the first neighbor solicitation is 0).

Therefore, **ipv6 nd nud retry 3 1000 5** command retransmits at intervals of 1,3,9,27,81 seconds. If the final wait time is not configured, the entry remains for 243 seconds before it is deleted.

The **ipv6 nd nud retry** command affects only the retransmit rate for the neighbor unreachability detection process, and not for the initial resolution, which uses the default of three neighbor solicitation packets sent 1 second apart.

### Examples

The following example shows how to configure a fixed interval of 1 second and three retransmits:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 1/1/4
Device(config-if)# ipv6 nd nud retry 1 1000 3
```

The following example shows how to configure a retransmit interval of 1, 2, 4, and 8:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 1/1/4
Device(config-if)# ipv6 nd nud retry 2 1000 4
```

The following example shows how to configure the retransmit intervals of 1, 3, 9, 27, 81:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 1/1/4
Device(config-if)# ipv6 nd nud retry 3 1000 5
```

### Related Commands

Command	Description
<b>ipv6 nd cache expire</b>	Configures the duration of time before an IPv6 neighbor discovery (ND) cache entry expires.
<b>ipv6 nd na glean</b>	Configures neighbor discovery to glean an entry from an unsolicited neighbor advertisement.
<b>show ipv6 interface</b>	Displays the usability status of interfaces that are configured for IPv6.

## ipv6 tcp adjust-mss

To adjust the maximum segment size (MSS) value of TCP packets that go through a router, use the **ipv6 tcp adjust-mss** command in interface configuration mode. To return the MSS value to the default setting, use the **no** form of this command.

```
ipv6 tcp adjust-mss max-segment-size
no ipv6 tcp adjust-mss max-segment-size
```

<b>Syntax Description</b>	<i>max-segment-size</i>	Maximum segment size, in bytes. The range is from 40 to 1940.
---------------------------	-------------------------	---

**Command Default** The MSS is determined by the originating host.

**Command Modes** Interface configuration (config-if)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines** When a host (usually a PC) initiates a TCP session with a server, the host negotiates the IP segment size by using the MSS option field in the TCP packet. The value of the MSS field is determined by the maximum transmission unit (MTU) configuration on the host. The default MSS size is 1940 bytes, when the default MTU of the containing IP datagram is 2000 bytes.

The **ipv6 tcp adjust-mss** command helps prevent TCP sessions from being dropped by adjusting the MSS value of the TCP packets.

The **ipv6 tcp adjust-mss** command is effective only for TCP connections that pass through the router.

### Examples

The following example shows the configuration of a PPPoE client with the MSS value set to 1432:

```
vpdn enable
no vpdn logging
!
vpdn-group 1
request-dialin
protocol pppoe
!
interface Ethernet0/1
  ipv6 address 2001:DB8:0:ABCD::1
  ipv6 tcp adjust-mss 1432
  ipv6 nat
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>ip mtu</b>	Sets the MTU size of IP packets sent on an interface.
	<b>ip tcp adjust-mss</b>	Sets the MSS size of IP packets sent on an interface on IPv4 traffic.

# key chain

To define an authentication key chain needed to enable authentication for routing protocols and enter key-chain configuration mode, use the **key chain** command in global configuration mode. To remove the key chain, use the **no** form of this command.

**key chain** *name-of-chain*  
**no key chain** *name-of-chain*

<b>Syntax Description</b>	<i>name-of-chain</i>	Name of a key chain. A key chain must have at least one key and can have up to 2147483647 keys.
---------------------------	----------------------	---

**Command Default** No key chain exists.

**Command Modes** Global configuration (config)

**Usage Guidelines** You must configure a key chain with keys to enable authentication.

Although you can identify multiple key chains, we recommend using one key chain per interface per routing protocol. Upon specifying the **key chain** command, you enter key chain configuration mode.

## Examples

The following example shows how to specify key chain:

```
Device(config-keychain-key) # key-string chestnut
```

Related Commands	Command	Description
	<b>accept-lifetime</b>	Sets the time period during which the authentication key on a key chain is received as valid.
	<b>key</b>	Identifies an authentication key on a key chain.
	<b>key-string (authentication)</b>	Specifies the authentication string for a key.
	<b>send-lifetime</b>	Sets the time period during which an authentication key on a key chain is valid to be sent.
	<b>show key chain</b>	Displays authentication key information.

## key-string (authentication)

To specify the authentication string for a key, use the **key-string**(authentication) command in key chain key configuration mode. To remove the authentication string, use the **no** form of this command.

**key-string** **key-string** *text*

**no key-string** *text*

### Syntax Description

<i>text</i>	Authentication string that must be sent and received in the packets using the routing protocol being authenticated. The string can contain from 1 to 80 uppercase and lowercase alphanumeric characters.
-------------	--

### Command Default

No authentication string for a key exists.

### Command Modes

Key chain key configuration (config-keychain-key)

### Examples

The following example shows how to specify the authentication string for a key:

```
Device (config-keychain-key) # key-string key1
```

### Related Commands

Command	Description
<b>accept-lifetime</b>	Sets the time period during which the authentication key on a key chain is received as valid.
<b>key</b>	Identifies an authentication key on a key chain.
<b>key chain</b>	Defines an authentication key-chain needed to enable authentication for routing protocols.
<b>send-lifetime</b>	Sets the time period during which an authentication key on a key chain is valid to be sent.
<b>show key chain</b>	Displays authentication key information.



# key

To identify an authentication key on a key chain, use the **key** command in key-chain configuration mode. To remove the key from the key chain, use the **no** form of this command.

**key** *key-id*  
**no key** *key-id*

## Syntax Description

<i>key-id</i>	Identification number of an authentication key on a key chain. The range of keys is from 0 to 2147483647. The key identification numbers need not be consecutive.
---------------	---

## Command Default

No key exists on the key chain.

## Command Modes

Command Modes Key-chain configuration (config-keychain)

## Usage Guidelines

It is useful to have multiple keys on a key chain so that the software can sequence through the keys as they become invalid after time, based on the **accept-lifetime** and **send-lifetime** key chain key command settings.

Each key has its own key identifier, which is stored locally. The combination of the key identifier and the interface associated with the message uniquely identifies the authentication algorithm and Message Digest 5 (MD5) authentication key in use. Only one authentication packet is sent, regardless of the number of valid keys. The software starts looking at the lowest key identifier number and uses the first valid key.

If the last key expires, authentication will continue and an error message will be generated. To disable authentication, you must manually delete the last valid key.

To remove all keys, remove the key chain by using the **no key chain** command.

## Examples

The following example shows how to specify a key to identify authentication on a key-chain:

```
Device(config-keychain)#key 1
```

## Related Commands

Command	Description
<b>accept-lifetime</b>	Sets the time period during which the authentication key on a key chain is received as valid.
<b>key chain</b>	Defines an authentication key chain needed to enable authentication for routing protocols.
<b>key-string (authentication)</b>	Specifies the authentication string for a key.
<b>show key chain</b>	Displays authentication key information.

## show ip nhrp nhs

To display Next Hop Resolution Protocol (NHRP) next hop server (NHS) information, use the **show ip nhrp nhs** command in user EXEC or privileged EXEC mode.

**show ip nhrp nhs** [*interface*] [**detail**] [**redundancy**] [*cluster number*] [**preempted** | **running** | **waiting**]

### Syntax Description

<i>interface</i>	(Optional) Displays NHS information currently configured on the interface. See the table below for types, number ranges, and descriptions.
<b>detail</b>	(Optional) Displays detailed NHS information.
<b>redundancy</b>	(Optional) Displays information about NHS redundancy stacks.
<i>cluster number</i>	(Optional) Displays redundancy cluster information.
<b>preempted</b>	(Optional) Displays information about NHS that failed to become active and is preempted.
<b>running</b>	(Optional) Displays NHSs that are currently in Responding or Expecting replies states.
<b>waiting</b>	(Optional) Displays NHSs awaiting to be scheduled.

### Command Modes

User EXEC (>)

Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

### Usage Guidelines

The table below lists the valid types, number ranges, and descriptions for the optional *interface* argument.



#### Note

The valid types can vary according to the platform and interfaces on the platform.

**Table 13: Valid Types, Number Ranges, and Interface Descriptions**

Valid Types	Number Ranges	Interface Descriptions
<b>ANI</b>	0 to 1000	Autonomic-Networking virtual interface
<b>Auto-Template</b>	1 to 999	Auto-Template interface
<b>GMPLS</b>	0 to 1000	Multiprotocol Label Switching (MPLS) interface
<b>GigabitEthernet</b>	0 to 9	GigabitEthernet IEEE 802.3z
<b>InternalInterface</b>	0 to 9	Internal interface

Valid Types	Number Ranges	Interface Descriptions
<b>LISP</b>	0 to 65520	Locator/ID Separation Protocol (LISP) virtual interface
<b>loopback</b>	0 to 2147483647	Loopback interface
<b>Null</b>	0 to 0	Null interface
<b>PROTECTION_GROUP</b>	0 to 0	Protection-group controller
<b>Port-channel</b>	1 to 128	Port channel interface
<b>TenGigabitEthernet</b>	0 to 9	TenGigabitEthernet interface
<b>Tunnel</b>	0 to 2147483647	Tunnel interface
<b>Tunnel-tp</b>	0 to 65535	MPLS Transport Profile interface
<b>Vlan</b>	1 to 4094	VLAN interface

## Examples

The following is sample output from the **show ip nhrp nhs detail** command:

```
Switch# show ip nhrp nhs detail

Legend:
  E=Expecting replies
  R=Responding
Tunnell:
  10.1.1.1          E req-sent 128 req-failed 1 repl-recv 0
Pending Registration Requests:
Registration Request: Reqid 1, Ret 64 NHS 10.1.1.1
```

The table below describes the significant field shown in the display.

**Table 14: show ip nhrp nhs Field Descriptions**

Field	Description
Tunnell	Interface through which the target network is reached.

## Related Commands

Command	Description
<b>ip nhrp map</b>	Statically configures the IP-to-NBMA address mapping of IP destinations connected to an NBMA network.
<b>show ip nhrp</b>	Displays NHRP mapping information.

# show ip ports all

To display all the open ports on a device, use the **show ip ports all** in user EXEC or privileged EXEC mode.

## show ip ports all

### Syntax Description

Syntax Description

This command has no arguments or keywords.

### Command Default

No default behavior or values.

### Command Modes

User EXEC (>)

Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

This command provides a list of all open TCP/IP ports on the system including the ports opened using Cisco networking stack.

To close open ports, you can use one of the following methods:

- Use Access Control List (ACL).
- To close the UDP 2228 port, use the **no l2 traceroute** command.
- To close TCP 80, TCP 443, TCP 6970, TCP 8090 ports, use the **no ip http server** and **no ip http secure-server** commands.

### Examples

The following is sample output from the **show ip ports all** command:

```
Device#
show ip ports all
Proto Local Address Foreign Address State PID/Program Name
TCB Local Address Foreign Address (state)
tcp *:4786 *:* LISTEN 224/[IOS]SMI IBC server process
tcp *:443 *:* LISTEN 286/[IOS]HTTP CORE
tcp *:443 *:* LISTEN 286/[IOS]HTTP CORE
tcp *:80 *:* LISTEN 286/[IOS]HTTP CORE
tcp *:80 *:* LISTEN 286/[IOS]HTTP CORE
udp *:10002 *:* 0/[IOS] Unknown
udp *:2228 10.0.0.0:0 318/[IOS]L2TRACE SERVER
```

The table below describes the significant fields shown in the display

**Table 15: Field Descriptions of show ip ports all**

Field	Description
Protocol	Transport protocol used.

Field	Description
Local Address.	Device IP Address.
Foreign Address	Remote or peer address.
State	State of the connection. It can be listen, established or connected.
PID/Program Name	Process ID or name

**Related Commands**

Command	Description
<b>show tcp brief all</b>	Displays information about TCP connection endpoints.
<b>show ip sockets</b>	Displays IP sockets information.

# show key chain

To display the keychain, use the **show key chain** command.

**show key chain** [*name-of-chain*]

## Syntax Description

<i>name-of-chain</i>	(Optional) Name of the key chain to display, as named in the key chain command.
----------------------	---

## Command Default

If the command is used without any parameters, then it lists out all the key chains.

## Command Modes

Privileged EXEC (#)

## Examples

The following is sample output from the **show key chain** command:

```

show key chain
Device# show key chain

Key-chain AuthenticationGLBP:
  key 1 -- text "Thisisasecretkey"
    accept lifetime (always valid) - (always valid) [valid now]
    send lifetime (always valid) - (always valid) [valid now]
Key-chain glbp2:
  key 100 -- text "abc123"
    accept lifetime (always valid) - (always valid) [valid now]
    send lifetime (always valid) - (always valid) [valid now]

```

## Related Commands

Command	Description
<b>key-string</b>	Specifies the authentication string for a key.
<b>send-lifetime</b>	Sets the time period during which an authentication key on a key chain is valid to be sent.

# show track

To display information about objects that are tracked by the tracking process, use the **show track** command in privileged EXEC mode.

```
show track [object-number [brief] | application [brief] | interface [brief] | ip[route [brief] | [sla [brief]] | ipv6 [route [brief]] | list [route [brief]] | resolution [ip | ipv6] | stub-object [brief] | summary | timers]
```

## Syntax Description

<i>object-number</i>	(Optional) Object number that represents the object to be tracked. The range is from 1 to 1000.
<b>brief</b>	(Optional) Displays a single line of information related to the preceding argument or keyword.
<b>application</b>	(Optional) Displays tracked application objects.
<b>interface</b>	(Optional) Displays tracked interface objects.
<b>ip route</b>	(Optional) Displays tracked IP route objects.
<b>ip sla</b>	(Optional) Displays tracked IP SLA objects.
<b>ipv6 route</b>	(Optional) Displays tracked IPv6 route objects.
<b>list</b>	(Optional) Displays the list of boolean objects.
<b>resolution</b>	(Optional) Displays resolution of tracked parameters.
<b>summary</b>	(Optional) Displays the summary of the specified object.
<b>timers</b>	(Optional) Displays polling interval timers.

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
	This command was introduced.

## Usage Guidelines

Use this command to display information about objects that are tracked by the tracking process. When no arguments or keywords are specified, information for all objects is displayed.

A maximum of 1000 objects can be tracked. Although 1000 tracked objects can be configured, each tracked object uses CPU resources. The amount of available CPU resources on a device is dependent upon variables such as traffic load and how other protocols are configured and run. The ability to use 1000 tracked objects is dependent upon the available CPU. Testing should be conducted on site to ensure that the service works under the specific site traffic conditions.

## Examples

The following example shows information about the state of IP routing on the interface that is being tracked:

```
Device# show track 1

Track 1
  Interface GigabitEthernet 1/0/1 ip routing
  IP routing is Down (no IP addr)
  1 change, last change 00:01:08
```

The table below describes the significant fields shown in the displays.

**Table 16: show track Field Descriptions**

Field	Description
Track	Object number that is being tracked.
Interface GigabitEthernet 1/0/1 ip routing	Interface type, interface number, and object that is being tracked.
IP routing is	State value of the object, displayed as Up or Down. If the object is down, the reason is displayed.
1 change, last change	Number of times that the state of a tracked object has changed and the time (in <i>hh:mm:ss</i> ) since the last change.

## Related Commands

Command	Description
<b>show track resolution</b>	Displays the resolution of tracked parameters.
<b>track interface</b>	Configures an interface to be tracked and enters tracking configuration mode.
<b>track ip route</b>	Tracks the state of an IP route and enters tracking configuration mode.



# track

To configure an interface to be tracked where the Gateway Load Balancing Protocol (GLBP) weighting changes based on the state of the interface, use the **track** command in global configuration mode. To remove the tracking, use the **no** form of this command.

**track** *object-number* **interface** *type number* **line-protocol** | **ip routing** | **ipv6 routing**  
**no track** *object-number* **interface** *type number* **line-protocol** | **ip routing** | **ipv6 routing**

## Syntax Description

<i>object-number</i>	Object number in the range from 1 to 1000 representing the interface to be tracked.
<b>interface</b> <i>type number</i>	Interface type and number to be tracked.
<b>line-protocol</b>	Tracks whether the interface is up.
<b>ip routing</b>	Tracks whether IP routing is enabled, an IP address is configured on the interface, and the interface state is up, before reporting to GLBP that the interface is up.
<b>ipv6 routing</b>	Tracks whether IPv6 routing is enabled, an IP address is configured on the interface, and the interface state is up, before reporting to GLBP that the interface is up.

## Command Default

The state of the interfaces is not tracked.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced..

## Usage Guidelines

Use the **track** command in conjunction with the **glbp weighting** and **glbp weighting track** commands to configure parameters for an interface to be tracked. If a tracked interface on a GLBP device goes down, the weighting for that device is reduced. If the weighting falls below a specified minimum, the device will lose its ability to act as an active GLBP virtual forwarder.

A maximum of 1000 objects can be tracked. Although 1000 tracked objects can be configured, each tracked object uses CPU resources. The amount of available CPU resources on a device is dependent upon variables such as traffic load and how other protocols are configured and run. The ability to use 1000 tracked objects is dependent upon the available CPU. Testing should be conducted on site to ensure that the service works under the specific site traffic conditions.

## Examples

In the following example, TenGigabitEthernet interface 0/0/1 tracks whether GigabitEthernet interfaces 1/0/1 and 1/0/3 are up. If either of the GigabitEthernet interface goes down, the GLBP weighting is reduced by the default value of 10. If both GigabitEthernet interfaces go down, the GLBP weighting will fall below the lower threshold and the device will no longer be an active forwarder. To resume its role as an active forwarder, the device must have both tracked interfaces back up, and the weighting must rise above the upper threshold.

```
Device(config)# track 1 interface GigabitEthernet 1/0/1 line-protocol
```

```

Device(config-track)# exit
Device(config)# track 2 interface GigabitEthernet 1/0/3 line-protocol
Device(config-track)# exit
Device(config)# interface TenGigabitEthernet 0/0/1
Device(config-if)# ip address 10.21.8.32 255.255.255.0
Device(config-if)# glbp 10 weighting 110 lower 95 upper 105
Device(config-if)# glbp 10 weighting track 1
Device(config-if)# glbp 10 weighting track 2

```

### Related Commands

Command	Description
<b>glbp weighting</b>	Specifies the initial weighting value of a GLBP gateway.
<b>glbp weighting track</b>	Specifies an object to be tracked that affects the weighting of a GLBP gateway.

## vrrp

To create a Virtual Router Redundancy Protocol version 3 (VRRPv3) group and enter VRRPv3 group configuration mode, use the **vrrp**. To remove the VRRPv3 group, use the **no** form of this command.

```
vrrp group-id address-family {ipv4 | ipv6}
no vrrp group-id address-family {ipv4 | ipv6}
```

Syntax Description		
	<i>group-id</i>	Virtual router group number. The range is from 1 to 255.
	<b>address-family</b>	Specifies the address-family for this VRRP group.
	<b>ipv4</b>	(Optional) Specifies IPv4 address.
	<b>ipv6</b>	(Optional) Specifies IPv6 address.

**Command Default** None

**Command Modes** Interface configuration (config-if)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced..

### Usage Guidelines

#### Examples

The following example shows how to create a VRRPv3 group and enter VRRP configuration mode:

```
Device(config-if)# vrrp 3 address-family ipv4
```

Related Commands	Command	Description
	<b>timers advertise</b>	Sets the advertisement timer in milliseconds.

## vrrp description

To assign a description to the Virtual Router Redundancy Protocol (VRRP) group, use the **vrrp description** command in interface configuration mode. To remove the description, use the **no** form of this command.

**description** *text*

**no description**

### Syntax Description

<i>text</i>	Text (up to 80 characters) that describes the purpose or use of the group.
-------------	--

### Command Default

There is no description of the VRRP group.

### Command Modes

VRRP configuration (config-if-vrrp)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Examples

The following example enables VRRP. VRRP group 1 is described as Building A – Marketing and Administration.

```
Device(config-if-vrrp)# description Building A - Marketing and Administration
```

### Related Commands

Command	Description
<b>vrrp</b>	Creates a VRRPv3 group and enters VRRPv3 group configuration mode.

## vrrp preempt

To configure the device to take over as the current primary virtual router for a Virtual Router Redundancy Protocol (VRRP) group if it has higher priority than the current primary virtual router, use the **preempt** command in VRRP configuration mode. To disable this function, use the **no** form of this command.

**preempt** [**delay minimum** *seconds*]  
**no preempt**

<b>Syntax Description</b>	<b>delay minimum</b> <i>seconds</i>	(Optional) Number of seconds that the device will delay before issuing an advertisement claiming primary ownership. The default delay is 0 seconds.
---------------------------	-------------------------------------	---

**Command Default** This command is enabled.

**Command Modes** VRRP configuration (config-if-vrrp)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** By default, the device being configured with this command will take over as primary virtual router for the group if it has a higher priority than the current primary virtual router. You can configure a delay, which will cause the VRRP device to wait the specified number of seconds before issuing an advertisement claiming primary ownership.



**Note** The device that is the IP address owner will preempt, regardless of the setting of this command.

### Examples

The following example configures the device to preempt the current primary virtual router when its priority of 200 is higher than that of the current primary virtual router. If the device preempts the current primary virtual router, it waits 15 seconds before issuing an advertisement claiming it is the primary virtual router.

```
Device(config-if-vrrp)#preempt delay minimum 15
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>vrrp</b>	Creates a VRRPv3 group and enters VRRPv3 group configuration mode.
	<b>priority</b>	Sets the priority level of the device within a VRRP group.

## vrrp priority

To set the priority level of the device within a Virtual Router Redundancy Protocol (VRRP) group, use the **priority** command in interface configuration mode. To remove the priority level of the device, use the **no** form of this command.

**priority** *level*  
**no priority** *level*

<b>Syntax Description</b>	<i>level</i> Priority of the device within the VRRP group. The range is from 1 to 254. The default is 100.
---------------------------	--

**Command Default** The priority level is set to the default value of 100.

**Command Modes** VRRP configuration (config-if-vrrp)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use this command to control which device becomes the primary virtual router.

**Examples** The following example configures the device with a priority of 254:

```
Device(config-if-vrrp)# priority 254
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>vrrp</b>	Creates a VRRPv3 group and enters VRRPv3 group configuration mode.
	<b>vrrp preempt</b>	Configures the device to take over as primary virtual router for a VRRP group if it has higher priority than the current primary virtual router.

## vrrp timers advertise

To configure the interval between successive advertisements by the primary virtual router in a Virtual Router Redundancy Protocol (VRRP) group, use the **timers advertise** command in VRRP configuration mode. To restore the default value, use the **no** form of this command.

**timers advertise** [*msec*] *interval*  
**no timers advertise** [*msec*] *interval*

Syntax Description	
<i>group</i>	Virtual router group number. The group number range is from 1 to 255.
<b>msec</b>	(Optional) Changes the unit of the advertisement time from seconds to milliseconds. Without this keyword, the advertisement interval is in seconds.
<i>interval</i>	Time interval between successive advertisements by the primary virtual router. The unit of the interval is in seconds, unless the <b>msec</b> keyword is specified. The default is 1 second. The valid range is 1 to 255 seconds. When the <b>msec</b> keyword is specified, the valid range is 50 to 999 milliseconds.

**Command Default** The default interval of 1 second is configured.

**Command Modes** VRRP configuration (config-if-vrrp)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The advertisements being sent by the primary virtual router communicate the state and priority of the current primary virtual router.

The **vrrp timers advertise** command configures the time between successive advertisement packets and the time before other routers declare the primary router to be down. Routers or access servers on which timer values are not configured can learn timer values from the primary router. The timers configured on the primary router always override any other timer settings. All routers in a VRRP group must use the same timer values. If the same timer values are not set, the devices in the VRRP group will not communicate with each other and any misconfigured device will change its state to primary.

### Examples

The following example shows how to configure the primary virtual router to send advertisements every 4 seconds:

```
Device(config-if-vrrp)# timers advertise 4
```

Related Commands	Command	Description
	<b>vrrp</b>	Creates a VRRPv3 group and enters VRRPv3 group configuration mode.

Command	Description
<b>timers learn</b>	Configures the device, when it is acting as backup virtual router for a VRRP group, to learn the advertisement interval used by the primary virtual router.



## vrrs leader

To specify a leader's name to be registered with Virtual Router Redundancy Service (VRRS), use the **vrrs leader** command. To remove the specified VRRS leader, use the **no** form of this command.

**vrrs leader** *vrrs-leader-name*  
**no vrrs leader** *vrrs-leader-name*

### Syntax Description

<i>vrrs-leader-name</i>	Name of VRRS Tag to lead.
-------------------------	---------------------------

### Command Default

A registered VRRS name is unavailable by default.

### Command Modes

VRRP configuration (config-if-vrrp)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Examples

The following example specifies a leader's name to be registered with VRRS:

```
Device(config-if-vrrp)# vrrs leader leader-1
```

### Related Commands

Command	Description
<b>vrrp</b>	Creates a VRRP group and enters VRRP configuration mode.





## PART **IV**

# IP Multicast Routing

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## IP Multicast Routing Commands

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# cache-memory-max

To set the percentage of the system memory for cache, use the **cache-memory-max** command. To remove the percentage of system memory for cache, use the **no** form of this command.

**cache-memory-max** *cache-config-percentage*  
**no cache-memory-max** *cache-config-percentage*

---

## Syntax Description

*cache-config-percentage* A percentage of the system memory for cache.

---

## Command Default

By default, the system memory is set to 10 percent.

## Command Modes

mDNS configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The number of services learned in a network could be large, so there is an upper limit on the amount of cache memory that can be used.



### Note

You can override the default value by using this command.

When you try to add new records, and the cache is full, the records in the cache that are close to expiring are deleted to provide space for the new records.

## Example

This example sets 20 percent of the system memory for cache:

```
(config-mdns)# cache-memory-max 20
```

## clear ip mfib counters

To clear all the active IPv4 Multicast Forwarding Information Base (MFIB) traffic counters, use the **clear ip mfib counters** command in privileged EXEC mode.

```
clear ip mfib [global | vrf *] counters [group-address] [hostname | source-address]
```

### Syntax Description

<b>global</b>	(Optional) Resets the IP MFIB cache to the global default configuration.
<b>vrf *</b>	(Optional) Clears the IP MFIB cache for all VPN routing and forwarding instances.
<i>group-address</i>	(Optional) Limits the active MFIB traffic counters to the indicated group address.
<i>hostname</i>	(Optional) Limits the active MFIB traffic counters to the indicated host name.
<i>source-address</i>	(Optional) Limits the active MFIB traffic counters to the indicated source address.

### Command Default

None

### Command Modes

Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Example

The following example shows how to reset all the active MFIB traffic counters for all the multicast tables:

```
Device# clear ip mfib counters
```

The following example shows how to reset the IP MFIB cache counters to the global default configuration:

```
Device# clear ip mfib global counters
```

The following example shows how to clear the IP MFIB cache for all the VPN routing and forwarding instances:

```
Device# clear ip mfib vrf * counters
```



# clear ip mroute

To delete the entries in the IP multicast routing table, use the **clear ip mroute** command in privileged EXEC mode.

```
clear ip mroute [vrf vrf-name] {* | ip-address | group-address} [hostname | source-address]
```

Syntax Description	
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies the name that is assigned to the multicast VPN routing and forwarding (VRF) instance.
<b>*</b>	Specifies all Multicast routes.
<i>ip-address</i>	Multicast routes for the IP address.
<i>group-address</i>	Multicast routes for the group address.
<i>hostname</i>	(Optional) Multicast routes for the host name.
<i>source-address</i>	(Optional) Multicast routes for the source address.

**Command Default** None

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The *group-address* variable specifies one of the following:

- Name of the multicast group as defined in the DNS hosts table or with the **ip host** command.
- IP address of the multicast group in four-part, dotted notation.

If you specify a group name or address, you can also enter the source argument to specify a name or address of a multicast source that is sending to the group. A source does not need to be a member of the group.

## Example

The following example shows how to delete all the entries from the IP multicast routing table:

```
Device# clear ip mroute *
```

The following example shows how to delete all the sources on the 228.3.0.0 subnet that are sending to the multicast group 224.2.205.42 from the IP multicast routing table. This example shows how to delete all sources on network 228.3, not individual sources:

```
Device# clear ip mroute 224.2.205.42 228.3.0.0
```

## clear ip pim snooping vlan

To delete the Protocol Independent Multicast (PIM) snooping entries on a specific VLAN, use the **clear ip pim snooping vlan** command in user EXEC or privileged EXEC mode.

```
clear ip pim snooping vlan vlan-id [neighbor | statistics | mroute [source-ipgroup-ip]]
```

Syntax Description	Parameter	Description
	<b>vlan</b> <i>vlan-id</i>	VLAN ID. Valid values are from 1—4094.
	<b>neighbor</b>	Deletes all the neighbors.
	<b>statistics</b>	Deletes information about the VLAN statistics.
	<b>mroute</b> <i>group-addr src-addr</i>	Deletes the mroute entries in the specified group and the source IP address.

**Command Default** This command has no default settings.

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Examples** This example shows how to clear the IP PIM-snooping entries on a specific VLAN:

```
Router# clear ip pim snooping vlan 1001
```

Related Commands	Command	Description
	<b>ip pim snooping</b>	Enables PIM snooping globally.
	<b>show ip pim snooping</b>	Displays information about IP PIM snooping.

## ip igmp filter

To control whether or not all the hosts on a Layer 2 interface can join one or more IP multicast groups by applying an Internet Group Management Protocol (IGMP) profile to the interface, use the **ip igmp filter** interface configuration command on the stack or on a standalone . To remove the specified profile from the interface, use the **no** form of this command.

**ip igmp filter** *profile number*  
**no ip igmp filter**

### Syntax Description

*profile number* IGMP profile number to be applied. The range is 1—4294967295.

### Command Default

No IGMP filters are applied.

### Command Modes

Interface configuration (config-if)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

You can apply IGMP filters only to Layer 2 physical interfaces; you cannot apply IGMP filters to routed ports, switch virtual interfaces (SVIs), or ports that belong to an EtherChannel group.

An IGMP profile can be applied to one or more port interfaces, but one port can have only one profile applied to it.

### Example

This example shows how to configure IGMP profile 40 to permit the specified range of IP multicast addresses, then shows how to apply that profile to a port as a filter:

```
Device(config)# ip igmp profile 40
Device(config-igmp-profile)# permit
Device(config-igmp-profile)# range 233.1.1.1 233.255.255.255
Device(config-igmp-profile)# exit
Device(config)# interface gigabitethernet1/0/2
Device(config-if)# switchport
*Jan  3 18:04:17.007: %LINK-3-UPDOWN: Interface GigabitEthernet1/0/1, changed state to down.
NOTE: If this message appears, this interface changes to layer 2, so that you can apply the
filter.
Device(config-if)# ip igmp filter 40
```

You can verify your setting by using the **show running-config** command in privileged EXEC mode and by specifying an interface.

## ip igmp max-groups

To set the maximum number of Internet Group Management Protocol (IGMP) groups that a Layer 2 interface can join or to configure the IGMP throttling action when the maximum number of entries is in the forwarding table, use the **ip igmp max-groups** interface configuration command on the `stack` or on a standalone . To set the maximum back to the default, which is to have no maximum limit, or to return to the default throttling action, which is to drop the report, use the **no** form of this command.

```
ip igmp max-groups {max number | action { deny | replace } }
no ip igmp max-groups {max number | action }
```

### Syntax Description

<i>max number</i>	Maximum number of IGMP groups that an interface can join. The range is 0—4294967294. The default is no limit.
<b>action deny</b>	Drops the next IGMP join report when the maximum number of entries is in the IGMP snooping forwarding table. This is the default action.
<b>action replace</b>	Replaces the existing group with the new group for which the IGMP report was received when the maximum number of entries is in the IGMP snooping forwarding table.

### Command Default

The default maximum number of groups is no limit.

After the learns the maximum number of IGMP group entries on an interface, the default throttling action is to drop the next IGMP report that the interface receives and to not add an entry for the IGMP group to the interface.

### Command Modes

Interface configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

You can use this command only on Layer 2 physical interfaces and on logical EtherChannel interfaces. You cannot set IGMP maximum groups for routed ports, switch virtual interfaces (SVIs), or ports that belong to an EtherChannel group.

Follow these guidelines when configuring the IGMP throttling action:

- If you configure the throttling action as **deny**, and set the maximum group limit, the entries that were previously in the forwarding table are not removed, but are aged out. After these entries are aged out, when the maximum number of entries is in the forwarding table, the drops the next IGMP report received on the interface.
- If you configure the throttling action as **replace**, and set the maximum group limitation, the entries that were previously in the forwarding table are removed. When the maximum number of entries is in the forwarding table, the replaces a randomly selected multicast entry with the received IGMP report.
- When the maximum group limitation is set to the default (no maximum), entering the **ip igmp max-groups {deny | replace}** command has no effect.

### Example

The following example shows how to limit the number of IGMP groups that a port can join to 25:

```
Device(config)# interface gigabitethernet1/0/2
Device(config-if)# ip igmp max-groups 25
```

The following example shows how to configure the to replace the existing group with the new group for which the IGMP report was received when the maximum number of entries is in the forwarding table:

```
Device(config)# interface gigabitethernet2/0/1
Device(config-if)# ip igmp max-groups action replace
```

You can verify your setting by using the **show running-config** privileged EXEC command and by specifying an interface.

## ip igmp profile

To create an Internet Group Management Protocol (IGMP) profile and enter IGMP profile configuration mode, use the **ip igmp profile** global configuration command on the stack or on a standalone . From this mode, you can specify the configuration of the IGMP profile to be used for filtering IGMP membership reports from a switch port. To delete the IGMP profile, use the **no** form of this command.

**ip igmp profile** *profile number*  
**no ip igmp profile** *profile number*

<b>Syntax Description</b>	<i>profile number</i> The IGMP profile number being configured. The range is from 1—4294967295.				
<b>Command Default</b>	No IGMP profiles are defined. When configured, the default action for matching an IGMP profile is to deny matching addresses.				
<b>Command Modes</b>	Global configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines**

When you are in IGMP profile configuration mode, you can create a profile by using these commands:

- **deny**—Specifies that matching addresses are denied; this is the default condition.
- **exit**—Exits from igmp-profile configuration mode.
- **no**—Negates a command or resets to its defaults.
- **permit**—Specifies that matching addresses are permitted.
- **range**—Specifies a range of IP addresses for the profile. This can be a single IP address or a range with a start and an end address.

When entering a range, enter the low IP multicast address, a space, and the high IP multicast address.

You can apply an IGMP profile to one or more Layer 2 interfaces, but each interface can have only one profile applied to it.

### Example

The following example shows how to configure IGMP profile 40, which permits the specified range of IP multicast addresses:

```
Device(config)# ip igmp profile 40
Device(config-igmp-profile)# permit
Device(config-igmp-profile)# range 233.1.1.1 233.255.255.255
```

You can verify your settings by using the **show ip igmp profile** command in privileged EXEC mode.

# ip igmp snooping

To globally enable Internet Group Management Protocol (IGMP) snooping on the or to enable it on a per-VLAN basis, use the **ip igmp snooping** global configuration command on the stack or on a standalone . To return to the default setting, use the **no** form of this command.

**ip igmp snooping** [**vlan** *vlan-id*]  
**no ip igmp snooping** [**vlan** *vlan-id*]

<b>Syntax Description</b>	<b>vlan</b> <i>vlan-id</i> (Optional) Enables IGMP snooping on the specified VLAN. Ranges are 1—1001 and 1006—4094.				
<b>Command Default</b>	IGMP snooping is globally enabled on the . IGMP snooping is enabled on VLAN interfaces.				
<b>Command Modes</b>	Global configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	<p>When IGMP snooping is enabled globally, it is enabled in all of the existing VLAN interfaces. When IGMP snooping is globally disabled, it is disabled on all of the existing VLAN interfaces.</p> <p>VLAN IDs 1002 to 1005 are reserved for Token Ring and FDDI VLANs, and cannot be used in IGMP snooping.</p> <p><b>Example</b></p> <p>The following example shows how to globally enable IGMP snooping:</p> <pre>Device(config)# ip igmp snooping</pre> <p>The following example shows how to enable IGMP snooping on VLAN 1:</p> <pre>Device(config)# ip igmp snooping vlan 1</pre> <p>You can verify your settings by entering the <b>show ip igmp snooping</b> command in privileged EXEC mode.</p>				

## ip igmp snooping last-member-query-count

To configure how often Internet Group Management Protocol (IGMP) snooping will send query messages in response to receiving an IGMP leave message, use the **ip igmp snooping last-member-query-count** command in global configuration mode. To set *count* to the default value, use the **no** form of this command.

```
ip igmp snooping [vlan vlan-id] last-member-query-count count
no ip igmp snooping [vlan vlan-id] last-member-query-count count
```

<b>Syntax Description</b>	<b>vlan <i>vlan-id</i></b> (Optional) Sets the count value on a specific VLAN ID. The range is from 1—1001. Do not enter leading zeroes.				
	<b><i>count</i></b> Interval at which query messages are sent, in milliseconds. The range is from 1—7. The default is 2.				
<b>Command Default</b>	A query is sent every 2 milliseconds.				
<b>Command Modes</b>	Global configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines** When a multicast host leaves a group, the host sends an IGMP leave message. To check if this host is the last to leave the group, IGMP query messages are sent when the leave message is seen until the **last-member-query-interval** timeout period expires. If no response is received to the last-member queries before the timeout period expires, the group record is deleted.

Use the **ip igmp snooping last-member-query-interval** command to configure the timeout period.

When both IGMP snooping immediate-leave processing and the query count are configured, immediate-leave processing takes precedence.



**Note** Do not set the count to 1 because the loss of a single packet (the query packet from the switch to the host or the report packet from the host to the switch) may result in traffic forwarding being stopped even if the receiver is still there. Traffic continues to be forwarded after the next general query is sent by the switch, but the interval during which a receiver may not receive the query could be as long as 1 minute (with the default query interval).

The leave latency in Cisco IOS software may increase by up to 1 last-member query interval (LMQI) value when the switch is processing more than one leave within an LMQI. In such a scenario, the average leave latency is determined by the formula  $(\text{count} + 0.5) * \text{LMQI}$ . The result is that the default leave latency can range from 2.0 to 3.0 seconds with an average of 2.5 seconds under a higher load of IGMP leave processing. The leave latency under load for the minimum LMQI value of 100 milliseconds and a count of 1 is from 100 to 200 milliseconds, with an average of 150 milliseconds. This is done to limit the impact of higher rates of IGMP leave messages.



**Example**

The following example shows how to set the last member query count to 5:

```
Device(config)# ip igmp snooping last-member-query-count 5
```

## ip igmp snooping querier

To globally enable the Internet Group Management Protocol (IGMP) querier function in Layer 2 networks, use the **ip igmp snooping querier** global configuration command. Use the command with keywords to enable and configure the IGMP querier feature on a VLAN interface. To return to the default settings, use the **no** form of this command.

**ip igmp snooping** [**vlan** *vlan-id*] **querier** [**address** *ip-address* | **max-response-time** *response-time* | **query-interval** *interval-count* | **tcn query** {**count** *count* | **interval** *interval*} | **timer expiry** *expiry-time* | **version** *version*]

**no ip igmp snooping** [**vlan** *vlan-id*] **querier** [**address** | **max-response-time** | **query-interval** | **tcn query** {**count** | **interval**} | **timer expiry** | **version**]

Syntax Description		
<b>vlan</b> <i>vlan-id</i>	(Optional) Enables IGMP snooping and the IGMP querier function on the specified VLAN. Ranges are 1—1001 and 1006—4094.	
<b>address</b> <i>ip-address</i>	(Optional) Specifies a source IP address. If you do not specify an IP address, the querier tries to use the global IP address configured for the IGMP querier.	
<b>max-response-time</b> <i>response-time</i>	(Optional) Sets the maximum time to wait for an IGMP querier report. The range is 1—25 seconds.	
<b>query-interval</b> <i>interval-count</i>	(Optional) Sets the interval between IGMP queriers. The range is 1—18000 seconds.	
<b>tcn query</b>	(Optional) Sets parameters related to Topology Change Notifications (TCNs).	
<b>count</b> <i>count</i>	Sets the number of TCN queries to be executed during the TCN interval time. The range is 1—10.	
<b>interval</b> <i>interval</i>	Sets the TCN query interval time. The range is 1—255.	
<b>timer expiry</b> <i>expiry-time</i>	(Optional) Sets the length of time until the IGMP querier expires. The range is 60—300 seconds.	
<b>version</b> <i>version</i>	(Optional) Selects the IGMP version number that the querier feature uses. Select either 1 or 2.	

**Command Default** The IGMP snooping querier feature is globally disabled on the .  
When enabled, the IGMP snooping querier disables itself if it detects IGMP traffic from a multicast router.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use this command to enable IGMP snooping to detect the IGMP version and IP address of a device that sends IGMP query messages, which is also called a querier.

By default, the IGMP snooping querier is configured to detect devices that use IGMP Version 2 (IGMPv2), but does not detect clients that are using IGMP Version 1 (IGMPv1). You can manually configure the **max-response-time** value when devices use IGMPv2. You cannot configure the max-response-time when devices use IGMPv1. (The value cannot be configured, and is set to zero).

Non-RFC-compliant devices running IGMPv1 might reject IGMP general query messages that have a non-zero value as the **max-response-time** value. If you want the devices to accept the IGMP general query messages, configure the IGMP snooping querier to run IGMPv1.

VLAN IDs 1002—1005 are reserved for Token Ring and FDDI VLANs, and cannot be used in IGMP snooping.

## Example

The following example shows how to globally enable the IGMP snooping querier feature:

```
Device(config)# ip igmp snooping querier
```

The following example shows how to set the IGMP snooping querier maximum response time to 25 seconds:

```
Device(config)# ip igmp snooping querier max-response-time 25
```

The following example shows how to set the IGMP snooping querier interval time to 60 seconds:

```
Device(config)# ip igmp snooping querier query-interval 60
```

The following example shows how to set the IGMP snooping querier TCN query count to 25:

```
Device(config)# ip igmp snooping querier tcn count 25
```

The following example shows how to set the IGMP snooping querier timeout value to 60 seconds:

```
Device(config)# ip igmp snooping querier timer expiry 60
```

The following example shows how to set the IGMP snooping querier feature to Version 2:

```
Device(config)# ip igmp snooping querier version 2
```

You can verify your settings by entering the **show ip igmp snooping** privileged EXEC command.

## ip igmp snooping report-suppression

To enable Internet Group Management Protocol (IGMP) report suppression, use the **ip igmp snooping report-suppression** global configuration command on the stack or on a standalone . To disable IGMP report suppression, and to forward all IGMP reports to multicast routers, use the **no** form of this command.

**ip igmp snooping report-suppression**  
**no ip igmp snooping report-suppression**

<b>Syntax Description</b>	This command has no arguments or keywords.
---------------------------	--

<b>Command Default</b>	IGMP report suppression is enabled.
------------------------	-------------------------------------

<b>Command Modes</b>	Global configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	IGMP report suppression is supported only when the multicast query has IGMPv1 and IGMPv2 reports. This feature is not supported when the query includes IGMPv3 reports.
-------------------------	---

The uses IGMP report suppression to forward only one IGMP report per multicast router query to multicast devices. When IGMP report suppression is enabled (the default), the sends the first IGMP report from all the hosts for a group to all the multicast routers. The does not send the remaining IGMP reports for the group to the multicast routers. This feature prevents duplicate reports from being sent to the multicast devices.

If the multicast router query includes requests only for IGMPv1 and IGMPv2 reports, the forwards only the first IGMPv1 or IGMPv2 report from all the hosts for a group to all of the multicast routers. If the multicast router query also includes requests for IGMPv3 reports, the forwards all IGMPv1, IGMPv2, and IGMPv3 reports for a group to the multicast devices.

If you disable IGMP report suppression by entering the **no ip igmp snooping report-suppression** command, all IGMP reports are forwarded to all of the multicast routers.

### Example

The following example shows how to disable report suppression:

```
Device(config)# no ip igmp snooping report-suppression
```

You can verify your settings by entering the **show ip igmp snooping** command in privileged EXEC mode.

# ip igmp snooping vlan mrouter

To add a multicast router port, use the **ip igmp snooping mrouter** global configuration command on the stack or on a standalone . To return to the default settings, use the **no** form of this command.

---

**Command Default** By default, there are no multicast router ports.

---

**Command Modes** Global configuration

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

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**Usage Guidelines** VLAN IDs 1002—1005 are reserved for Token Ring and FDDI VLANs, and cannot be used in IGMP snooping. The configuration is saved in NVRAM.

## Example

The following example shows how to configure a port as a multicast router port:

```
Device(config)# ip igmp snooping vlan 1 mrouter interface gigabitethernet1/0/2
```

You can verify your settings by entering the **show ip igmp snooping** privileged EXEC command.

## ip igmp snooping vlan static

To enable Internet Group Management Protocol (IGMP) snooping and to statically add a Layer 2 port as a member of a multicast group, use the **ip igmp snooping vlan static** global configuration command on the stack or on a standalone . To remove the port specified as members of a static multicast group, use the **no** form of this command.

**ip igmp snooping vlan** *vlan-id* **static** *ip-address* **interface** *interface-id*  
**no ip igmp snooping vlan** *vlan-id* **static** *ip-address* **interface** *interface-id*

### Syntax Description

<i>vlan-id</i>	Enables IGMP snooping on the specified VLAN. Ranges are 1—1001 and 1006—4094.
<i>ip-address</i>	Adds a Layer 2 port as a member of a multicast group with the specified group IP address.
<b>interface</b> <i>interface-id</i>	Specifies the interface of the member port. The <i>interface-id</i> has these options: <ul style="list-style-type: none"> <li>• <i>fastethernet interface number</i>—A Fast Ethernet IEEE 802.3 interface.</li> <li>• <i>gigabitethernet interface number</i>—A Gigabit Ethernet IEEE 802.3z interface.</li> <li>• <i>tengigabitethernet interface number</i>—A 10-Gigabit Ethernet IEEE 802.3z interface.</li> <li>• <i>port-channel interface number</i>—A channel interface. The range is 0—128.</li> </ul>

### Command Default

By default, no ports are statically configured as members of a multicast group.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

VLAN IDs 1002 to 1005 are reserved for Token Ring and FDDI VLANs, and cannot be used in IGMP snooping.

The configuration is saved in NVRAM.

### Example

The following example shows how to statically configure a host on an interface:

```
Device(config)# ip igmp snooping vlan 1 static 224.2.4.12 interface
gigabitEthernet1/0/1
```

Configuring port gigabitethernet1/0/1 on group 224.2.4.12

You can verify your settings by entering the **show ip igmp snooping** command in privileged EXEC mode.

## ip multicast auto-enable

To support authentication, authorization, and accounting (AAA) enabling of IP multicast, use the **ip multicast auto-enable** command. This command allows multicast routing to be enabled dynamically on dialup interfaces using AAA attributes from a RADIUS server. To disable IP multicast for AAA, use the **no** form of this command.

**ip multicast auto-enable**  
**no ip multicast auto-enable**

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** None

---

**Command Modes** Global configuration

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

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**Usage Guidelines** None

### Example

The following example shows how to enable AAA on IP multicast:

```
Device(config)# ip multicast auto-enable
```

## ip pim accept-register

To configure a candidate rendezvous point (RP) switch to filter Protocol Independent Multicast (PIM) register messages, use the **ip pim accept-register** command in global configuration mode. To disable this function, use the **no** form of this command.

```
ip pim [vrf vrf-name ] accept-register {list access-list}
no ip pim [vrf vrf-name ] accept-register
```

<b>Syntax Description</b>	<p><b>vrf</b> <i>vrf-name</i> (Optional) Configures a PIM register filter on candidate RPs for (S, G) traffic associated with the multicast Virtual Private Network (VPN) routing and forwarding (MVRP) instance specified for the <i>vrf-name</i> argument.</p> <p><b>list</b> <i>access-list</i> Specifies the <i>access-list</i> argument as a number or name that defines the (S, G) traffic in PIM register messages to be permitted or denied. The range is 100—199 and the expanded range is 2000—2699. An IP-named access list can also be used.</p>				
<b>Command Default</b>	No PIM register filters are configured.				
<b>Command Modes</b>	Global configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines**

Use this command to prevent unauthorized sources from registering with the RP. If an unauthorized source sends a register message to the RP, the RP will immediately send back a register-stop message.

The access list provided for the **ip pim accept-register** command should only filter IP source addresses and IP destination addresses. Filtering on other fields (for example, IP protocol or UDP port number) will not be effective and may cause undesired traffic to be forwarded from the RP down the shared tree to multicast group members. If more complex filtering is required, use the **ip multicast boundary** command instead.

### Example

The following example shows how to permit register packets for a source address sending to any group range, with the exception of source address 172.16.10.1 sending to the SSM group range (232.0.0.0/8). These are denied. These statements should be configured on all candidate RPs because candidate RPs will receive PIM registers from first-hop routers or switches.

```
Device(config)# ip pim accept-register list ssm-range
Device(config)# ip access-list extended ssm-range
Device(config-ext-nacl)# deny ip any 232.0.0.0 0.255.255.255
Device(config-ext-nacl)# permit ip any any
```



## ip pim bsr-candidate

To configure the Device to be a candidate BSR, use the **ip pim bsr-candidate** command in global configuration mode. To remove the switch as a candidate BSR, use the **no** form of this command.

```
ip pim [vrf vrf-name] bsr-candidate interface-id [hash-mask-length] [priority]
no ip pim [vrf vrf-name] bsr-candidate
```

Syntax Description		
<b>vrf</b> <i>vrf-name</i>	(Optional) Configures the Device to be a candidate BSR for the Multicast Virtual Private Network (MVPN) routing and forwarding (MVRP) instance specified for the <i>vrf-name</i> argument.	
<i>interface-id</i>	ID of the interface on the Device from which the BSR address is derived to make it a candidate. This interface must be enabled for Protocol Independent Multicast (PIM) using the <b>ip pim</b> command. Valid interfaces include physical ports, port channels, and VLANs.	
<i>hash-mask-length</i>	(Optional) Length of a mask (32 bits maximum) that is to be ANDed with the group address before the PIMv2 hash function is called. All groups with the same seed hash correspond to the same rendezvous point (RP). For example, if this value is 24, only the first 24 bits of the group addresses matter. The hash mask length allows one RP to be used for multiple groups. The default hash mask length is 0.	
<i>priority</i>	(Optional) Priority of the candidate BSR (C-BSR). The range is from 0 to 255. The default priority is 0. The C-BSR with the highest priority value is preferred.	

**Command Default** The Device is not configured to announce itself as a candidate BSR.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The interface specified for this command must be enabled for Protocol Independent Multicast (PIM) using the **ip pim** command.

This command configures the Device to send BSR messages to all of its PIM neighbors, with the address of the designated interface as the BSR address.

This command should be configured on backbone Devices that have good connectivity to all parts of the PIM domain.

The BSR mechanism is specified in RFC 2362. Candidate RP (C-RP) switches unicast C-RP advertisement packets to the BSR. The BSR then aggregates these advertisements in BSR messages, which it regularly multicasts with a TTL of 1 to the ALL-PIM-ROUTERS group address, 224.0.0.13. The multicasting of these messages is handled by hop-by-hop RPF flooding; so, no pre-existing IP multicast routing setup is required (unlike with AutoRP). In addition, the BSR does not preselect the designated RP for a particular group range (unlike AutoRP); instead, each switch that receives BSR messages will elect RPs for group ranges based on the information in the BSR messages.

Cisco Device always accept and process BSR messages. There is no command to disable this function.

Cisco Device perform the following steps to determine which C-RP is used for a group:

- A long match lookup is performed on the group prefix that is announced by the BSR C-RPs.
- If more than one BSR-learned C-RP is found by the longest match lookup, the C-RP with the lowest priority (configured with the **ip pim rp-candidate** command) is preferred.
- If more than one BSR-learned C-RP has the same priority, the BSR hash function is used to select the RP for a group.
- If more than one BSR-learned C-RP returns the same hash value derived from the BSR hash function, the BSR C-RP with the highest IP address is preferred.

### Example

The following example shows how to configure the IP address of the Device on Gigabit Ethernet interface 1/0/0 to be a BSR C-RP with a hash mask length of 0 and a priority of 192:

```
Device(config)# ip pim bsr-candidate GigabitEthernet1/0/1 0 192
```

# ip pim rp-candidate

To configure the Device to advertise itself to the BSR as a Protocol Independent Multicast (PIM) Version 2 (PIMv2) candidate rendezvous point (C-RP), use the **ip pim rp-candidate** command in global configuration mode. To remove the Device as a C-RP, use the **no** form of this command.

```
ip pim [vrf vrf-name] rp-candidate interface-id [group-list access-list-number]  
no ip pim [vrf vrf-name] rp-candidate interface-id [group-list access-list-number]
```

Syntax Description		
<b>vrf</b> <i>vrf-name</i>	(Optional) Configures the switch to advertise itself to the BSR as PIMv2 C-RP for the Multicast Virtual Private Network (MVPN) routing and forwarding (MVRP) instance specified for the <i>vrf-name</i> argument.	
<i>interface-id</i>	ID of the interface whose associated IP address is advertised as a candidate RP address. Valid interfaces include physical ports, port channels, and VLANs.	
<b>group-list</b> <i>access-list-number</i>	(Optional) Specifies the standard IP access list number that defines the group prefixes that are advertised in association with the RP address.	

**Command Default** The Device is not configured to announce itself to the BSR as a PIMv2 C-RP.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use this command to configure the Device to send PIMv2 messages so that it advertises itself as a candidate RP to the BSR.

This command should be configured on backbone Devices that have good connectivity to all parts of the PIM domain.

The IP address associated with the interface specified by *interface-id* will be advertised as the C-RP address.

The interface specified for this command must be enabled for Protocol Independent Multicast (PIM) using the **ip pim** command.

If the optional **group-list** keyword and *access-list-number* argument are configured, the group prefixes defined by the standard IP access list will also be advertised in association with the RP address.

## Example

The following example shows how to configure the switch to advertise itself as a C-RP to the BSR in its PIM domain. The standard access list number 4 specifies the group prefix associated with the RP that has the address identified by Gigabit Ethernet interface 1/0/1.

```
Device(config)# ip pim rp-candidate GigabitEthernet1/0/1 group-list 4
```

## ip pim send-rp-announce

To use Auto-RP to configure groups for which the Device will act as a rendezvous point (RP), use the **ip pim send-rp-announce** command in global configuration mode. To unconfigure the Device as an RP, use the **no** form of this command.

```
ip pim [vrf vrf-name] send-rp-announce interface-id scope ttl-value [group-list access-list-number]
[interval seconds]
no ip pim [vrf vrf-name] send-rp-announce interface-id
```

### Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Uses Auto-RP to configure groups for which the Device will act as a rendezvous point (RP) for the <i>vrf-name</i> argument.
<i>interface-id</i>	Enter the interface ID of the interface that identifies the RP address. Valid interfaces include physical ports, port channels, and VLANs.
<b>scope</b> <i>ttl-value</i>	Specifies the time-to-live (TTL) value in hops that limits the number of Auto-RP announcements. Enter a hop count that is high enough to ensure that the RP-announce messages reach all the mapping agents in the network. There is no default setting. The range is 1—255.
<b>group-list</b> <i>access-list-number</i>	(Optional) Specifies the standard IP access list number that defines the group prefixes that are advertised in association with the RP address. Enter an IP standard access list number from 1—99. If no access list is configured, the RP is used for all groups.
<b>interval</b> <i>seconds</i>	(Optional) Specifies the interval between RP announcements, in seconds. The total hold time of the RP announcements is automatically set to three times the value of the interval. The default interval is 60 seconds. The range is 1—16383.

### Command Default

Auto-RP is disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Enter this command on the Device that you want to be an RP. When you are using Auto-RP to distribute group-to-RP mappings, this command causes the router to send an Auto-RP announcement message to the well-known group CISCO-RP-ANNOUNCE (224.0.1.39). This message announces the router as a candidate RP for the groups in the range described by the access list.

### Example

The following example shows how to configure the Device to send RP announcements out all Protocol Independent Multicast (PIM)-enabled interfaces for a maximum of 31 hops. The IP address by which the switch wants to be identified as RP is the IP address associated with Gigabit Ethernet interface 1/0/1 at an interval of 120 seconds:

```
Device(config)# ip pim send-rp-announce GigabitEthernet1/0/1 scope 31 group-list 5 interval  
120
```

# ip pim snooping

To enable Protocol Independent Multicast (PIM) snooping globally, use the **ip pim snooping** command in global configuration mode. To disable PIM snooping globally, use the **no** form of this command.

**ip pim snooping**  
**no ip pim snooping**

**Syntax Description** This command has no arguments or keywords.

**Command Default** PIM snooping is not enabled.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** PIM snooping is not supported on groups that use the reserved MAC address range, for example, 0100.5e00.00xx, as an alias.

When you disable PIM snooping globally, PIM snooping is disabled on all the VLANs.

## Examples

The following example shows how to enable PIM snooping globally:

```
ip pim snooping
```

The following example shows how to disable PIM snooping globally:

```
no ip pim snooping
```

## Related Commands

Command	Description
<b>clear ip pim snooping</b>	Deletes PIM snooping on an interface.
<b>show ip pim snooping</b>	Displays information about IP PIM snooping.

## ip pim snooping dr-flood

To enable flooding of packets to the designated router, use the **ip pim snooping dr-flood** command in global configuration mode. To disable the flooding of packets to the designated router, use the **no** form of this command.

**ip pim snooping dr-flood**  
**no ip pim snooping dr-flood**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The flooding of packets to the designated router is enabled by default.

**Command Modes** Global configuration

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** PIM snooping is not supported on groups that use the reserved MAC address range, for example, 0100.5e00.00xx, as an alias.

Enter the **no ip pim snooping dr-flood** command only on switches that have no designated routers attached. The designated router is programmed automatically in the (S,G) O-list.

### Examples

The following example shows how to enable flooding of packets to the designated router:

```
ip pim snooping dr-flood
```

The following example shows how to disable flooding of t packets to the designated router:

```
no ip pim snooping dr-flood
```

Related Commands	Command	Description
	<b>clear ip pim snooping</b>	Deletes PIM snooping on an interface.
	<b>show ip pim snooping</b>	Displays information about IP PIM snooping.

## ip pim snooping vlan

To enable Protocol Independent Multicast (PIM) snooping on an interface, use the **ip pim snooping vlan** command in global configuration mode. To disable PIM snooping on an interface, use the **no** form of this command.

**ip pim snooping vlan** *vlan-id*  
**no ip pim snooping vlan** *vlan-id*

<b>Syntax Description</b>	<i>vlan-id</i> VLAN ID value. The range is 1—1001. Do not enter leading zeroes.
---------------------------	---

**Command Default** PIM snooping is disabled on an interface.

**Command Modes** Global configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** PIM snooping is not supported on groups that use the reserved MAC address range, for example, 0100.5e00.00xx, as an alias.

This command automatically configures the VLAN if it is not already configured. The configuration is saved in NVRAM.

### Examples

This example shows how to enable PIM snooping on a VLAN interface:

```
Router(config)# ip pim snooping vlan 2
```

This example shows how to disable PIM snooping on a VLAN interface:

```
Router(config)# no ip pim snooping vlan 2
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>clear ip pim snooping</b>	Deletes PIM snooping on an interface.
	<b>ip pim snooping</b>	Enables PIM snooping globally.
	<b>show ip pim snooping</b>	Displays information about IP PIM snooping.



## ip pim spt-threshold

To specify the threshold that must be reached before moving to shortest-path tree (spt), use the **ip pim spt-threshold** command in global configuration mode. To remove the threshold, use the **no** form of this command.

```
ip pim {kpbs | infinity} [group-list access-list]
no ip pim {kpbs | infinity} [group-list access-list]
```

<b>Syntax Description</b>	<i>kpbs</i>	Threshold that must be reached before moving to shortest-path tree (spt). 0 is the only valid entry even though the range is 0 to 4294967. A 0 entry always switches to the source-tree.
	<b>infinity</b>	Specifies that all the sources for the specified group use the shared tree, never switching to the source tree.
	<b>group-list</b> <i>access-list</i>	(Optional) Specifies an access list number or a specific access list that you have created by name. If the value is 0 or if the <b>group-list</b> <i>access-list</i> option is not used, the threshold applies to all the groups.
<b>Command Default</b>	Switches to the PIM shortest-path tree (spt).	
<b>Command Modes</b>	Global configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Example

The following example shows how to make all the sources for access list 16 use the shared tree:

```
Device(config)# ip pim spt-threshold infinity group-list 16
```

## match message-type

To set a message type to match a service list, use the **match message-type** command.

**match message-type** **announcement** | **any** | **query**

Syntax Description	
<b>announcement</b>	Allows only service advertisements or announcements for the .
<b>any</b>	Allows any match type.
<b>query</b>	Allows only a query from the client for a certain in the network.

**Command Default** None

**Command Modes** Service list configuration.

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Multiple service maps of the same name with different sequence numbers can be created, and the evaluation of the filters will be ordered on the sequence number. Service lists are an ordered sequence of individual statements, with each one having a permit or deny result. The evaluation of a service list consists of a list scan in a predetermined order, and an evaluation of the criteria of each statement that matches. A list scan is stopped once the first statement match is found and a permit/deny action associated with the statement match is performed. The default action after scanning through the entire list is to deny.



**Note** It is not possible to use the **match** command if you have used the **service-list mdns-sd service-list-name query** command. The **match** command can be used only for the **permit** or **deny** option.

### Example

The following example shows how to set the announcement message type to be matched:

```
(config-mdns-sd-sl)# match message-type announcement
```

## match service-type

To set the value of the mDNS service type string to match, use the **match service-type** command.

**match service-type** *line*

<b>Syntax Description</b>	<i>line</i> Regular expression to match the service type in packets.				
<b>Command Default</b>	None				
<b>Command Modes</b>	Service list configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	It is not possible to use the <b>match</b> command if you have used the <b>service-list mdns-sd service-list-name query</b> command. The <b>match</b> command can be used only for the <b>permit</b> or <b>deny</b> option.				

### Example

The following example shows how to set the value of the mDNS service type string to match:

```
(config-mdns-sd-sl)# match service-type _ipp._tcp
```

## match service-instance

To set a service instance to match a service list, use the **match service-instance** command.

**match service-instance** *line*

<b>Syntax Description</b>	<i>line</i> Regular expression to match the service instance in packets.
---------------------------	--

<b>Command Default</b>	None
------------------------	------

<b>Command Modes</b>	Service list configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	It is not possible to use the <b>match</b> command if you have used the <b>service-list mdns-sd</b> <i>service-list-name</i> <b>query</b> command. The <b>match</b> command can be used only for the <b>permit</b> or <b>deny</b> option.
-------------------------	---

### Example

The following example shows how to set the service instance to match:

```
(config-mdns-sd-sl)# match service-instance servInst 1
```

# mrinfo

To query which neighboring multicast routers or multilayer switches are acting as peers, use the **mrinfo** command in user EXEC or privileged EXEC mode.

**mrinfo** [**vrf** *route-name*] [*hostname* | *address*] [*interface-id*]

Syntax Description		
<b>vrf</b> <i>route-name</i>	(Optional)	Specifies the VPN routing or forwarding instance.
<i>hostname</i>   <i>address</i>	(Optional)	Domain Name System (DNS) name or IP address of the multicast router or multilayer switch to query. If omitted, the switch queries itself.
<i>interface-id</i>	(Optional)	Interface ID.

**Command Default** The command is disabled.

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **mrinfo** command is the original tool of the multicast backbone (MBONE) to determine which neighboring multicast routers or switches are peering with multicast routers or switches. Cisco routers supports **mrinfo** requests from Cisco IOS Release 10.2.

You can query a multicast router or multilayer switch using the **mrinfo** command. The output format is identical to the multicast routed version of the Distance Vector Multicast Routing Protocol (DVMRP). (The mrouterd software is the UNIX software that implements DVMRP.)

## Example

The following is the sample output from the **mrinfo** command:

```
Device# mrinfo
vrf 192.0.1.0
192.31.7.37 (barrnet-gw.cisco.com) [version cisco 11.1] [flags: PMSA]:
  192.31.7.37 -> 192.31.7.34 (sj-wall-2.cisco.com) [1/0/pim]
  192.31.7.37 -> 192.31.7.47 (dirtylab-gw-2.cisco.com) [1/0/pim]
  192.31.7.37 -> 192.31.7.44 (dirtylab-gw-1.cisco.com) [1/0/pim]
```



---

**Note** The flags indicate the following:

- P: prune-capable
  - M: mtrace-capable
  - S: Simple Network Management Protocol-capable
  - A: Auto RP capable
-

# redistribute mdns-sd

To redistribute services or service announcements across subnets, use the **redistribute mdns-sd** command. To disable redistribution of services or service announcements across subnets, use the **no** form of this command.

**redistribute mdns-sd**  
**no redistribute mdns-sd**

This command has no arguments or keywords.

---

**Command Default**

The redistribution of services or service announcements across subnets is disabled.

---

**Command Modes**

mDNS configuration

---

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

**Usage Guidelines**

To redistribute service announcements across interfaces, use the **redistribute mdns-sd** command. This command sends out unsolicited announcements received on one interface to all of the other interfaces. The outgoing announcements are filtered as per the out-service policy defined for the interface, or, in absence of a per-interface service policy, based on the global out-service policy.

In the absence of a redistribute option, services can be discovered by querying in a Layer 3 domain that is not local to the service provider.

**Example**

The following example shows how to redistribute services or service announcements across subnets:

```
(config-mdns) # redistribute mdns-sd
```



---

**Note** If redistribution is enabled globally, global configuration is given higher priority than interface configuration.

---

## service-list mdns-sd

To enter mDNS service discovery service-list mode on the , use the **service-list mdns-sd** command. To exit mDNS service discovery service-list mode, use the **no** form of this command.

**service-list mdns-sd** *service-list-name* {**permit** | **deny**} *sequence-number* [**query**]  
**no service-list mdns-sd** *service-list-name* {**permit** | **deny**} *sequence-number* [**query**]

### Syntax Description

<i>service-list-name</i>	Name of the service list.
<b>permit</b> <i>sequence number</i>	Permits a filter on the service list to be applied to the sequence number.
<b>deny</b> <i>sequence number</i>	Denies a filter on the service list to be applied to the sequence number.
<b>query</b>	Associates a query for the service list name.

### Command Default

Disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Service filters are modeled around access lists and route maps.

Multiple service maps of the same name with different sequence numbers can be created and the evaluation of the filters ordered on the sequence number. Service lists are an ordered sequence of individual statements, with each having a permit or deny result. The evaluation of a service list consists of a list scan in a predetermined order, and an evaluation of the criteria of each statement that matches. A list scan is terminated once the first statement match is found, and an action, permit, or deny that is associated with the statement match is performed. The default action after scanning through the entire list will be to deny.

This command can be used to enter mDNS service discovery service-list mode.

In this mode you can:

- Create a service list and apply a filter on the service list according to the **permit** or **deny** option applied to the sequence number.

### Example

The following example shows how to create a service list and apply a filter on the service list according to the **permit** or **deny** option applied to a sequence number:

```
(config)# service-list mdns-sd s11 permit 3
```



# service-policy-query

To configure the service-list query periodicity, use the **service-policy-query** command. To delete the configuration, use the **no** form of this command.

**service-policy-query** [*service-list-query-name service-list-query-periodicity*]  
**no service-policy-query**

<b>Syntax Description</b>	<i>service-list-query-name service-list-query-periodicity</i> (Optional) Service-list query periodicity.
---------------------------	--

<b>Command Default</b>	Disabled.
------------------------	-----------

<b>Command Modes</b>	mDNS configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	Since there are devices that do not send unsolicited announcements and to force such devices the learning of services and to keep them refreshed in the cache, this command contains an active query feature that ensures that the services listed in the active query list are queried.
-------------------------	--

## Example

This example shows how to configure service list query periodicity:

```
(config-mdns)# service-policy-query sl-query1 100
```

## service-routing mdns-sd

To enable the mDNS gateway functionality for a device and enter multicast DNS configuration mode, use the **service-routing mdns-sd** command. To restore the default settings and return to global configuration mode, enter the **no** form of this command.

**service-routing mdns-sd**  
**no service-routing mdns-sd**

This command has no arguments or keywords.

---

**Command Default** Disabled.

---

**Command Modes** Global configuration

---

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---



---

**Usage Guidelines** The mDNS gateway functionality can only be enabled or disabled globally, not on a per-interface basis. The service- filter policy and redistribution can be configured globally as well as on a per-interface basis. Any interface-specific configuration overrides the global configuration.

### Example

The following example shows how to enable the mDNS gateway functionality for a device and enter multicast DNS configuration mode:

```
(config) # service-routing mdns-sd
```

## service-policy

To apply a filter on incoming or outgoing service-discovery information on a service list, use the **service-policy** command. To remove the filter, use the **no** form of this command.

```
service-policy service-policy-name {IN | OUT}
no service-policy service-policy-name {IN | OUT}
```

### Syntax Description

**IN** Applies a filter on incoming service-discovery information.

**OUT** Applies a filter on outgoing service-discovery information.

### Command Default

Disabled.

### Command Modes

mDNS configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Example

The following example shows how to apply a filter on incoming service-discovery information on a service list:

```
(config-mdns)# service-policy serv-poll IN
```

# show ip igmp filter

To display Internet Group Management Protocol (IGMP) filter information, use the **show ip igmp filter** command in privileged EXEC mode.

**show ip igmp** [*vrf vrf-name*] **filter**

<b>Syntax Description</b>	<b>vrf vrf-name</b> (Optional) Supports the multicast VPN routing and forwarding (VRF) instance.
---------------------------	--

<b>Command Default</b>	IGMP filters are enabled by default.
------------------------	--------------------------------------

<b>Command Modes</b>	Privileged EXEC
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	The <b>show ip igmp filter</b> command displays information about all filters defined on the .
-------------------------	--

## Example

The following example shows the sample output from the **show ip igmp filter** command:

```
Device# show ip igmp filter
IGMP filter enabled
```

# show ip igmp profile

To display all the configured Internet Group Management Protocol (IGMP) profiles or a specified IGMP profile, use the **show ip igmp profile** command in privileged EXEC mode.

```
show ip igmp [vrf vrf-name] profile [profile number]
```

<b>Syntax Description</b>	<p><b>vrf vrf-name</b> (Optional) Supports the multicast VPN routing and forwarding (VRF) instance.</p> <p><b>profile number</b> (Optional) IGMP profile number to be displayed. The range is 1 to 4294967295. If no profile number is entered, all the IGMP profiles are displayed.</p>				
<b>Command Default</b>	IGMP profiles are undefined by default.				
<b>Command Modes</b>	Privileged EXEC				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	None				

## Examples

The following example shows the output of the **show ip igmp profile** command for profile number 40 on the :

```
Device# show ip igmp profile 40
IGMP Profile 40
  permit
  range 233.1.1.1 233.255.255.255
```

The following example shows the output of the **show ip igmp profile** command for all the profiles configured on the :

```
Device# show ip igmp profile

IGMP Profile 3
  range 230.9.9.0 230.9.9.0
IGMP Profile 4
  permit
  range 229.9.9.0 229.255.255.255
```

# show ip igmp snooping

To display the Internet Group Management Protocol (IGMP) snooping configuration of the or the VLAN, use the **show ip igmp snooping** command in user EXEC or privileged EXEC mode.

**show ip igmp snooping** [**groups** | **mrouter** | **querier**] [**vlan** *vlan-id*] [**detail**]

Syntax Description	
<b>groups</b>	(Optional) Displays the IGMP snooping multicast table.
<b>mrouter</b>	(Optional) Displays the IGMP snooping multicast router ports.
<b>querier</b>	(Optional) Displays the configuration and operation information for the IGMP querier.
<b>vlan</b> <i>vlan-id</i>	(Optional) Specifies a VLAN; the range is 1 to 1001 and 1006 to 4094.
<b>detail</b>	(Optional) Displays operational state information.

**Command Default** None

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** VLAN IDs 1002—1005 are reserved for Token Ring and FDDI VLANs, and cannot be used in IGMP snooping. Expressions are case sensitive. For example, if you enter | **exclude output**, the lines that contain "output" do not appear, but the lines that contain "Output" appear.

## Examples

The following is a sample output from the **show ip igmp snooping vlan 1** command. It shows snooping characteristics for a specific VLAN:

```
Device# show ip igmp snooping vlan 1

Global IGMP Snooping configuration:
-----
IGMP snooping                : Enabled
IGMPv3 snooping (minimal)    : Enabled
Report suppression           : Enabled
TCN solicit query            : Disabled
TCN flood query count        : 2
Robustness variable          : 2
Last member query count      : 2
Last member query interval   : 1000

Vlan 1:
-----
IGMP snooping                : Enabled
```

```

IGMPv2 immediate leave      : Disabled
Multicast router learning mode : pim-dvmrp
CGMP interoperability mode   : IGMP_ONLY
Robustness variable         : 2
Last member query count      : 2
Last member query interval   : 1000

```

The following is a sample output from the **show ip igmp snooping** command. It displays snooping characteristics for all the VLANs on the :

```
Device# show ip igmp snooping
```

```
Global IGMP Snooping configuration:
```

```

-----
IGMP snooping                : Enabled
IGMPv3 snooping (minimal)    : Enabled
Report suppression           : Enabled
TCN solicit query            : Disabled
TCN flood query count        : 2
Robustness variable          : 2
Last member query count      : 2
Last member query interval    : 1000

```

```
Vlan 1:
```

```

-----
IGMP snooping                : Enabled
IGMPv2 immediate leave      : Disabled
Multicast router learning mode : pim-dvmrp
CGMP interoperability mode   : IGMP_ONLY
Robustness variable         : 2
Last member query count      : 2
Last member query interval   : 1000

```

```
Vlan 2:
```

```

-----
IGMP snooping                : Enabled
IGMPv2 immediate leave      : Disabled
Multicast router learning mode : pim-dvmrp
CGMP interoperability mode   : IGMP_ONLY
Robustness variable         : 2
Last member query count      : 2
Last member query interval   : 1000

```

```

-
.
.
.

```

# show ip igmp snooping groups

To display the Internet Group Management Protocol (IGMP) snooping multicast table for the or the multicast information, use the **show ip igmp snooping groups** command in privileged EXEC mode.

**show ip igmp snooping groups** [**vlan** *vlan-id* ] [[**count**] | *ip\_address*]

## Syntax Description

<b>vlan</b> <i>vlan-id</i>	(Optional) Specifies a VLAN; the range is 1 to 1001 and 1006 to 4094. Use this option to display the multicast table for a specified multicast VLAN or specific multicast information.
<b>count</b>	(Optional) Displays the total number of entries for the specified command options instead of the actual entries.
<i>ip_address</i>	(Optional) Characteristics of the multicast group with the specified group IP address.

## Command Modes

Privileged EXEC  
User EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Expressions are case sensitive. For example, if you enter | **exclude output**, the lines that contain "output" do not appear, but the lines that contain "Output" appear.

## Examples

The following is a sample output from the **show ip igmp snooping groups** command without any keywords. It displays the multicast table for the .

```
Device# show ip igmp snooping groups
```

```

Vlan      Group          Type      Version      Port List
-----
1         224.1.4.4      igmp
1         224.1.4.5      igmp
2         224.0.1.40     igmp      v2           Gi1/0/15
104      224.1.4.2      igmp      v2           Gi2/0/1, Gi2/0/2
104      224.1.4.3      igmp      v2           Gi2/0/1, Gi2/0/2

```

The following is a sample output from the **show ip igmp snooping groups count** command. It displays the total number of multicast groups on the .

```
Device# show ip igmp snooping groups count
```

```
Total number of multicast groups: 2
```

The following is a sample output from the **show ip igmp snooping groups vlan vlan-id ip-address** command. It shows the entries for the group with the specified IP address:

```
Device# show ip igmp snooping groups vlan 104 224.1.4.2
```

```

Vlan      Group          Type      Version      Port List

```



```
-----  
104      224.1.4.2      igmp      v2      Gi2/0/1, Gi1/0/15
```

# show ip igmp snooping mrouter

To display the Internet Group Management Protocol (IGMP) snooping dynamically learned and manually configured multicast router ports for the or for the specified multicast VLAN, use the **show ip igmp snooping mrouter** command in privileged EXEC mode.

**show ip igmp snooping mrouter** [**vlan** *vlan-id*]

<b>Syntax Description</b>	<b>vlan</b> <i>vlan-id</i> (Optional) Specifies a VLAN; Ranges are from 1—1001 and 1006—4094.	
<b>Command Modes</b>	User EXEC Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	<p>VLAN IDs 1002—1005 are reserved for Token Ring and FDDI VLANs, and cannot be used in IGMP snooping.</p> <p>When multicast VLAN registration (MVR) is enabled, the <b>show ip igmp snooping mrouter</b> command displays MVR multicast router information and IGMP snooping information.</p> <p>Expressions are case sensitive, for example, if you enter   exclude output, the lines that contain "output" do not appear, but the lines that contain "Output" appear.</p>	

## Example

The following is a sample output from the **show ip igmp snooping mrouter** command. It shows how to display multicast router ports on the :

```
Device# show ip igmp snooping mrouter

Vlan      ports
----      -
1         Gi2/0/1 (dynamic)
```

# show ip igmp snooping querier

To display the configuration and operation information for the IGMP querier that is configured on a , use the **show ip igmp snooping querier** command in user EXEC mode.

```
show ip igmp snooping querier [vlan vlan-id] [detail ]
```

<b>Syntax Description</b>	<b>vlan <i>vlan-id</i></b> (Optional) Specifies a VLAN; Ranges are from 1—1001 and 1006—4094.
	<b>detail</b> (Optional) Displays detailed IGMP querier information.

<b>Command Modes</b>	User EXEC Privileged EXEC
----------------------	------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **show ip igmp snooping querier** command to display the IGMP version and the IP address of a detected device, also called a querier, that sends IGMP query messages. A subnet can have multiple multicast routers but only one IGMP querier. In a subnet running IGMPv2, one of the multicast routers is elected as the querier. The querier can be a Layer 3 .

The **show ip igmp snooping querier** command output also shows the VLAN and the interface on which the querier was detected. If the querier is the , the output shows the Port field as Router. If the querier is a router, the output shows the port number on which the querier was detected in the Port field.

The **show ip igmp snooping querier detail** user EXEC command is similar to the **show ip igmp snooping querier** command. However, the **show ip igmp snooping querier** command displays only the device IP address most recently detected by the querier.

The **show ip igmp snooping querier detail** command displays the device IP address most recently detected by the querier and this additional information:

- The elected IGMP querier in the VLAN
- The configuration and operational information pertaining to the querier (if any) that is configured in the VLAN

Expressions are case sensitive, for example, if you enter | **exclude output**, the lines that contain "output" do not appear, but the lines that contain "Output" appear.

## Examples

The following is a sample output from the **show ip igmp snooping querier** command:

```
Device> show ip igmp snooping querier
Vlan      IP Address      IGMP Version      Port
-----
1         172.20.50.11    v3                 Gi1/0/1
2         172.20.40.20    v2                 Router
```

The following is a sample output from the **show ip igmp snooping querier detail** command:

```
Device> show ip igmp snooping querier detail

Vlan      IP Address      IGMP Version  Port
-----
1         1.1.1.1         v2            Fa8/0/1
Global IGMP querier status

-----
admin state           : Enabled
admin version         : 2
source IP address     : 0.0.0.0
query-interval (sec) : 60
max-response-time (sec) : 10
querier-timeout (sec) : 120
tcn query count       : 2
tcn query interval (sec) : 10
Vlan 1: IGMP querier status

-----
elected querier is 1.1.1.1      on port Fa8/0/1
-----
admin state           : Enabled
admin version         : 2
source IP address     : 10.1.1.65
query-interval (sec) : 60
max-response-time (sec) : 10
querier-timeout (sec) : 120
tcn query count       : 2
tcn query interval (sec) : 10
operational state     : Non-Querier
operational version   : 2
tcn query pending count : 0
```

# show ip pim autorp

To display global information about auto-rp, use the **show ip pim autorp** command in privileged EXEC mode.

**show ip pim autorp**

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** Auto RP is enabled by default.

---

**Command Modes** Privileged EXEC

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

**Usage Guidelines** This command displays whether auto-rp is enabled or disabled.

## Example

The following command output shows that Auto RP is enabled:

```
Device# show ip pim autorp

AutoRP Information:
  AutoRP is enabled.
  RP Discovery packet MTU is 0.
  224.0.1.40 is joined on GigabitEthernet1/0/1.

PIM AutoRP Statistics: Sent/Received
  RP Announce: 0/0, RP Discovery: 0/0
```

# show ip pim bsr-router

To display information related to Protocol Independent Multicast (PIM) bootstrap router (BSR) protocol processing, use the **show ip pim bsr-router** command in user EXEC or privileged EXEC mode.

**show ip pim bsr-router**

**Syntax Description** This command has no arguments or keywords.

**Command Default** None

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** In addition to Auto RP, the BSR RP method can be configured. After the BSR RP method is configured, this command displays the BSR router information.

The following is sample output from the **show ip pim bsr-router** command:

```
Device# show ip pim bsr-router

PIMv2 Bootstrap information
This system is the Bootstrap Router (BSR)
  BSR address: 172.16.143.28
  Uptime: 04:37:59, BSR Priority: 4, Hash mask length: 30
  Next bootstrap message in 00:00:03 seconds

Next Cand_RP_advertisement in 00:00:03 seconds.
  RP: 172.16.143.28(Ethernet0), Group acl: 6
```

## show ip pim bsr

To display information related to Protocol Independent Multicast (PIM) bootstrap router (BSR) protocol processing, use the **show ip pim bsr** command in user EXEC or privileged EXEC mode.

**show ip pim bsr**

<b>Syntax Description</b>	This command has no arguments or keywords.
---------------------------	--

<b>Command Default</b>	None
------------------------	------

<b>Command Modes</b>	User EXEC Privileged EXEC
----------------------	------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	In addition to Auto RP, the BSR RP method can be configured. After the BSR RP method is configured, this command displays the BSR router information.
-------------------------	---

The following is sample output from the **show ip pim bsr** command:

```
Device# show ip pim bsr

PIMv2 Bootstrap information
This system is the Bootstrap Router (BSR)
  BSR address: 172.16.143.28
  Uptime: 04:37:59, BSR Priority: 4, Hash mask length: 30
  Next bootstrap message in 00:00:03 seconds

Next Cand_RP_advertisement in 00:00:03 seconds.
  RP: 172.16.143.28(Ethernet0), Group acl: 6
```

# show ip pim snooping

To display the information about IP PIM snooping, use the **show ip pim snooping** command in user EXEC or privileged EXEC mode.

## Global Status

**show ip pim snooping**

## VLAN Status

**show ip pim snooping vlan** *vlan-id* [**neighbor** | **statistics** | **mroute** [*source-ipgroup-ip*]]

### Syntax Description

<b>vlan</b> <i>vlan-id</i>	Displays information for a specific VLAN; Valid values are from 1—4094.
<b>neighbor</b>	(Optional) Displays information about the neighbor database.
<b>statistics</b>	(Optional) Displays information about the VLAN statistics.
<b>mroute</b>	(Optional) Displays information about the mroute database.
<i>source-ip</i>	(Optional) Source IP address.
<i>group-ip</i>	(Optional) Group IP address.

### Command Default

This command has no default settings.

### Command Modes

User EXEC Privileged EXEC

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Examples

The following example shows how to display information about the global status:

```
Router# show ip pim snooping

Global runtime mode: Enabled
Global admin mode   : Enabled
DR Flooding status  : Disabled
SGR-Prune Suppression: Enabled
Number of user enabled VLANs: 1
User enabled VLANs: 1001
```

This example shows how to display information about a specific VLAN:

```
Router# show ip pim snooping vlan 1001

4 neighbors (0 DR priority incapable, 4 Bi-dir incapable)
5000 mroutes, 0 mac entries
DR is 10.10.10.4
RP DF Set:
QinQ snooping : Disabled
```



This example shows how to display information about the neighbor database for a specific VLAN:

```
Router# show ip pim snooping vlan 1001 neighbor

IP Address      Mac address      Port              Uptime/Expires   Flags
VLAN 1001: 3 neighbors
10.10.10.2      000a.f330.344a  Po128             02:52:27/00:01:41
10.10.10.1      000a.f330.334a  Hul/0/7           04:54:14/00:01:38
10.10.10.4      000a.f330.3c00  Hul/0/1           04:53:45/00:01:34 DR
```

This example shows how to display the detailed statistics for a specific VLAN:

```
Router# show ip pim snooping vlan 1001 statistics

PIMv2 statistics:
Total                : 56785
Process Enqueue      : 56785
Process PIMv2 input queue current outstanding : 0
Process PIMv2 input queue max size reached   : 110
Error - Global Process State not RUNNING     : 0
Error - Process Enqueue                       : 0
Error - Drops                                       : 0
Error - Bad packet floods                      : 0
Error - IP header generic error               : 0
Error - IP header payload len too long        : 0
Error - IP header payload len too short       : 0
Error - IP header checksum                    : 0
Error - IP header dest ip not 224.0.0.13     : 0
Error - PIM header payload len too short      : 0
Error - PIM header checksum                   : 0
Error - PIM header checksum in Registers      : 0
Error - PIM header version not 2             : 0
```

This example shows how to display information about the mroute database for all the mroute in a specific VLAN:

```
Router# show ip pim snooping vlan 10 mroute

Flags: J/P - (*,G) Join/Prune, j/p - (S,G) Join/Prune
SGR-P - (S,G,R) Prune

VLAN 1001: 5000 mroutes
(*, 225.0.1.0), 00:14:54/00:02:59
 10.10.10.120->10.10.10.105, 00:14:54/00:02:59, J
  Downstream ports: Po128
  Upstream ports: Hul/0/7
  Outgoing ports: Hul/0/7 Po128

(11.11.11.10, 225.0.1.0), 00:14:54/00:02:59
 10.10.10.130->10.10.10.120, 00:14:54/00:02:59, SGR-P
  Downstream ports:
  Upstream ports: Hul/0/7
  Outgoing ports:

(*, 225.0.5.0), 00:14:53/00:02:57
 10.10.10.105->10.10.10.10, 00:14:53/00:02:57, J
  Downstream ports: Po128
  Upstream ports: Hul/0/7
  Outgoing ports: Hul/0/7 Po128

(11.11.11.10, 225.0.5.0), 00:14:53/00:02:57
 10.10.10.105->10.10.10.130, 00:14:53/00:02:57, SGR-P
```

```

Downstream ports:
Upstream  ports: Hu1/0/7
Outgoing  ports:
Number of matching mroutes found: 4

```

This example shows how to display information about the PIM mroute for a specific source address:

```
Router# show ip pim snooping vlan 10 mroute 172.16.100.100
```

```

(*, 172.16.100.100), 00:16:36/00:02:36
 10.10.10.1->10.10.10.2, 00:16:36/00:02:36, J
Downstream ports: 3/12
Upstream  ports: 3/13
Outgoing  ports: 3/12 3/13

```

This example shows how to display information about the PIM mroute for a specific source and group address:

```
Router# show ip pim snooping vlan 10 mroute 192.168.0.0 172.16.10.10
```

```

(192.168.0.0, 172.16.10.10), 00:03:04/00:00:25
 10.10.10.1->10.10.10.2, 00:03:04/00:00:25, j
Downstream ports: 3/12
Upstream  ports: 3/13
Outgoing  ports: 3/12 3/13

```

The table below describes the significant fields shown in the display.

**Table 17: show ip pim snooping Field Descriptions**

Field	Description
Downstream ports	Ports on which PIM joins were received.
Upstream ports	Ports towards RP and source.
Outgoing ports	List of all upstream and downstream ports for the multicast flow.

#### Related Commands

Command	Description
<b>clear ip pim snooping vlan</b>	Deletes PIM snooping on an interface.
<b>ip pim snooping</b>	Enables PIM snooping globally.
<b>ip pim snooping vlan</b>	Enables PIM snooping on an interface.

# show ip pim tunnel

To display information about the Protocol Independent Multicast (PIM) register encapsulation and decapsulation tunnels on an interface, use the **show ip pim tunnel** command.

```
show ip pim [vrf vrf-name] tunnel [Tunnel interface-number | verbose]
```

<b>Syntax Description</b>	<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
	<b>Tunnel</b> <i>interface-number</i>	(Optional) Specifies the tunnel interface number.
	<b>verbose</b>	(Optional) Provides additional information, such as the MAC encapsulation header and platform-specific information.
<b>Command Default</b>	None	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **show ip pim tunnel** to display information about PIM tunnel interfaces.

PIM tunnel interfaces are used by the IPv4 Multicast Forwarding Information Base (MFIB) for the PIM sparse mode (PIM-SM) registration process. Two types of PIM tunnel interfaces are used by the the IPv4 MFIB:

- A PIM encapsulation tunnel (PIM Encap Tunnel)
- A PIM decapsulation tunnel (PIM Decap Tunnel)

The PIM Encap Tunnel is dynamically created whenever a group-to- rendezvous point (RP) mapping is learned (through auto-RP, bootstrap router (BSR), or static RP configuration). The PIM Encap Tunnel is used to encapsulate multicast packets sent by first-hop designated routers (DRs) that have directly connected sources.

Similar to the PIM Encap Tunnel, the PIM Decap Tunnel interface is dynamically created—but it is created only on the RP whenever a group-to-RP mapping is learned. The PIM Decap Tunnel interface is used by the RP to decapsulate PIM register messages.



**Note** PIM tunnels will not appear in the running configuration.

The following syslog message appears when a PIM tunnel interface is created:

```
* %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel<interface_number>,
changed state to up
```

The following is sample output from the **show ip pim tunnel** taken from an RP. The output is used to verify the PIM Encap and Decap Tunnel on the RP:

```
Device# show ip pim tunnel
```

```
Tunnel0  
  Type : PIM Encap  
  RP   : 70.70.70.1*  
  Source: 70.70.70.1  
Tunnel1*  
  Type : PIM Decap  
  RP   : 70.70.70.1*  
  Source: -R2#
```



---

**Note** The asterisk (\*) indicates that the router is the RP. The RP will always have a PIM Encap and Decap Tunnel interface.

---

# show mdns cache

To display mDNS cache information for the , use the **show mdns cache** command in privileged EXEC mode.

```
show mdns cache [interface type number | name record-name [type record-type] | type record-type]
```

Syntax Description	
<b>interface</b> <i>type-number</i>	(Optional) Specifies a particular interface type and number for which mDNS cache information is to be displayed.
<b>name</b> <i>record-name</i>	(Optional) Specifies a particular name for which mDNS cache information is to be displayed.
<b>type</b> <i>record-type</i>	(Optional) Specifies a particular type for which mDNS cache information is to be displayed.

**Command Default** None

**Command Modes** Privileged EXEC

User EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Expressions are case sensitive. For example, if you enter | **exclude output**, the lines that contain output do not appear, but the lines that contain output appear.

## Example

The following is an example of output from the **show mdns cache** command without any keywords:

```
# show mdns cache
```

```

[<NAME>]                               [<TYPE>] [<CLASS>] [<TTL>/Remaining] [Accessed] [If-name] [Mac
Address] [<RR Record Data>]

 _airplay._tcp.local                    PTR      IN      4500/4455      0      V1121
 b878.2e33.c7c5 CAMPUS APPLE TV1._airplay._tcp.local

 CAMPUS APPLE TV1._airplay._tcp.local SRV      IN      120/75        2      V1121
 b878.2e33.c7c5 CAMPUS-APPLE-TV1.local

 CAMPUS-APPLE-TV1.local                 A        IN      120/75        2      V1121
 b878.2e33.c7c5 121.1.0.254

 CAMPUS APPLE TV1._airplay._tcp.local TXT      IN      4500/4455      2      V1121
 b878.2e33.c7c5 (162) 'deviceid=B8:78:2E:33:C7:C6'

                               'features=0x5a7ffff7' 'flags=0x4'
```

## show mdns cache

```

      'model=AppleT~'~
    _ipp._tcp.local PTR IN 4500/4465 2 V12
    2894.0fed.447f EPSON XP-400 Series._ipp._tcp.local

    EPSON XP-400 Series._ipp._tcp.local SRV IN 120/85 2 V12
    2894.0fed.447f EPSONC053AA.local

    EPSONC053AA.local A IN 120/85 2 V12
    2894.0fed.447f 121.1.0.251

    EPSON XP-400 Series._ipp._tcp.local TXT IN 4500/4465 2 V12
    2894.0fed.447f (384)'txtvers=1' N XP-400 Series'

      'usbFG=EPSON''usb_MDL=XP~'~
    _smb._tcp.local PTR IN 4500/4465 2 V12
    2894.0fed.447f EPSON XP-400 Series._smb._tcp.local

    EPSON XP-400 Series._smb._tcp.local SRV IN 120/85 2 V12
    2894.0fed.447f EPSONC053AA.local

    EPSON XP-400 Series._smb._tcp.local TXT IN 4500/4465 2 V12
    2894.0fed.447f (1)'' R2-Access1#

```

# show mdns requests

To display information for outstanding mDNS requests, including record name and record type information, for the , use the **show mdns requests** command in privileged EXEC mode.

**show mdns requests** [**detail** | **name** *record-name* | **type** *record-type* [ **name** *record-name* ]]

Syntax Description	detail	Displays detailed mDNS request information.
	<b>name</b> <i>record-name</i>	Displays detailed mDNS request information based on name.
	<b>type</b> <i>record-type</i>	Displays detailed mDNS request information based on type.

**Command Default** None

**Command Modes** Privileged EXEC  
User EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Expressions are case sensitive. For example, if you enter | exclude output, the lines that contain output do not appear, but the lines that contain output appear.

## Example

This is an example of output from the **show mdns requests** command without any keywords:

```
# show mdns requests
MDNS Outstanding Requests
=====
Request name :  _airplay._tcp.local
Request type  :  PTR
Request class :  IN
-----
Request name :  *.*
Request type  :  PTR
Request class :  IN
```

# show mdns statistics

To display mDNS statistics for the , use the **show mdns statistics** command in privileged EXEC mode.

```
show mdns statistics {all | service-list list-name | service-policy {all | interface type-number
}}
```

Syntax Description		
<b>all</b>		Displays the service policy, service list, and interface information.
<b>service-list</b> <i>list-name</i>		Displays the service list information.
<b>service-policy</b>		Displays the service policy information.
<b>interface</b> <i>type number</i>		Displays interface information.

**Command Default** None

**Command Modes** Privileged EXEC  
User EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Expressions are case sensitive, for example, if you enter | **exclude output**, the lines that contain "output" do not appear, but the lines that contain "Output" appear.

## Example

The following is a sample output from the **show mdns statistics all** command:

```
# show mdns statistics all

mDNS Statistics
mDNS packets sent      : 0
mDNS packets received  : 0
mDNS packets dropped   : 0
mDNS cache memory in use: 64224(bytes)
```



# show platform software fed switch ip multicast

To display platform-dependent IP multicast tables and other information, use the **show platform software fed switch ip multicast** command in privileged EXEC mode.

**show platform software fed switch***switch-number* | **active** | **standby****ip multicastgroups** | **hardware**[**detail**] | **interfaces** | **retry**

Syntax Description		
<b>switch</b> { <i>switch_num</i>   <b>active</b>   <b>standby</b> }	The device for which you want to display information.	<ul style="list-style-type: none"> <li>• <i>switch_num</i>—Enter the switch ID. Displays information for the specified switch.</li> <li>• <b>active</b>—Displays information for the active switch.</li> <li>• <b>standby</b>—Displays information for the standby switch, if available.</li> </ul>
<b>groups</b>	Displays the IP multicast routes per group.	
<b>hardware</b> [ <b>detail</b> ]	Displays the IP multicast routes loaded into hardware. The optional <b>detail</b> keyword is used to show the port members in the destination index and route index.	
<b>interfaces</b>	Displays the IP multicast interfaces.	
<b>retry</b>	Displays the IP multicast routes in the retry queue.	

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use this command only when you are working directly with a technical support representative while troubleshooting a problem. Do not use this command unless a technical support representative asks you to do so.

## Example

The following example shows how to display platform IP multicast routes per group:

```
Device# show platform software fed active ip multicast groups

Total Number of entries:3
MROUTE ENTRY vrf 0 (*, 224.0.0.0)
Token: 0x0000001f6 flags: C
No RPF interface.
Number of OIF: 0
Flags: 0x10 Pkts : 0
OIF Details:No OIF interface.
```

```

DI details
-----
Handle:0x603cf7f8 Res-Type:ASIC_RSC_DI Asic-Num:255
Feature-ID:AL_FID_L3_MULTICAST_IPV4 Lkp-ftr-id:LKP_FEAT_INVALID ref_count:1
Hardware Indices/Handles: index0:0x51f6 index1:0x51f6

Cookie length 56
0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x4 0xe0 0x0 0x0 0x0 0x0 0x0
0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0
0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0 0x0

Detailed Resource Information (ASIC# 0)
-----

al_rsc_di
RM:index = 0x51f6
RM:pmap = 0x0
RM:cmi = 0x0
RM:rcp_pmap = 0x0
RM:force data copy = 0
RM:remote cpu copy = 0
RM:remote data copy = 0
RM:local cpu copy = 0
RM:local data copy = 0

al_rsc_cmi
RM:index = 0x51f6
RM:cti_lo[0] = 0x0
RM:cti_lo[1] = 0x0
RM:cti_lo[2] = 0x0
RM:cpu_q_vpn[0] = 0x0
RM:cpu_q_vpn[1] = 0x0
RM:cpu_q_vpn[2] = 0x0
RM:npu_index = 0x0
RM:strip_seg = 0x0
RM:copy_seg = 0x0
Detailed Resource Information (ASIC# 1)
-----

al_rsc_di
RM:index = 0x51f6
RM:pmap = 0x0
RM:cmi = 0x0
RM:rcp_pmap = 0x0
RM:force data copy = 0
RM:remote cpu copy = 0
RM:remote data copy = 0
RM:local cpu copy = 0
RM:local data copy = 0

al_rsc_cmi
RM:index = 0x51f6
RM:cti_lo[0] = 0x0
RM:cti_lo[1] = 0x0
RM:cti_lo[2] = 0x0
RM:cpu_q_vpn[0] = 0x0
RM:cpu_q_vpn[1] = 0x0
RM:cpu_q_vpn[2] = 0x0
RM:npu_index = 0x0
RM:strip_seg = 0x0
RM:copy_seg = 0x0
=====

```

<output truncated>

show platform software fed switch ip multicast



# PART **V**

## **IPv6**

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## IPv6 Commands

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## clear ipv6 access-list

To reset the IPv6 access list match counters, use the **clear ipv6 access-list** command in privileged EXEC mode.

```
clear ipv6 access-list [access-list-name]
```

<b>Syntax Description</b>	<i>access-list-name</i> (Optional) Name of the IPv6 access list for which to clear the match counters. Names cannot contain a space or quotation mark, or begin with a numeric.
---------------------------	---

**Command Default** No reset is initiated.

**Command Modes** Privileged EXEC (#)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **clear ipv6 access-list** command is similar to the **clear ip access-list counters** command, except that it is IPv6-specific.

The **clear ipv6 access-list** command used without the *access-list-name* argument resets the match counters for all IPv6 access lists configured on the router.

This command resets the IPv6 global ACL hardware counters.

### Examples

The following example resets the match counters for the IPv6 access list named marketing:

```
Device# clear ipv6 access-list marketing
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>hardware statistics</b>	Enables the collection of hardware statistics.
	<b>ipv6 access-list</b>	Defines an IPv6 access list and enters IPv6 access list configuration mode.
	<b>show ipv6 access-list</b>	Displays the contents of all current IPv6 access lists.

# clear ipv6 dhcp

To clear IPv6 Dynamic Host Configuration Protocol (DHCP) information, use the **clear ipv6 dhcp** command in privileged EXEC mode:

```
clear ipv6 dhcp
```

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **clear ipv6 dhcp** command deletes DHCP for IPv6 information.

## Examples

The following example :

```
Device# clear ipv6 dhcp
```

# clear ipv6 dhcp binding

To delete automatic client bindings from the Dynamic Host Configuration Protocol (DHCP) for IPv6 server binding table, use the **clear ipv6 dhcp binding** command in privileged EXEC mode.

```
clear ipv6 dhcp binding [ipv6-address] [vrf vrf-name]
```

Syntax Description	
<i>ipv6-address</i>	(Optional) The address of a DHCP for IPv6 client.  This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **clear ipv6 dhcp binding** command is used as a server function.

A binding table entry on the DHCP for IPv6 server is automatically:

- Created whenever a prefix is delegated to a client from the configuration pool.
- Updated when the client renews, rebinds, or confirms the prefix delegation.
- Deleted when the client releases all the prefixes in the binding voluntarily, all prefixes' valid lifetimes have expired, or an administrator runs the **clear ipv6 dhcp binding** command.

If the **clear ipv6 dhcp binding** command is used with the optional *ipv6-address* argument specified, only the binding for the specified client is deleted. If the **clear ipv6 dhcp binding** command is used without the *ipv6-address* argument, then all automatic client bindings are deleted from the DHCP for IPv6 binding table. If the optional **vrf** *vrf-name* keyword and argument combination is used, only the bindings for the specified VRF are cleared.

## Examples

The following example deletes all automatic client bindings from the DHCP for IPv6 server binding table:

```
Device# clear ipv6 dhcp binding
```

Related Commands	Command	Description
	<b>show ipv6 dhcp binding</b>	Displays automatic client bindings from the DHCP for IPv6 server binding table.

# clear ipv6 dhcp client

To restart the Dynamic Host Configuration Protocol (DHCP) for IPv6 client on an interface, use the **clear ipv6 dhcp client** command in privileged EXEC mode.

**clear ipv6 dhcp client** *interface-type interface-number*

## Syntax Description

<i>interface-type interface-number</i>	Interface type and number. For more information, use the question mark (?) online help function.
--	--

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **clear ipv6 dhcp client** command restarts the DHCP for IPv6 client on specified interface after first releasing and unconfiguring previously acquired prefixes and other configuration options (for example, Domain Name System [DNS] servers).

## Examples

The following example restarts the DHCP for IPv6 client for Ethernet interface 1/0:

```
Device# clear ipv6 dhcp client Ethernet 1/0
```

## Related Commands

Command	Description
<b>show ipv6 dhcp interface</b>	Displays DHCP for IPv6 interface information.

# clear ipv6 dhcp conflict

To clear an address conflict from the Dynamic Host Configuration Protocol for IPv6 (DHCPv6) server database, use the **clear ipv6 dhcp conflict** command in privileged EXEC mode.

**clear ipv6 dhcp conflict** *\*ipv6-address* | **vrf** *vrf-name*

Syntax Description		
	*	Clears all address conflicts.
	<i>ipv6-address</i>	Clears the host IPv6 address that contains the conflicting address.
	<b>vrf</b> <i>vrf-name</i>	Specifies a virtual routing and forwarding (VRF) name.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** When you configure the DHCPv6 server to detect conflicts, it uses ping. The client uses neighbor discovery to detect clients and reports to the server through a DECLINE message. If an address conflict is detected, the address is removed from the pool, and the address is not assigned until the administrator removes the address from the conflict list.

If you use the asterisk (\*) character as the address parameter, DHCP clears all conflicts.

If the **vrf** *vrf-name* keyword and argument are specified, only the address conflicts that belong to the specified VRF will be cleared.

## Examples

The following example shows how to clear all address conflicts from the DHCPv6 server database:

```
Device# clear ipv6 dhcp conflict *
```

Related Commands	Command	Description
	<b>show ipv6 dhcp conflict</b>	Displays address conflicts found by a DHCPv6 server when addresses are offered to the client.

# clear ipv6 dhcp relay binding

To clear an IPv6 address or IPv6 prefix of a Dynamic Host Configuration Protocol (DHCP) for IPv6 relay binding, use the **clear ipv6 dhcp relay binding** command in privileged EXEC mode.

```
clear ipv6 dhcp relay binding vrf vrf-name* ipv6-addressipv6-prefix
```

```
clear ipv6 dhcp relay binding vrf vrf-name* ipv6-prefix
```

Syntax Description	Parameter	Description
	<b>vrf</b> <i>vrf-name</i>	Specifies a virtual routing and forwarding (VRF) configuration.
	*	Clears all DHCPv6 relay bindings.
	<i>ipv6-address</i>	DHCPv6 address.
	<i>ipv6-prefix</i>	IPv6 prefix.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **clear ipv6 dhcp relay binding** command deletes a specific IPv6 address or IPv6 prefix of a DHCP for IPv6 relay binding. If no relay client is specified, no binding is deleted.

## Examples

The following example shows how to clear the binding for a client with a specified IPv6 address:

```
Device# clear ipv6 dhcp relay binding 2001:0DB8:3333:4::5
```

The following example shows how to clear the binding for a client with the VRF name vrf1 and a specified prefix on a Cisco uBR10012 universal broadband device:

```
Device# clear ipv6 dhcp relay binding vrf vrf1 2001:DB8:0:1::/64
```

Related Commands	Command	Description
	<b>show ipv6 dhcp relay binding</b>	Displays DHCPv6 IANA and DHCPv6 IAPD bindings on a relay agent.



## clear ipv6 eigrp

To delete entries from Enhanced Interior Gateway Routing Protocol (EIGRP) for IPv6 routing tables, use the **clear ipv6 eigrp** command in privileged EXEC mode.

```
clear ipv6 eigrp [as-number] [neighbor [ipv6-address | interface-type interface-number]]
```

Syntax Description		
<i>as-number</i>	(Optional) Autonomous system number.	
<b>neighbor</b>	(Optional) Deletes neighbor router entries.	
<i>ipv6-address</i>	(Optional) IPv6 address of a neighboring router.	
<i>interface-type</i>	(Optional) The interface type of the neighbor router.	
<i>interface-number</i>	(Optional) The interface number of the neighbor router.	

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **clear ipv6 eigrp** command without any arguments or keywords to clear all EIGRP for IPv6 routing table entries. Use the *as-number* argument to clear routing table entries on a specified process, and use the **neighbor***ipv6-address* keyword and argument, or the *interface-type**interface-number* argument, to remove a specific neighbor from the neighbor table.

### Examples

The following example removes the neighbor whose IPv6 address is 3FEE:12E1:2AC1:EA32:

```
Device# clear ipv6 eigrp neighbor 3FEE:12E1:2AC1:EA32
```

## clear ipv6 mfib counters

To reset all active Multicast Forwarding Information Base (MFIB) traffic counters, use the **clear ipv6 mfib counters** command in privileged EXEC mode.

**clear ipv6 mfib** [**vrf** *vrf-name*] **counters** [*group-name* | *group-address* [*source-address**source-name*]]

### Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<i>group-name</i>   <i>group-address</i>	(Optional) IPv6 address or name of the multicast group.
<i>source-address</i>   <i>source-name</i>	(Optional) IPv6 address or name of the source.

### Command Modes

Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

After you enable the **clear ipv6 mfib counters** command, you can determine if additional traffic is forwarded by using one of the following show commands that display traffic counters:

- **show ipv6 mfib**
- **show ipv6 mfib active**
- **show ipv6 mfib count**
- **show ipv6 mfib interface**
- **show ipv6 mfib summary**

### Examples

The following example clears and resets all MFIB traffic counters:

```
Device# clear ipv6 mfib counters
```

## clear ipv6 mld counters

To clear the Multicast Listener Discovery (MLD) interface counters, use the **clear ipv6 mld counters** command in privileged EXEC mode.

```
clear ipv6 mld [vrf vrf-name] counters [interface-type]
```

Syntax Description	<i>vrf vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
	<i>interface-type</i>	(Optional) Interface type. For more information, use the question mark (?) online help function.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **clear ipv6 mld counters** command to clear the MLD counters, which keep track of the number of joins and leaves received. If you omit the optional *interface-type* argument, the **clear ipv6 mld counters** command clears the counters on all interfaces.

### Examples

The following example clears the counters for Ethernet interface 1/0:

```
Device# clear ipv6 mld counters Ethernet1/0
```

Related Commands	Command	Description
	<b>show ipv6 mld interface</b>	Displays multicast-related information about an interface.

# clear ipv6 mld traffic

To reset the Multicast Listener Discovery (MLD) traffic counters, use the **clear ipv6 mld traffic** command in privileged EXEC mode.

**clear ipv6 mld** [*vrf vrf-name*] **traffic**

## Syntax Description

<b>vrf vrf-name</b>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
---------------------	--

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Using the **clear ipv6 mld traffic** command will reset all MLD traffic counters.

## Examples

The following example resets the MLD traffic counters:

```
Device# clear ipv6 mld traffic
```

Command	Description
<b>show ipv6 mld traffic</b>	Displays the MLD traffic counters.

# clear ipv6 mtu

To clear the maximum transmission unit (MTU) cache of messages, use the **clear ipv6 mtu** command in privileged EXEC mode.

**clear ipv6 mtu**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Messages are not cleared from the MTU cache.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** If a router is flooded with ICMPv6 toobig messages, the router is forced to create an unlimited number of entries in the MTU cache until all available memory is consumed. Use the **clear ipv6 mtu** command to clear messages from the MTU cache.

**Examples** The following example clears the MTU cache of messages:

```
Device# clear ipv6 mtu
```

Related Commands	Command	Description
	<b>ipv6 flowset</b>	Configures flow-label marking in 1280-byte or larger packets sent by the router.

# clear ipv6 multicast aaa authorization

To clear authorization parameters that restrict user access to an IPv6 multicast network, use the **clear ipv6 multicast aaa authorization** command in privileged EXEC mode.

**clear ipv6 multicast aaa authorization** [*interface-type interface-number*]

## Syntax Description

<i>interface-type interface-number</i>	Interface type and number. For more information, use the question mark (?) online help function.
--	--

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Using the **clear ipv6 multicast aaa authorization** command without the optional *interface-type* and *interface-number* arguments will clear all authorization parameters on a network.

## Examples

The following example clears all configured authorization parameters on an IPv6 network:

```
Device# clear ipv6 multicast aaa authorization FastEthernet 1/0
```

## Related Commands

Command	Description
<b>aaa authorization multicast default</b>	Sets parameters that restrict user access to an IPv6 multicast network.

## clear ipv6 nd destination

To clear IPv6 host-mode destination cache entries, use the **clear ipv6 nd destination** command in privileged EXEC mode.

```
clear ipv6 nd destination[vrf vrf-name]
```

<b>Syntax Description</b>	<b>vrf</b> <i>vrf-name</i> (Optional) Specifies a virtual routing and forwarding (VRF) configuration.
---------------------------	---

**Command Modes** Privileged EXEC (#)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **clear ipv6 nd destination** command clears IPv6 host-mode destination cache entries. If the **vrf** *vrf-name* keyword and argument pair is used, then only information about the specified VRF is cleared.

### Examples

The following example shows how to clear IPv6 host-mode destination cache entries:

```
Device# clear ipv6 nd destination
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>ipv6 nd host mode strict</b>	Enables the conformant, or strict, IPv6 host mode.

# clear ipv6 nd on-link prefix

To clear on-link prefixes learned through router advertisements (RAs), use the **clear ipv6 nd on-link prefix** command in privileged EXEC mode.

**clear ipv6 nd on-link prefix**[*vrf vrf-name*]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
----------------------------	--

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **clear ipv6 nd on-link prefix** command to clear locally reachable IPv6 addresses (e.g., on-link prefixes) learned through RAs. If the **vrf** *vrf-name* keyword and argument pair is used, then only information about the specified VRF is cleared.

## Examples

The following examples shows how to clear on-link prefixes learned through RAs:

```
Device# clear ipv6 nd on-link prefix
```

## Related Commands

Command	Description
<b>ipv6 nd host mode strict</b>	Enables the conformant, or strict, IPv6 host mode.



## clear ipv6 nd router

To clear neighbor discovery (ND) device entries learned through router advertisements (RAs), use the **clear ipv6 nd router** command in privileged EXEC mode.

```
clear ipv6 nd router[vrf vrf-name]
```

<b>Syntax Description</b>	<b>vrf</b> <i>vrf-name</i> (Optional) Specifies a virtual routing and forwarding (VRF) configuration.
---------------------------	---

**Command Modes** Privileged EXEC (#)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **clear ipv6 nd router** command to clear ND device entries learned through RAs. If the **vrf** *vrf-name* keyword and argument pair is used, then only information about the specified VRF is cleared.

### Examples

The following example shows how to clear neighbor discovery ND device entries learned through RAs:

```
Device# clear ipv6 nd router
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>ipv6 nd host mode strict</b>	Enables the conformant, or strict, IPv6 host mode.

## clear ipv6 neighbors

To delete all entries in the IPv6 neighbor discovery cache, except static entries and ND cache entries on non-virtual routing and forwarding (VRF) interfaces, use the **clear ipv6 neighbors** command in privileged EXEC mode.

```
clear ipv6 neighbors [interface type number[ipv6 ipv6-address] | statistics | vrf table-name
[ipv6-address | statistics]]
```

**clear ipv6 neighbors**

### Syntax Description

<b>interface</b> <i>type number</i>	(Optional) Clears the IPv6 neighbor discovery cache in the specified interface.
<b>ipv6</b> <i>ipv6-address</i>	(Optional) Clears the IPv6 neighbor discovery cache that matches the specified IPv6 address on the specified interface.
<b>statistics</b>	(Optional) Clears the IPv6 neighbor discovery entry cache.
<b>vrf</b>	(Optional) Clears entries for a virtual private network (VPN) routing or forwarding instance.
<i>table-name</i>	(Optional) Table name or identifier. The value range is from 0x0 to 0xFFFFFFFF (0 to 65535 in decimal).

### Command Modes

Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **clear ipv6 neighbor** command clears ND cache entries. If the command is issued without the **vrf** keyword, then the command clears ND cache entries on interfaces associated with the default routing table (e.g., those interfaces that do not have a **vrf forwarding** statement). If the command is issued with the **vrf** keyword, then it clears ND cache entries on interfaces associated with the specified VRF.

### Examples

The following example deletes all entries, except static entries and ND cache entries on non-VRF interfaces, in the neighbor discovery cache:

```
Device# clear ipv6 neighbors
```

The following example clears all IPv6 neighbor discovery cache entries, except static entries and ND cache entries on non-VRF interfaces, on Ethernet interface 0/0:

```
Device# clear ipv6 neighbors interface Ethernet 0/0
```

The following example clears a neighbor discovery cache entry for 2001:0DB8:1::1 on Ethernet interface 0/0:

```
Device# clear ipv6 neighbors interface Ethernet0/0 ipv6 2001:0DB8:1::1
```

In the following example, interface Ethernet 0/0 is associated with the VRF named red. Interfaces Ethernet 1/0 and Ethernet 2/0 are associated with the default routing table (because they are not associated with a VRF). Therefore, the **clear ipv6 neighbor** command will clear ND cache entries on interfaces Ethernet 1/0 and Ethernet 2/0 only. In order to clear ND cache entries on interface Ethernet 0/0, the user must issue the **clear ipv6 neighbor vrf red** command.

```
interface ethernet0/0
  vrf forward red
  ipv6 address 2001:db8:1::1/64

interface ethernet1/0
  ipv6 address 2001:db8:2::1/64

interface ethernet2/0
  ipv6 address 2001:db8:3::1/64
```

#### Related Commands

Command	Description
<b>ipv6 neighbor</b>	Configures a static entry in the IPv6 neighbor discovery cache.
<b>show ipv6 neighbors</b>	Displays IPv6 neighbor discovery cache information.

## clear ipv6 nhrp

To clear all dynamic entries from the Next Hop Resolution Protocol (NHRP) cache, use the **clear ipv6 nhrp** command in privileged EXEC mode.

**clear ipv6 nhrp** [*ipv6-address* | **counters**]

Syntax Description	
<i>ipv6-address</i>	(Optional) The IPv6 network to delete.
<b>counters</b>	(Optional) Specifies NHRP counters to delete.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command does not clear any static (configured) IPv6-to-nonbroadcast multiaccess (NBMA) address mappings from the NHRP cache.

### Examples

The following example shows how to clear all dynamic entries from the NHRP cache for the interface:

```
Device# clear ipv6 nhrp
```

Related Commands	Command	Description
	<b>show ipv6 nhrp</b>	Displays the NHRP cache.

# clear ipv6 ospf

To clear the Open Shortest Path First (OSPF) state based on the OSPF routing process ID, use the **clear ipv6 ospf** command in privileged EXEC mode.

**clear ipv6 ospf** [*process-id*] **process** | **force-spf** | **redistribution**

Syntax Description		
<i>process-id</i>	(Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when enabling the OSPF routing process.	
<b>process</b>	Restarts the OSPF process.	
<b>force-spf</b>	Starts the shortest path first (SPF) algorithm without first clearing the OSPF database.	
<b>redistribution</b>	Clears OSPF route redistribution.	

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** When the **process** keyword is used with the **clear ipv6 ospf** command, the OSPF database is cleared and repopulated, and then the shortest path first (SPF) algorithm is performed. When the **force-spf** keyword is used with the **clear ipv6 ospf** command, the OSPF database is not cleared before the SPF algorithm is performed.

Use the *process-id* option to clear only one OSPF process. If the *process-id* option is not specified, all OSPF processes are cleared.

## Examples

The following example starts the SPF algorithm without clearing the OSPF database:

```
Device# clear ipv6 ospf force-spf
```

## clear ipv6 ospf counters

To clear the Open Shortest Path First (OSPF) state based on the OSPF routing process ID, use the **clear ipv6 ospf** command in privileged EXEC mode.

```
clear ipv6 ospf [process-id] counters [neighbor [neighbor-interfaceneighbor-id]]
```

### Syntax Description

<i>process-id</i>	(Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when enabling the OSPF routing process.
<b>neighbor</b>	(Optional) Neighbor statistics per interface or neighbor ID.
<i>neighbor-interface</i>	(Optional) Neighbor interface.
<i>neighbor-id</i>	(Optional) IPv6 or IP address of the neighbor.

### Command Modes

Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **neighbor** *neighbor-interface* option to clear counters for all neighbors on a specified interface. If the **neighbor** *neighbor-interface* option is not used, all OSPF counters are cleared.

Use the **neighbor** *neighbor-id* option to clear counters at a specified neighbor. If the **neighbor** *neighbor-id* option is not used, all OSPF counters are cleared.

### Examples

The following example provides detailed information on a neighbor router:

```
Device# show ipv6 ospf neighbor detail
Neighbor 10.0.0.1
  In the area 1 via interface Serial19/0
  Neighbor:interface-id 21, link-local address FE80::A8BB:CFFF:FE00:6F00
  Neighbor priority is 1, State is FULL, 6 state changes
  Options is 0x194AE05
  Dead timer due in 00:00:37
  Neighbor is up for 00:00:15
  Index 1/1/1, retransmission queue length 0, number of retransmission 1
  First 0x0(0)/0x0(0)/0x0(0) Next 0x0(0)/0x0(0)/0x0(0)
  Last retransmission scan length is 1, maximum is 1
  Last retransmission scan time is 0 msec, maximum is 0 msec
```

The following example clears all neighbors on the specified interface:

```
Device# clear ipv6 ospf counters neighbor s19/0
```

The following example now shows that there have been 0 state changes since the **clear ipv6 ospf counters neighbor s19/0** command was used:

```

Device# show ipv6 ospf neighbor detail
Neighbor 10.0.0.1
  In the area 1 via interface Serial19/0
  Neighbor:interface-id 21, link-local address FE80::A8BB:CCFF:FE00:6F00
  Neighbor priority is 1, State is FULL, 0 state changes
  Options is 0x194AE05
  Dead timer due in 00:00:39
  Neighbor is up for 00:00:43
  Index 1/1/1, retransmission queue length 0, number of retransmission 1
  First 0x0(0)/0x0(0)/0x0(0) Next 0x0(0)/0x0(0)/0x0(0)
  Last retransmission scan length is 1, maximum is 1
  Last retransmission scan time is 0 msec, maximum is 0 msec

```

**Related Commands**

Command	Description
<b>show ipv6 ospf neighbor</b>	Displays OSPF neighbor information on a per-interface basis.

## clear ipv6 ospf events

To clear the Open Shortest Path First (OSPF) for IPv6 event log content based on the OSPF routing process ID, use the **clear ipv6 ospf events** command in privileged EXEC mode.

**clear ipv6 ospf** [*process-id*] **events**

### Syntax Description

<i>process-id</i>	(Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when enabling the OSPF routing process.
-------------------	--

### Command Modes

Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the optional *process-id* argument to clear the IPv6 event log content of a specified OSPF routing process. If the *process-id* argument is not used, all event log content is cleared.

### Examples

The following example enables the clearing of OSPF for IPv6 event log content for routing process 1:

```
Device# clear ipv6 ospf 1 events
```



## clear ipv6 pim reset

To delete all entries from the topology table and reset the Multicast Routing Information Base (MRIB) connection, use the **clear ipv6 pim reset** command in privileged EXEC mode.

```
clear ipv6 pim [vrf vrf-name] reset
```

<b>Syntax Description</b>	<b>vrf</b> <i>vrf-name</i> (Optional) Specifies a virtual routing and forwarding (VRF) configuration.
---------------------------	---

**Command Modes** Privileged EXEC (#)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Using the **clear ipv6 pim reset** command breaks the PIM-MRIB connection, clears the topology table, and then reestablishes the PIM-MRIB connection. This procedure forces MRIB resynchronization.



**Caution** Use the **clear ipv6 pim reset** command with caution, as it clears all PIM protocol information from the PIM topology table. Use of the **clear ipv6 pim reset** command should be reserved for situations where PIM and MRIB communication are malfunctioning.

### Examples

The following example deletes all entries from the topology table and resets the MRIB connection:

```
Device# clear ipv6 pim reset
```

## clear ipv6 pim topology

To clear the Protocol Independent Multicast (PIM) topology table, use the **clear ipv6 pim topology** command in privileged EXEC mode.

**clear ipv6 pim** [**vrf** *vrf-name*] **topology** [*group-name**group-address*]

<b>Syntax Description</b>	<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
	<i>group-name</i>   <i>group-address</i>	(Optional) IPv6 address or name of the multicast group.

**Command Default** When the command is used with no arguments, all group entries located in the PIM topology table are cleared of PIM protocol information.

**Command Modes** Privileged EXEC (#)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command clears PIM protocol information from all group entries located in the PIM topology table. Information obtained from the MRIB table is retained. If a multicast group is specified, only those group entries are cleared.

### Examples

The following example clears all group entries located in the PIM topology table:

```
Device# clear ipv6 pim topology
```

## clear ipv6 pim traffic

To clear the Protocol Independent Multicast (PIM) traffic counters, use the **clear ipv6 pim traffic** command in privileged EXEC mode.

```
clear ipv6 pim [vrf vrf-name] traffic
```

<b>Syntax Description</b>	<b>vrf</b> <i>vrf-name</i> (Optional) Specifies a virtual routing and forwarding (VRF) configuration.
---------------------------	---

**Command Default** When the command is used with no arguments, all traffic counters are cleared.

**Command Modes** Privileged EXEC (#)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command clears PIM traffic counters. If the **vrf** *vrf-name* keyword and argument are used, only those counters are cleared.

**Examples** The following example clears all PIM traffic counter:

```
Device# clear ipv6 pim traffic
```

## clear ipv6 prefix-list

To reset the hit count of the IPv6 prefix list entries, use the **clear ipv6 prefix-list** command in privileged EXEC mode.

**clear ipv6 prefix-list** [*prefix-list-name*] [*ipv6-prefix/prefix-length*]

### Syntax Description

<i>prefix-list-name</i>	(Optional) The name of the prefix list from which the hit count is to be cleared.
<i>ipv6-prefix</i>	(Optional) The IPv6 network from which the hit count is to be cleared. This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
<i>/ prefix-length</i>	(Optional) The length of the IPv6 prefix. A decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash mark must precede the decimal value.

### Command Default

The hit count is automatically cleared for all IPv6 prefix lists.

### Command Modes

Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **clear ipv6 prefix-list** command is similar to the **clear ip prefix-list** command, except that it is IPv6-specific.

The hit count is a value indicating the number of matches to a specific prefix list entry.

### Examples

The following example clears the hit count from the prefix list entries for the prefix list named `first_list` that match the network mask `2001:0DB8::/35`.

```
Device# clear ipv6 prefix-list first_list 2001:0DB8::/35
```

### Related Commands

Command	Description
<b>ipv6 prefix-list</b>	Creates an entry in an IPv6 prefix list.
<b>ipv6 prefix-list sequence-number</b>	Enables the generation of sequence numbers for entries in an IPv6 prefix list.
<b>show ipv6 prefix-list</b>	Displays information about an IPv6 prefix list or prefix list entries.

# clear ipv6 rip

To delete routes from the IPv6 Routing Information Protocol (RIP) routing table, use the **clear ipv6 rip** command in privileged EXEC mode.

```
clear ipv6 rip [name][vrf vrf-name]
```

```
clear ipv6 rip [name]
```

Syntax Description		
	<i>name</i>	(Optional) Name of an IPv6 RIP process.
	<b>vrf</b> <i>vrf-name</i>	(Optional) Clears information about the specified Virtual Routing and Forwarding (VRF) instance.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

When the *name* argument is specified, only routes for the specified IPv6 RIP process are deleted from the IPv6 RIP routing table. If no *name* argument is specified, all IPv6 RIP routes are deleted.

Use the **show ipv6 rip** command to display IPv6 RIP routes.

Use the **clear ipv6 rip name vrf vrf-name** command to delete the specified VRF instances for the specified IPv6 RIP process.

## Examples

The following example deletes all the IPv6 routes for the RIP process called one:

```
Device# clear ipv6 rip one
```

The following example deletes the IPv6 VRF instance, called vrf1 for the RIP process, called one:

```
Device# clear ipv6 rip one vrf vrf1
```

```
*Mar 15 12:36:17.022: RIPng: Deleting 2001:DB8::/32
*Mar 15 12:36:17.022: [Exec]IPv6RT[vrf1]: rip <name>, Delete all next-hops for 2001:DB8::1
*Mar 15 12:36:17.022: [Exec]IPv6RT[vrf1]: rip <name>, Delete 2001:DB8::1 from table
*Mar 15 12:36:17.022: [IPv6 RIB Event Handler]IPv6RT[<red>]: Event: 2001:DB8::1, Del, owner
rip, previous None
```

Related Commands	Command	Description
	<b>debug ipv6 rip</b>	Displays the current contents of the IPv6 RIP routing table.
	<b>ipv6 rip vrf-mode enable</b>	Enables VRF-aware support for IPv6 RIP.
	<b>show ipv6 rip</b>	Displays the current content of the IPv6 RIP routing table.

# clear ipv6 route

To delete routes from the IPv6 routing table, use the **clear ipv6 route** command in privileged EXEC mode.

**clear ipv6 route** *ipv6-address*/*ipv6-prefix/prefix-length* | \*

## Syntax Description

<i>ipv6-address</i>	The address of the IPv6 network to delete from the table.  This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
<i>ipv6-prefix</i>	The IPv6 network number to delete from the table.  This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
<i>/ prefix-length</i>	The length of the IPv6 prefix. A decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash mark must precede the decimal value.
*	Clears all IPv6 routes.

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **clear ipv6 route** command is similar to the **clear ip route** command, except that it is IPv6-specific.

When the *ipv6-address* or *ipv6-prefix/prefix-length* argument is specified, only that route is deleted from the IPv6 routing table. When the \* keyword is specified, all routes are deleted from the routing table (the per-destination maximum transmission unit [MTU] cache is also cleared).

## Examples

The following example deletes the IPv6 network 2001:0DB8::/35:

```
Device# clear ipv6 route 2001:0DB8::/35
```

## Related Commands

Command	Description
<b>ipv6 route</b>	Establishes static IPv6 routes.
<b>show ipv6 route</b>	Displays the current contents of the IPv6 routing table.

# clear ipv6 spd

To clear the most recent Selective Packet Discard (SPD) state transition, use the **clear ipv6 spd** command in privileged EXEC mode.

**clear ipv6 spd**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **clear ipv6 spd** command removes the most recent SPD state transition and any trend historical data.

**Examples** The following example shows how to clear the most recent SPD state transition:

```
Device# clear ipv6 spd
```

# clear ipv6 traffic

To reset IPv6 traffic counters, use the **clear ipv6 traffic** command in privileged EXEC mode.

**clear ipv6 traffic** [*interface-type interface-number*]

## Syntax Description

<i>interface-type interface-number</i>	Interface type and number. For more information, use the question mark (?) online help function.
--	--

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Using this command resets the counters in the output from the **show ipv6 traffic** command.

## Examples

The following example resets the IPv6 traffic counters. The output from the **show ipv6 traffic** command shows that the counters are reset:

```
Device# clear ipv6 traffic
Device# show ipv6 traffic
IPv6 statistics:
  Rcvd: 1 total, 1 local destination
        0 source-routed, 0 truncated
        0 format errors, 0 hop count exceeded
        0 bad header, 0 unknown option, 0 bad source
        0 unknown protocol, 0 not a router
        0 fragments, 0 total reassembled
        0 reassembly timeouts, 0 reassembly failures
  Sent: 1 generated, 0 forwarded
        0 fragmented into 0 fragments, 0 failed
        0 encapsulation failed, 0 no route, 0 too big
  Mcast: 0 received, 0 sent
ICMP statistics:
  Rcvd: 1 input, 0 checksum errors, 0 too short
        0 unknown info type, 0 unknown error type
  unreachable: 0 routing, 0 admin, 0 neighbor, 0 address, 0 port
  parameter: 0 error, 0 header, 0 option
        0 hopcount expired, 0 reassembly timeout, 0 too big
        0 echo request, 0 echo reply
        0 group query, 0 group report, 0 group reduce
        0 router solicit, 0 router advert, 0 redirects
        0 neighbor solicit, 1 neighbor advert
  Sent: 1 output
        unreachable: 0 routing, 0 admin, 0 neighbor, 0 address, 0 port
        parameter: 0 error, 0 header, 0 option
        0 hopcount expired, 0 reassembly timeout, 0 too big
        0 echo request, 0 echo reply
        0 group query, 0 group report, 0 group reduce
        0 router solicit, 0 router advert, 0 redirects
        0 neighbor solicit, 1 neighbor advert
UDP statistics:
```



```
Rcvd: 0 input, 0 checksum errors, 0 length errors
      0 no port, 0 dropped
Sent: 0 output
TCP statistics:
Rcvd: 0 input, 0 checksum errors
Sent: 0 output, 0 retransmitted
```

**Related Commands**

Command	Description
<b>show ipv6 traffic</b>	Displays IPv6 traffic statistics.

## ipv6 access-list

To define an IPv6 access list and to place the device in IPv6 access list configuration mode, use the **ipv6 access-list** command in global configuration mode. To remove the access list, use the **no** form of this command.

**ipv6 access-list** *access-list-name*  
**no ipv6 access-list** *access-list-name*

### Syntax Description

<i>access-list-name</i>	Name of the IPv6 access list. Names cannot contain a space or quotation mark, or begin with a numeric.
-------------------------	--

### Command Default

No IPv6 access list is defined.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **ipv6 access-list** command is similar to the **ip access-list** command, except that it is IPv6-specific.

The standard IPv6 ACL functionality supports --in addition to traffic filtering based on source and destination addresses--filtering of traffic based on IPv6 option headers and optional, upper-layer protocol type information for finer granularity of control (functionality similar to extended ACLs in IPv4). IPv6 ACLs are defined by using the **ipv6 access-list** command in global configuration mode and their permit and deny conditions are set by using the **deny** and **permit** commands in IPv6 access list configuration mode. Configuring the **ipv6 access-list** command places the device in IPv6 access list configuration mode--the device prompt changes to Device(config-ipv6-acl)#. From IPv6 access list configuration mode, permit and deny conditions can be set for the defined IPv6 ACL.



#### Note

IPv6 ACLs are defined by a unique name (IPv6 does not support numbered ACLs). An IPv4 ACL and an IPv6 ACL cannot share the same name.

For backward compatibility, the **ipv6 access-list** command with the **deny** and **permit** keywords in global configuration mode is still supported; however, an IPv6 ACL defined with deny and permit conditions in global configuration mode is translated to IPv6 access list configuration mode.

Refer to the deny (IPv6) and permit (IPv6) commands for more information on filtering IPv6 traffic based on IPv6 option headers and optional, upper-layer protocol type information. See the "Examples" section for an example of a translated IPv6 ACL configuration.



**Note** Every IPv6 ACL has implicit **permit icmp any any nd-na**, **permit icmp any any nd-ns**, and **deny ipv6 any any** statements as its last match conditions. (The former two match conditions allow for ICMPv6 neighbor discovery.) An IPv6 ACL must contain at least one entry for the implicit **deny ipv6 any any** statement to take effect. The IPv6 neighbor discovery process makes use of the IPv6 network layer service; therefore, by default, IPv6 ACLs implicitly allow IPv6 neighbor discovery packets to be sent and received on an interface. In IPv4, the Address Resolution Protocol (ARP), which is equivalent to the IPv6 neighbor discovery process, makes use of a separate data link layer protocol; therefore, by default, IPv4 ACLs implicitly allow ARP packets to be sent and received on an interface.



**Note** IPv6 prefix lists, not access lists, should be used for filtering routing protocol prefixes.

Use the **ipv6 traffic-filter** interface configuration command with the *access-list-name* argument to apply an IPv6 ACL to an IPv6 interface. Use the **ipv6 access-class** line configuration command with the *access-list-name* argument to apply an IPv6 ACL to incoming and outgoing IPv6 virtual terminal connections to and from the device.



**Note** An IPv6 ACL applied to an interface with the **ipv6 traffic-filter** command filters traffic that is forwarded, not originated, by the device.



**Note** When using this command to modify an ACL that is already associated with a bootstrap router (BSR) candidate rendezvous point (RP) (see the **ipv6 pim bsr candidate rp** command) or a static RP (see the **ipv6 pim rp-address** command), any added address ranges that overlap the PIM SSM group address range (FF3x::/96) are ignored. A warning message is generated and the overlapping address ranges are added to the ACL, but they have no effect on the operation of the configured BSR candidate RP or static RP commands.

Duplicate remark statements can no longer be configured from the IPv6 access control list. Because each remark statement is a separate entity, each one is required to be unique.

## Examples

The following example is from a device running Cisco IOS Release 12.0(23)S or later releases. The example configures the IPv6 ACL list named list1 and places the device in IPv6 access list configuration mode.

```
Device(config)# ipv6 access-list list1
Device(config-ipv6-acl)#
```

The following example is from a device running Cisco IOS Release 12.2(2)T or later releases, 12.0(21)ST, or 12.0(22)S. The example configures the IPv6 ACL named list2 and applies the ACL to outbound traffic on Ethernet interface 0. Specifically, the first ACL entry keeps all packets from the network FEC0:0:0:2::/64 (packets that have the site-local prefix FEC0:0:0:2 as the first 64 bits of their source IPv6 address) from exiting out of Ethernet interface 0. The second entry in the ACL permits all other traffic to exit out of Ethernet interface 0. The second entry is necessary because an implicit deny all condition is at the end of each IPv6 ACL.

```

Device(config)# ipv6 access-list list2 deny FEC0:0:0:2::/64 any
Device(config)# ipv6 access-list list2 permit any any
Device(config)# interface ethernet 0
Device(config-if)# ipv6 traffic-filter list2 out

```

If the same configuration was entered on a device running Cisco IOS Release 12.0(23)S or later releases, the configuration would be translated into IPv6 access list configuration mode as follows:

```

ipv6 access-list list2
  deny FEC0:0:0:2::/64 any
  permit ipv6 any any
interface ethernet 0
  ipv6 traffic-filter list2 out

```



**Note** IPv6 is automatically configured as the protocol type in **permit any any** and **deny any any** statements that are translated from global configuration mode to IPv6 access list configuration mode.



**Note** IPv6 ACLs defined on a device running Cisco IOS Release 12.2(2)T or later releases, 12.0(21)ST, or 12.0(22)S that rely on the implicit deny condition or specify a **deny any any** statement to filter traffic should contain **permit** statements for link-local and multicast addresses to avoid the filtering of protocol packets (for example, packets associated with the neighbor discovery protocol). Additionally, IPv6 ACLs that use **deny** statements to filter traffic should use a **permit any any** statement as the last statement in the list.



**Note** An IPv6 device will not forward to another network an IPv6 packet that has a link-local address as either its source or destination address (and the source interface for the packet is different from the destination interface for the packet).

## Related Commands

Command	Description
<b>deny (IPv6)</b>	Sets deny conditions for an IPv6 access list.
<b>ipv6 access-class</b>	Filters incoming and outgoing connections to and from the device based on an IPv6 access list.
<b>ipv6 pim bsr candidate rp</b>	Configures the candidate RP to send PIM RP advertisements to the BSR.
<b>ipv6 pim rp-address</b>	Configure the address of a PIM RP for a particular group range.
<b>ipv6 traffic-filter</b>	Filters incoming or outgoing IPv6 traffic on an interface.
<b>permit (IPv6)</b>	Sets permit conditions for an IPv6 access list.
<b>show ipv6 access-list</b>	Displays the contents of all current IPv6 access lists.

# ipv6 cef

To enable Cisco Express Forwarding for IPv6, use the **ipv6 cef** command in global configuration mode. To disable Cisco Express Forwarding for IPv6, use the **no** form of this command.

**ipv6 cef**  
**no ipv6 cef**

## Syntax Description

This command has no arguments or keywords.

## Command Default

Cisco Express Forwarding for IPv6 is disabled by default.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **ipv6 cef** command is similar to the **ip cef** command, except that it is IPv6-specific.

The **ipv6 cef** command is not available on the Cisco 12000 series Internet routers because this distributed platform operates only in distributed Cisco Express Forwarding for IPv6 mode.



### Note

The **ipv6 cef** command is not supported in interface configuration mode.



### Note

Some distributed architecture platforms support both Cisco Express Forwarding for IPv6 and distributed Cisco Express Forwarding for IPv6. When Cisco Express Forwarding for IPv6 is configured on distributed platforms, Cisco Express Forwarding switching is performed by the Route Processor (RP).



### Note

You must enable Cisco Express Forwarding for IPv4 by using the **ip cef** global configuration command before enabling Cisco Express Forwarding for IPv6 by using the **ipv6 cef** global configuration command.

Cisco Express Forwarding for IPv6 is advanced Layer 3 IP switching technology that functions the same and offer the same benefits as Cisco Express Forwarding for IPv4. Cisco Express Forwarding for IPv6 optimizes network performance and scalability for networks with dynamic, topologically dispersed traffic patterns, such as those associated with web-based applications and interactive sessions.

## Examples

The following example enables standard Cisco Express Forwarding for IPv4 operation and then standard Cisco Express Forwarding for IPv6 operation globally on the Device.

```
Device(config)# ip cef
Device(config)# ipv6 cef
```

### Related Commands

Command	Description
<b>ip route-cache</b>	Controls the use of high-speed switching caches for IP routing.
<b>ipv6 cef accounting</b>	Enables Cisco Express Forwarding for IPv6 and distributed Cisco Express Forwarding for IPv6 network accounting.
<b>ipv6 cef distributed</b>	Enables distributed Cisco Express Forwarding for IPv6.
<b>show cef</b>	Displays which packets the line cards dropped or displays which packets were not express-forwarded.
<b>show ipv6 cef</b>	Displays entries in the IPv6 FIB.

## ipv6 cef accounting

To enable Cisco Express Forwarding for IPv6 and distributed Cisco Express Forwarding for IPv6 network accounting, use the **ipv6 cef accounting** command in global configuration mode or interface configuration mode. To disable Cisco Express Forwarding for IPv6 network accounting, use the **no** form of this command.

```
ipv6 cef accounting accounting-types
no ipv6 cef accounting accounting-types
```

### Specific Cisco Express Forwarding Accounting Information Through Interface Configuration Mode

```
ipv6 cef accounting non-recursive external | internal
no ipv6 cef accounting non-recursive external | internal
```

Syntax Description	
<i>accounting-types</i>	The <i>accounting-types</i> argument must be replaced with at least one of the following keywords. Optionally, you can follow this keyword by any or all of the other keywords, but you can use each keyword only once. <ul style="list-style-type: none"> <li>• <b>load-balance-hash</b> --Enables load balancing hash bucket counters.</li> <li>• <b>non-recursive</b> --Enables accounting through nonrecursive prefixes.</li> <li>• <b>per-prefix</b> --Enables express forwarding of the collection of the number of packets and bytes to a destination (or prefix).</li> <li>• <b>prefix-length</b> --Enables accounting through prefix length.</li> </ul>
<b>non-recursive</b>	Enables accounting through nonrecursive prefixes. This keyword is optional when used in global configuration mode after another keyword is entered. See the <i>accounting-types</i> argument.
<b>external</b>	Counts input traffic in the nonrecursive external bin.
<b>internal</b>	Counts input traffic in the nonrecursive internal bin.

**Command Default** Cisco Express Forwarding for IPv6 network accounting is disabled by default.

**Command Modes** Global configuration (config)  
Interface configuration (config-if)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 cef accounting** command is similar to the **ip cef accounting** command, except that it is IPv6-specific. Configuring Cisco Express Forwarding for IPv6 network accounting enables you to collect statistics on Cisco Express Forwarding for IPv6 traffic patterns in your network.

When you enable network accounting for Cisco Express Forwarding for IPv6 by using the **ipv6 cef accounting** command in global configuration mode, accounting information is collected at the Route Processor (RP) when Cisco Express Forwarding for IPv6 mode is enabled and at the line cards when distributed Cisco Express Forwarding for IPv6 mode is enabled. You can then display the collected accounting information using the **show ipv6 cef** EXEC command.

For prefixes with directly connected next hops, the **non-recursive** keyword enables express forwarding of the collection of packets and bytes through a prefix. This keyword is optional when this command is used in global configuration mode after you enter another keyword on the **ipv6 cef accounting** command.

This command in interface configuration mode must be used in conjunction with the global configuration command. The interface configuration command allows a user to specify two different bins (internal or external) for the accumulation of statistics. The internal bin is used by default. The statistics are displayed through the **show ipv6 cef detail** command.

Per-destination load balancing uses a series of 16 hash buckets into which the set of available paths are distributed. A hash function operating on certain properties of the packet is applied to select a bucket that contains a path to use. The source and destination IP addresses are the properties used to select the bucket for per-destination load balancing. Use the **load-balance-hash** keyword with the **ipv6 cef accounting** command to enable per-hash-bucket counters. Enter the **show ipv6 cef prefix internal** command to display the per-hash-bucket counters.

## Examples

The following example enables the collection of Cisco Express Forwarding for IPv6 accounting information for prefixes with directly connected next hops:

```
Device(config)# ipv6 cef accounting non-recursive
```

## Related Commands

Command	Description
<b>ip cef accounting</b>	Enable Cisco Express Forwarding network accounting (for IPv4).
<b>show cef</b>	Displays information about packets <b>forwarded by Cisco Express Forwarding</b> .
<b>show ipv6 cef</b>	Displays entries in the IPv6 FIB.



# ipv6 cef distributed

To enable distributed Cisco Express Forwarding for IPv6, use the **ipv6 cef distributed** command in global configuration mode. To disable Cisco Express Forwarding for IPv6, use the **no** form of this command.

**ipv6 cef distributed**  
**no ipv6 cef distributed**

## Syntax Description

This command has no arguments or keywords.

## Command Default

Distributed Cisco Express Forwarding for IPv6 is disabled by default.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **ipv6 cef distributed** command is similar to the **ip cef distributed** command, except that it is IPv6-specific.

Enabling distributed Cisco Express Forwarding for IPv6 globally on the router by using the **ipv6 cef distributed** in global configuration mode distributes the Cisco Express Forwarding processing of IPv6 packets from the Route Processor (RP) to the line cards of distributed architecture platforms.



**Note** To forward distributed Cisco Express Forwarding for IPv6 traffic on the router, configure the forwarding of IPv6 unicast datagrams globally on your router by using the **ipv6 unicast-routing** global configuration command, and configure an IPv6 address and IPv6 processing on an interface by using the **ipv6 address** interface configuration command.



**Note** You must enable distributed Cisco Express Forwarding for IPv4 by using the **ip cef distributed** global configuration command before enabling distributed Cisco Express Forwarding for IPv6 by using the **ipv6 cef distributed** global configuration command.

Cisco Express Forwarding is advanced Layer 3 IP switching technology. Cisco Express Forwarding optimizes network performance and scalability for networks with dynamic, topologically dispersed traffic patterns, such as those associated with web-based applications and interactive sessions.

## Examples

The following example enables distributed Cisco Express Forwarding for IPv6 operation:

```
Device(config)# ipv6 cef distributed
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>ip route-cache</b>	Controls the use of high-speed switching caches for IP routing.
<b>show ipv6 cef</b>	Displays entries in the IPv6 FIB.

## ipv6 cef load-sharing algorithm

To select a Cisco Express Forwarding load-balancing algorithm for IPv6, use the **ipv6 cef load-sharing algorithm** command in global configuration mode. To return to the default universal load-balancing algorithm, use the **no** form of this command.

**ipv6 cef load-sharing algorithm original | universal[id]**  
**no ipv6 cef load-sharing algorithm**

Syntax Description	original	Sets the load-balancing algorithm to the original algorithm based on a source and destination hash.
	universal	Sets the load-balancing algorithm to the universal algorithm that uses a source and destination and an ID hash.
	id	(Optional) Fixed identifier in hexadecimal format.

**Command Default** The universal load-balancing algorithm is selected by default. If you do not configure the fixed identifier for a load-balancing algorithm, the router automatically generates a unique ID.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 cef load-sharing algorithm** command is similar to the **ip cef load-sharing algorithm** command, except that it is IPv6-specific.

When the Cisco Express Forwarding for IPv6 load-balancing algorithm is set to universal mode, each device on the network can make a different load-sharing decision for each source-destination address pair.

### Examples

The following example shows how to enable the Cisco Express Forwarding original load-balancing algorithm for IPv6:

```
Device(config)# ipv6 cef load-sharing algorithm original
```

Related Commands	Command	Description
	<b>ip cef load-sharing algorithm</b>	Selects a Cisco Express Forwarding load-balancing algorithm (for IPv4).

# ipv6 cef optimize neighbor resolution

To configure address resolution optimization from Cisco Express Forwarding for IPv6 for directly connected neighbors, use the **ipv6 cef optimize neighbor resolution** command in global configuration mode. To disable address resolution optimization from Cisco Express Forwarding for IPv6 for directly connected neighbors, use the **no** form of this command.

**ipv6 cef optimize neighbor resolution**  
**no ipv6 cef optimize neighbor resolution**

**Syntax Description** This command has no arguments or keywords.

**Command Default** If this command is not configured, Cisco Express Forwarding for IPv6 does not optimize the address resolution of directly connected neighbors.

**Command Modes** Global configuration (config)

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 cef optimize neighbor resolution** command is very similar to the **ip cef optimize neighbor resolution** command, except that it is IPv6-specific.

Use this command to trigger Layer 2 address resolution of neighbors directly from Cisco Express Forwarding for IPv6.

## Examples

The following example shows how to optimize address resolution from Cisco Express Forwarding for IPv6 for directly connected neighbors:

```
Device(config)# ipv6 cef optimize neighbor resolution
```

Command	Description
<b>ip cef optimize neighbor resolution</b>	Configures address resolution optimization from Cisco Express Forwarding for IPv4 for directly connected neighbors.

## ipv6 destination-guard policy

To define a destination guard policy, use the **ipv6 destination-guard policy** command in global configuration mode. To remove the destination guard policy, use the **no** form of this command.

```
ipv6 destination-guard policy [policy-name]
no ipv6 destination-guard policy [policy-name]
```

### Syntax Description

<i>policy-name</i>	(Optional) Name of the destination guard policy.
--------------------	--

### Command Default

No destination guard policy is defined.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

This command enters destination-guard configuration mode. The destination guard policies can be used to filter IPv6 traffic based on the destination address to block data traffic from an unknown source.

### Examples

The following example shows how to define the name of a destination guard policy:

```
Device(config)#ipv6 destination-guard policy policy1
```

### Related Commands

Command	Description
<b>show ipv6 destination-guard policy</b>	Displays destination guard information.

# ipv6 dhcp-relay bulk-lease

To configure bulk lease query parameters, use the **ipv6 dhcp-relay bulk-lease** command in global configuration mode. To remove the bulk-lease query configuration, use the **no** form of this command.

**ipv6 dhcp-relay bulk-lease data-timeout** *seconds* | **retry** *number* [**disable**]  
**no ipv6 dhcp-relay bulk-lease** [**disable**]

## Syntax Description

<b>data-timeout</b>	(Optional) Bulk lease query data transfer timeout.
<i>seconds</i>	(Optional) The range is from 60 seconds to 600 seconds. The default is 300 seconds.
<b>retry</b>	(Optional) Sets the bulk lease query retries.
<i>number</i>	(Optional) The range is from 0 to 5. The default is 5.
<b>disable</b>	(Optional) Disables the DHCPv6 bulk lease query feature.

## Command Default

Bulk lease query is enabled automatically when the DHCP for IPv6 (DHCPv6) relay agent feature is enabled.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **ipv6 dhcp-relay bulk-lease** command in global configuration mode to configure bulk lease query parameters, such as data transfer timeout and bulk-lease TCP connection retries.

The DHCPv6 bulk lease query feature is enabled automatically when the DHCPv6 relay agent is enabled. The DHCPv6 bulk lease query feature itself cannot be enabled using this command. To disable this feature, use the **ipv6 dhcp-relay bulk-lease** command with the **disable** keyword.

## Examples

The following example shows how to set the bulk lease query data transfer timeout to 60 seconds:

```
Device(config)# ipv6 dhcp-relay bulk-lease data-timeout 60
```

## ipv6 dhcp-relay option vpn

To enable the DHCP for IPv6 relay VRF-aware feature, use the `ipv6 dhcp-relay option vpn` command in global configuration mode. To disable the feature, use the **no** form of this command.

**ipv6 dhcp-relay option vpn**  
**no ipv6 dhcp-relay option vpn**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The DHCP for IPv6 relay VRF-aware feature is not enabled on the router.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 dhcp-relay option vpn** command allows the DHCPv6 relay VRF-aware feature to be enabled globally on the router. If the **ipv6 dhcp relay option vpn** command is enabled on a specified interface, it overrides the global **ipv6 dhcp-relay option vpn** command.

**Examples** The following example enables the DHCPv6 relay VRF-aware feature globally on the router:

```
Device(config)# ipv6 dhcp-relay option vpn
```

Related Commands	Command	Description
	<b>ipv6 dhcp relay option vpn</b>	Enables the DHCPv6 relay VRF-aware feature on an interface.

## ipv6 dhcp-relay source-interface

To configure an interface to use as the source when relaying messages, use the **ipv6 dhcp-relay source-interface** command in global configuration mode. To remove the interface from use as the source, use the no form of this command.

**ipv6 dhcp-relay source-interface** *interface-type interface-number*  
**no ipv6 dhcp-relay source-interface** *interface-type interface-number*

### Syntax Description

<i>interface-type</i> <i>interface-number</i>	(Optional) Interface type and number that specifies output interface for a destination. If this argument is configured, client messages are forwarded to the destination address through the link to which the output interface is connected.
--	---

### Command Default

The address of the server-facing interface is used as the IPv6 relay source.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

If the configured interface is shut down, or if all of its IPv6 addresses are removed, the relay will revert to its standard behavior.

The interface configuration (using the **ipv6 dhcp relay source-interface** command in interface configuration mode) takes precedence over the global configuration if both have been configured.

### Examples

The following example configures the Loopback 0 interface to be used as the relay source:

```
Device(config)# ipv6 dhcp-relay source-interface loopback 0
```

### Related Commands

Command	Description
<b>ipv6 dhcp relay source-interface</b>	Enables DHCP for IPv6 service on an interface.



## ipv6 dhcp binding track ppp

To configure Dynamic Host Configuration Protocol (DHCP) for IPv6 to release any bindings associated with a PPP connection when that connection closes, use the **ipv6 dhcp binding track ppp** command in global configuration mode. To return to the default behavior, use the **no** form of this command.

**ipv6 dhcp binding track ppp**  
**no ipv6 dhcp binding track ppp**

### Syntax Description

This command has no arguments or keywords.

### Command Default

When a PPP connection closes, the DHCP bindings associated with that connection are not released.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **ipv6 dhcp binding track ppp** command configures DHCP for IPv6 to automatically release any bindings associated with a PPP connection when that connection is closed. The bindings are released automatically to accommodate subsequent new registrations by providing sufficient resource.



#### Note

In IPv6 broadband deployment using DHCPv6, you must enable release of prefix bindings associated with a PPP virtual interface using this command. This ensures that DHCPv6 bindings are tracked together with PPP sessions, and in the event of DHCP REBIND failure, the client initiates DHCPv6 negotiation again.

A binding table entry on the DHCP for IPv6 server is automatically:

- Created whenever a prefix is delegated to a client from the configuration pool.
- Updated when the client renews, rebinds, or confirms the prefix delegation.
- Deleted when the client releases all the prefixes in the binding voluntarily, all prefixes' valid lifetimes have expired, or an administrator clears the binding.

### Examples

The following example shows how to release the prefix bindings associated with the PPP:

```
Device(config)# ipv6 dhcp binding track ppp
```

## ipv6 dhcp database

To configure a Dynamic Host Configuration Protocol (DHCP) for IPv6 binding database agent, use the **ipv6 dhcp database** command in global configuration mode. To delete the database agent, use the **no** form of this command.

```
ipv6 dhcp database agent [write-delay seconds] [timeout seconds]
no ipv6 dhcp database agent
```

### Syntax Description

<i>agent</i>	A flash, local bootflash, compact flash, NVRAM, FTP, TFTP, or Remote Copy Protocol (RCP) uniform resource locator.
<b>write-delay</b> <i>seconds</i>	(Optional) How often (in seconds) DHCP for IPv6 sends database updates. The default is 300 seconds. The minimum write delay is 60 seconds.
<b>timeout</b> <i>seconds</i>	(Optional) How long, in seconds, the router waits for a database transfer.

### Command Default

Write-delay default is 300 seconds. Timeout default is 300 seconds.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **ipv6 dhcp database** command specifies DHCP for IPv6 binding database agent parameters. The user may configure multiple database agents.

A binding table entry is automatically created whenever a prefix is delegated to a client from the configuration pool, updated when the client renews, rebinds, or confirms the prefix delegation, and deleted when the client releases all the prefixes in the binding voluntarily, all prefixes' valid lifetimes have expired, or administrators enable the clear ipv6 dhcp binding command. These bindings are maintained in RAM and can be saved to permanent storage using the *agent* argument so that the information about configuration such as prefixes assigned to clients is not lost after a system reload or power down. The bindings are stored as text records for easy maintenance.

Each permanent storage to which the binding database is saved is called the database agent. A database agent can be a remote host such as an FTP server or a local file system such as NVRAM.

The **write-delay** keyword specifies how often, in seconds, that DHCP sends database updates. By default, DHCP for IPv6 server waits 300 seconds before sending any database changes.

The **timeout** keyword specifies how long, in seconds, the router waits for a database transfer. Infinity is defined as 0 seconds, and transfers that exceed the timeout period are canceled. By default, the DHCP for IPv6 server waits 300 seconds before canceling a database transfer. When the system is going to reload, there is no transfer timeout so that the binding table can be stored completely.

### Examples

The following example specifies DHCP for IPv6 binding database agent parameters and stores binding entries in TFTP:

```
Device(config)# ipv6 dhcp database tftp://10.0.0.1/dhcp-binding
```

The following example specifies DHCP for IPv6 binding database agent parameters and stores binding entries in bootflash:

```
Device(config)# ipv6 dhcp database bootflash
```

**Related Commands**

Command	Description
<code>clear ipv6 dhcp binding</code>	Deletes automatic client bindings from the DHCP for IPv6 server binding table
<code>show ipv6 dhcp database</code>	Displays DHCP for IPv6 binding database agent information.

## ipv6 dhcp iana-route-add

To add routes for individually assigned IPv6 addresses on a relay or server, use the **ipv6 dhcp iana-route-add** command in global configuration mode. To disable route addition for individually assigned IPv6 addresses on a relay or server, use the **no** form of the command.

**ipv6 dhcp iana-route-add**  
**no ipv6 dhcp iana-route-add**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Route addition for individually assigned IPv6 addresses on a relay or server is disabled by default.

**Command Modes** Global configuration (config)

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 dhcp iana-route-add** command is disabled by default and has to be enabled if route addition is required. Route addition for Internet Assigned Numbers Authority (IANA) is possible if the client is connected to the relay or server through unnumbered interfaces, and if route addition is enabled with the help of this command.

**Examples** The following example shows how to enable route addition for individually assigned IPv6 addresses:

```
Device(config)# ipv6 dhcp iana-route-add
```

## ipv6 dhcp iapd-route-add

To enable route addition by Dynamic Host Configuration Protocol for IPv6 (DHCPv6) relay and server for the delegated prefix, use the **ipv6 dhcp iapd-route-add** command in global configuration mode. To disable route addition, use the **no** form of the command.

**ipv6 dhcp iapd-route-add**  
**no ipv6 dhcp iapd-route-add**

### Syntax Description

This command has no arguments or keywords.

### Command Default

DHCPv6 relay and DHCPv6 server add routes for delegated prefixes by default.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The DHCPv6 relay and the DHCPv6 server add routes for delegated prefixes by default. The presence of this command on a router does not mean that routes will be added on that router. When you configure the command, routes for delegated prefixes will only be added on the first Layer 3 relay and server.

### Examples

The following example shows how to enable the DHCPv6 relay and server to add routes for a delegated prefix:

```
Device(config)# ipv6 dhcp iapd-route-add
```

## ipv6 dhcp-ldra

To enable Lightweight DHCPv6 Relay Agent (LDRA) functionality on an access node, use the **ipv6 dhcp-ldra** command in global configuration mode. To disable the LDRA functionality, use the **no** form of this command.

```
ipv6 dhcp-ldra {enable | disable}
no ipv6 dhcp-ldra {enable | disable}
```

### Syntax Description

**enable** Enables LDRA functionality on an access node.

**disable** Disables LDRA functionality on an access node.

### Command Default

By default, LDRA functionality is not enabled on an access node.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

You must configure the LDRA functionality globally using the **ipv6 dhcp-ldra** command before configuring it on a VLAN or an access node (such as a Digital Subscriber Link Access Multiplexer [DSLAM] or an Ethernet switch) interface.

### Example

The following example shows how to enable the LDRA functionality:

```
Device(config)# ipv6 dhcp-ldra enable
Device(config)# exit
```



#### Note

In the above example, Device denotes an access node.

### Related Commands

Command	Description
<b>ipv6 dhcp ldra attach-policy</b>	Enables LDRA functionality on a VLAN.
<b>ipv6 dhcp-ldra attach-policy</b>	Enables LDRA functionality on an interface.

## ipv6 dhcp ping packets

To specify the number of packets a Dynamic Host Configuration Protocol for IPv6 (DHCPv6) server sends to a pool address as part of a ping operation, use the **ipv6 dhcp ping packets** command in global configuration mode. To prevent the server from pinging pool addresses, use the **no** form of this command.

**ipv6 dhcp ping packets** *number*  
**ipv6 dhcp ping packets**

<b>Syntax Description</b>	<i>number</i>	The number of ping packets sent before the address is assigned to a requesting client. The valid range is from 0 to 10.
---------------------------	---------------	---

**Command Default** No ping packets are sent before the address is assigned to a requesting client.

**Command Modes** Global configuration (#)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The DHCPv6 server pings a pool address before assigning the address to a requesting client. If the ping is unanswered, the server assumes, with a high probability, that the address is not in use and assigns the address to the requesting client.

Setting the *number* argument to 0 turns off the DHCPv6 server ping operation

### Examples

The following example specifies four ping attempts by the DHCPv6 server before further ping attempts stop:

```
Device(config)# ipv6 dhcp ping packets 4
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>clear ipv6 dhcp conflict</b>	Clears an address conflict from the DHCPv6 server database.
	show ipv6 dhcp conflict	Displays address conflicts found by a DHCPv6 server, or reported through a DECLINE message from a client.

# ipv6 dhcp pool

To configure a Dynamic Host Configuration Protocol (DHCP) for IPv6 server configuration information pool and enter DHCP for IPv6 pool configuration mode, use the **ipv6 dhcp pool** command in global configuration mode. To delete a DHCP for IPv6 pool, use the **no** form of this command.

**ipv6 dhcp pool** *poolname*  
**no ipv6 dhcp pool** *poolname*

## Syntax Description

<i>poolname</i>	User-defined name for the local prefix pool. The pool name can be a symbolic string (such as "Engineering") or an integer (such as 0).
-----------------	--

## Command Default

DHCP for IPv6 pools are not configured.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **ipv6 dhcp pool** command to create a DHCP for IPv6 server configuration information pool. When the **ipv6 dhcp pool** command is enabled, the configuration mode changes to DHCP for IPv6 pool configuration mode. In this mode, the administrator can configure pool parameters, such as prefixes to be delegated and Domain Name System (DNS) servers, using the following commands:

- **address prefix** *IPv6-prefix* [**lifetime** {*valid-lifetime preferred-lifetime* | **infinite**}] sets an address prefix for address assignment. This address must be in hexadecimal, using 16-bit values between colons.
- **link-address** *IPv6-prefix* sets a link-address IPv6 prefix. When an address on the incoming interface or a link-address in the packet matches the specified IPv6-prefix, the server uses the configuration information pool. This address must be in hexadecimal, using 16-bit values between colons.
- **vendor-specific** *vendor-id* enables DHCPv6 vendor-specific configuration mode. Specify a vendor identification number. This number is the vendor IANA Private Enterprise Number. The range is 1 to 4294967295. The following configuration command is available:
  - **suboption** *number* sets vendor-specific suboption number. The range is 1 to 65535. You can enter an IPv6 address, ASCII text, or a hex string as defined by the suboption parameters.



### Note

The **hex** value used under the **suboption** keyword allows users to enter only hex digits (0-f). Entering an invalid **hex** value does not delete the previous configuration.

Once the DHCP for IPv6 configuration information pool has been created, use the **ipv6 dhcp server** command to associate the pool with a server on an interface. If you do not configure an information pool, you need to use the **ipv6 dhcp server interface** configuration command to enable the DHCPv6 server function on an interface.



When you associate a DHCPv6 pool with an interface, only that pool services requests on the associated interface. The pool also services other interfaces. If you do not associate a DHCPv6 pool with an interface, it can service requests on any interface.

Not using any IPv6 address prefix means that the pool returns only configured options.

The **link-address** command allows matching a link-address without necessarily allocating an address. You can match the pool from multiple relays by using multiple link-address configuration commands inside a pool.

Since a longest match is performed on either the address pool information or the link information, you can configure one pool to allocate addresses and another pool on a subprefix that returns only configured options.

## Examples

The following example specifies a DHCP for IPv6 configuration information pool named cisco1 and places the router in DHCP for IPv6 pool configuration mode:

```
Device(config)# ipv6 dhcp pool cisco1
Device(config-dhcpv6)#
```

The following example shows how to configure an IPv6 address prefix for the IPv6 configuration pool cisco1:

```
Device(config-dhcpv6)# address prefix 2001:1000::0/64
Device(config-dhcpv6)# end
```

The following example shows how to configure a pool named engineering with three link-address prefixes and an IPv6 address prefix:

```
Device# configure terminal
Device(config)# ipv6 dhcp pool engineering
Device(config-dhcpv6)# link-address 2001:1001::0/64
Device(config-dhcpv6)# link-address 2001:1002::0/64
Device(config-dhcpv6)# link-address 2001:2000::0/48
Device(config-dhcpv6)# address prefix 2001:1003::0/64
Device(config-dhcpv6)# end
```

The following example shows how to configure a pool named 350 with vendor-specific options:

```
Device# configure terminal
Device(config)# ipv6 dhcp pool 350
Device(config-dhcpv6)# vendor-specific 9
Device(config-dhcpv6-vs)# suboption 1 address 1000:235D::1
Device(config-dhcpv6-vs)# suboption 2 ascii "IP-Phone"
Device(config-dhcpv6-vs)# end
```

## Related Commands

Command	Description
<b>ipv6 dhcp server</b>	Enables DHCP for IPv6 service on an interface.
<b>show ipv6 dhcp pool</b>	Displays DHCP for IPv6 configuration pool information.

## ipv6 flow monitor

This command activates a previously created flow monitor by assigning it to the interface to analyze incoming or outgoing traffic.

To activate a previously created flow monitor, use the **ipv6 flow monitor** command. To de-activate a flow monitor, use the **no** form of the command.

**ipv6 flow monitor** *ipv6-monitor-name* [**sampler** *ipv6-sampler-name*] **input** | **output**  
**no ipv6 flow monitor** *ipv6-monitor-name* [**sampler** *ipv6-sampler-name*] **input** | **output**

Syntax Description		
<i>ipv6-monitor-name</i>		Activates a previously created flow monitor by assigning it to the interface to analyze incoming or outgoing traffic.
<b>sampler</b> <i>ipv6-sampler-name</i>		Applies the flow monitor sampler.
<b>input</b>		Applies the flow monitor on input traffic.
<b>output</b>		Applies the flow monitor on output traffic.

**Command Default** IPv6 flow monitor is not activated until it is assigned to an interface.

**Command Modes** Interface configuration (config-if)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You cannot attach a NetFlow monitor to a port channel interface. If both service module interfaces are part of an EtherChannel, you should attach the monitor to both physical interfaces.

This example shows how to apply a flow monitor to an interface:

```
Device(config)# interface gigabitethernet 1/1/2
Device(config-if)# ip flow monitor FLOW-MONITOR-1 input
Device(config-if)# ip flow monitor FLOW-MONITOR-2 output
Device(config-if)# end
```

# ipv6 dhcp server vrf enable

To enable the DHCP for IPv6 server VRF-aware feature, use the **ipv6 dhcp server vrf enable** command in global configuration mode. To disable the feature, use the **no** form of this command.

**ipv6 dhcp server vrf enable**  
**no ipv6 dhcp server vrf enable**

## Syntax Description

This command has no arguments or keywords.

## Command Default

The DHCPv6 server VRF-aware feature is not enabled.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **ipv6 dhcp server option vpn** command allows the DHCPv6 server VRF-aware feature to be enabled globally on a device.

## Examples

The following example enables the DHCPv6 server VRF-aware feature globally on a device:

```
Device(config)# ipv6 dhcp server option vpn
```

# ipv6 general-prefix

To define an IPv6 general prefix, use the **ipv6 general-prefix** command in global configuration mode. To remove the IPv6 general prefix, use the **no** form of this command.

**ipv6 general-prefix** *prefix-name* *ipv6-prefix/prefix-length* | **6to4** *interface-type* *interface-number* | **6rd** *interface-type* *interface-number*  
**no ipv6 general-prefix** *prefix-name*

## Syntax Description

<i>prefix-name</i>	The name assigned to the prefix.
<i>ipv6-prefix</i>	The IPv6 network assigned to the general prefix.  This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.  When defining a general prefix manually, specify both the <i>ipv6-prefix</i> and <i>/prefix-length</i> arguments.
<i>/ prefix-length</i>	The length of the IPv6 prefix. A decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash mark must precede the decimal value.  When defining a general prefix manually, specify both the <i>ipv6-prefix</i> and <i>/prefix-length</i> arguments.
<b>6to4</b>	Allows configuration of a general prefix based on an interface used for 6to4 tunneling.  When defining a general prefix based on a 6to4 interface, specify the <b>6to4</b> keyword and the <i>interface-type interface-number</i> argument.
<i>interface-type</i> <i>interface-number</i>	Interface type and number. For more information, use the question mark (?) online help function.  When defining a general prefix based on a 6to4 interface, specify the <b>6to4</b> keyword and the <i>interface-type interface-number</i> argument.
<b>6rd</b>	Allows configuration of a general prefix computed from an interface used for IPv6 rapid deployment (6RD) tunneling.

## Command Default

No general prefix is defined.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the `ipv6 general-prefix` command to define an IPv6 general prefix.

A general prefix holds a short prefix, based on which a number of longer, more specific, prefixes can be defined. When the general prefix is changed, all of the more specific prefixes based on it will change, too. This function greatly simplifies network renumbering and allows for automated prefix definition.

More specific prefixes, based on a general prefix, can be used when configuring IPv6 on an interface.

When defining a general prefix based on an interface used for 6to4 tunneling, the general prefix will be of the form 2002:a.b.c.d::/48, where "a.b.c.d" is the IPv4 address of the interface referenced.

## Examples

The following example manually defines an IPv6 general prefix named my-prefix:

```
Device(config)# ipv6 general-prefix my-prefix 2001:DB8:2222::/48
```

The following example defines an IPv6 general prefix named my-prefix based on a 6to4 interface:

```
Device(config)# ipv6 general-prefix my-prefix 6to4 ethernet0
```

## Related Commands

Command	Description
<b>show ipv6 general-prefix</b>	Displays information on general prefixes for an IPv6 addresses.

# ipv6 local policy route-map

To enable local policy-based routing (PBR) for IPv6 packets, use the **ipv6 local policy route-map** command in global configuration mode. To disable local policy-based routing for IPv6 packets, use the **no** form of this command.

**ipv6 local policy route-map** *route-map-name*  
**no ipv6 local policy route-map** *route-map-name*

<b>Syntax Description</b>	<i>route-map-name</i>	Name of the route map to be used for local IPv6 PBR. The name must match a <i>route-map-name</i> value specified by the <b>route-map</b> command.
---------------------------	-----------------------	---

**Command Default** IPv6 packets are not policy routed.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Packets originating from a router are not normally policy routed. However, you can use the **ipv6 local policy route-map** command to policy route such packets. You might enable local PBR if you want packets originated at the router to take a route other than the obvious shortest path.

The **ipv6 local policy route-map** command identifies a route map to be used for local PBR. The **route-map** commands each have a list of **match** and **set** commands associated with them. The **match** commands specify the match criteria, which are the conditions under which packets should be policy routed. The **set** commands specify set actions, which are particular policy routing actions to be performed if the criteria enforced by the **match** commands are met. The **no ipv6 local policy route-map** command deletes the reference to the route map and disables local policy routing.

## Examples

In the following example, packets with a destination IPv6 address matching that allowed by access list pbr-src-90 are sent to the router at IPv6 address 2001:DB8::1:

```
ipv6 access-list src-90
 permit ipv6 host 2001::90 2001:1000::/64
route-map pbr-src-90 permit 10
 match ipv6 address src-90
 set ipv6 next-hop 2001:DB8::1
ipv6 local policy route-map pbr-src-90
```

Related Commands	Command	Description
	<b>ipv6 policy route-map</b>	Configures IPv6 PBR on an interface.
	<b>match ipv6 address</b>	Specifies an IPv6 access list to be used to match packets for PBR for IPv6.
	<b>match length</b>	Bases policy routing on the Level 3 length of a packet.

Command	Description
<b>route-map (IP)</b>	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
<b>set default interface</b>	Specifies the default interface to output packets that pass a match clause of a route map for policy routing and have no explicit route to the destination.
<b>set interface</b>	Specifies the default interface to output packets that pass a match clause of a route map for policy routing.
<b>set ipv6 default next-hop</b>	Specifies an IPv6 default next hop to which matching packets will be forwarded.
<b>set ipv6 next-hop (PBR)</b>	Indicates where to output IPv6 packets that pass a match clause of a route map for policy routing.
<b>set ipv6 precedence</b>	Sets the precedence value in the IPv6 packet header.

## ipv6 local pool

To configure a local IPv6 prefix pool, use the `ipv6 local pool` configuration command with the prefix pool name. To disband the pool, use the **no** form of this command.

**ipv6 local pool poolname prefix/prefix-length assigned-length [shared] [cache-size size]**  
**no ipv6 local pool poolname**

### Syntax Description

<i>poolname</i>	User-defined name for the local prefix pool.
<i>prefix</i>	IPv6 prefix assigned to the pool. This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
<i>/ prefix-length</i>	The length of the IPv6 prefix assigned to the pool. A decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address).
<i>assigned-length</i>	Length of prefix, in bits, assigned to the user from the pool. The value of the <i>assigned-length</i> argument cannot be less than the value of the <i>/ prefix-length</i> argument.
<b>shared</b>	(Optional) Indicates that the pool is a shared pool.
<b>cache-size size</b>	(Optional) Specifies the size of the cache.

### Command Default

No pool is configured.

### Command Modes

Global configuration (global)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

All pool names must be unique.

IPv6 prefix pools have a function similar to IPv4 address pools. Contrary to IPv4, a block of addresses (an address prefix) are assigned and not single addresses.

Prefix pools are not allowed to overlap.

Once a pool is configured, it cannot be changed. To change the configuration, the pool must be removed and recreated. All prefixes already allocated will also be freed.

### Examples

This example shows the creation of an IPv6 prefix pool:

```
Device(config)# ipv6 local pool pool1 2001:0DB8::/29 64
Device(config)# end
Device# show ipv6 local pool
```



```
Pool Prefix Free In use
pool1 2001:0DB8::/29 65516 20
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>debug ipv6 pool</b>	Enables IPv6 pool debugging.
<b>peer default ipv6 address pool</b>	Specifies the pool from which client prefixes are assigned for PPP links.
<b>prefix-delegation pool</b>	Specifies a named IPv6 local prefix pool from which prefixes are delegated to DHCP for IPv6 clients.
<b>show ipv6 local pool</b>	Displays information about any defined IPv6 address pools.

# ipv6 mld snooping

To enable Multicast Listener Discovery version 2 (MLDv2) protocol snooping globally, use the **ipv6 mld snooping** command in global configuration mode. To disable the MLDv2 snooping globally, use the **no** form of this command.

**ipv6 mld snooping**  
**no ipv6 mld snooping**

**Syntax Description** This command has no arguments or keywords.

**Command Default** This command is enabled.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced on the Supervisor Engine 720.

**Usage Guidelines** MLDv2 snooping is supported on the Supervisor Engine 720 with all versions of the Policy Feature Card 3 (PFC3).

To use MLDv2 snooping, configure a Layer 3 interface in the subnet for IPv6 multicast routing or enable the MLDv2 snooping querier in the subnet.

## Examples

This example shows how to enable MLDv2 snooping globally:

```
Device(config)# ipv6 mld snooping
```

Related Commands	Command	Description
	<b>show ipv6 mld snooping</b>	Displays MLDv2 snooping information.

## ipv6 mld ssm-map enable

To enable the Source Specific Multicast (SSM) mapping feature for groups in the configured SSM range, use the **ipv6 mld ssm-map enable** command in global configuration mode. To disable this feature, use the **no** form of this command.

```
ipv6 mld [vrf vrf-name] ssm-map enable
no ipv6 mld [vrf vrf-name] ssm-map enable
```

<b>Syntax Description</b>	<b>vrf</b> <i>vrf-name</i> (Optional) Specifies a virtual routing and forwarding (VRF) configuration.
---------------------------	---

**Command Default** The SSM mapping feature is not enabled.

**Command Modes** Global configuration (config)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 mld ssm-map enable** command enables the SSM mapping feature for groups in the configured SSM range. When the **ipv6 mld ssm-map enable** command is used, SSM mapping defaults to use the Domain Name System (DNS).

SSM mapping is applied only to received Multicast Listener Discovery (MLD) version 1 or MLD version 2 membership reports.

### Examples

The following example shows how to enable the SSM mapping feature:

```
Device(config)# ipv6 mld ssm-map enable
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>debug ipv6 mld ssm-map</b>	Displays debug messages for SSM mapping.
	<b>ipv6 mld ssm-map query dns</b>	Enables DNS-based SSM mapping.
	<b>ipv6 mld ssm-map static</b>	Configures static SSM mappings.
	<b>show ipv6 mld ssm-map</b>	Displays SSM mapping information.

## ipv6 mld state-limit

To limit the number of Multicast Listener Discovery (MLD) states globally, use the **ipv6 mld state-limit** command in global configuration mode. To disable a configured MLD state limit, use the **no** form of this command.

```
ipv6 mld [vrf vrf-name] state-limit number
no ipv6 mld [vrf vrf-name] state-limit number
```

Syntax Description	Parameter	Description
	<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
	<i>number</i>	Maximum number of MLD states allowed on a router. The valid range is from 1 to 64000.

**Command Default** No default number of MLD limits is configured. You must configure the number of maximum MLD states allowed globally on a router when you configure this command.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	Cisco IOS XE Everest 16.5.1a
		This command was introduced.

**Usage Guidelines** Use the **ipv6 mld state-limit** command to configure a limit on the number of MLD states resulting from MLD membership reports on a global basis. Membership reports sent after the configured limits have been exceeded are not entered in the MLD cache and traffic for the excess membership reports is not forwarded.

Use the **ipv6 mld limit** command in interface configuration mode to configure the per-interface MLD state limit.

Per-interface and per-system limits operate independently of each other and can enforce different configured limits. A membership state will be ignored if it exceeds either the per-interface limit or global limit.

### Examples

The following example shows how to limit the number of MLD states on a router to 300:

```
Device(config)# ipv6 mld state-limit 300
```

Related Commands	Command	Description
	<b>ipv6 mld access-group</b>	Enables the performance of IPv6 multicast receiver access control.
	<b>ipv6 mld limit</b>	Limits the number of MLD states resulting from MLD membership state on a per-interface basis.

## ipv6 multicast-routing

To enable multicast routing using Protocol Independent Multicast (PIM) and Multicast Listener Discovery (MLD) on all IPv6-enabled interfaces of the router and to enable multicast forwarding, use the **ipv6 multicast-routing** command in global configuration mode. To stop multicast routing and forwarding, use the **no** form of this command.

**ipv6 multicast-routing** [**vrf** *vrf-name*]  
**no ipv6 multicast-routing**

### Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
----------------------------	--

### Command Default

Multicast routing is not enabled.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **ipv6 multicast-routing** command to enable multicast forwarding. This command also enables Protocol Independent Multicast (PIM) and Multicast Listener Discovery (MLD) on all IPv6-enabled interfaces of the router being configured.

You can configure individual interfaces before you enable multicast so that you can then explicitly disable PIM and MLD protocol processing on those interfaces, as needed. Use the **no ipv6 pim** or the **no ipv6 mld router** command to disable IPv6 PIM or MLD router-side processing, respectively.

### Examples

The following example enables multicast routing and turns on PIM and MLD on all interfaces:

```
Device(config)# ipv6 multicast-routing
```

### Related Commands

Command	Description
<b>ipv6 pim rp-address</b>	Configures the address of a PIM RP for a particular group range.
<b>no ipv6 pim</b>	Turns off IPv6 PIM on a specified interface.
<b>no ipv6 mld router</b>	Disables MLD router-side processing on a specified interface.

# ipv6 multicast group-range

To disable multicast protocol actions and traffic forwarding for unauthorized groups or channels on all the interfaces in a router, use the **ipv6 multicast group-range** command in global configuration mode. To return to the command's default settings, use the **no** form of this command.

```
ipv6 multicast [vrf vrf-name] group-range [access-list-name]  
no ipv6 multicast [vrf vrf-name] group-range [access-list-name]
```

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<i>access-list-name</i>	(Optional) Name of an access list that contains authenticated subscriber groups and authorized channels that can send traffic to the router.

## Command Default

Multicast is enabled for groups and channels permitted by a specified access list and disabled for groups and channels denied by a specified access list.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **ipv6 multicast group-range** command provides an access control mechanism for IPv6 multicast edge routing. The access list specified by the *access-list-name* argument specifies the multicast groups or channels that are to be permitted or denied. For denied groups or channels, the router ignores protocol traffic and actions (for example, no Multicast Listener Discovery (MLD) states are created, no mroute states are created, no Protocol Independent Multicast (PIM) joins are forwarded), and drops data traffic on all interfaces in the system, thus disabling multicast for denied groups or channels.

Using the **ipv6 multicast group-range** global configuration command is equivalent to configuring the MLD access control and multicast boundary commands on all interfaces in the system. However, the **ipv6 multicast group-range** command can be overridden on selected interfaces by using the following interface configuration commands:

- **ipv6 mld access-group** *access-list-name*
- **ipv6 multicast boundary scope** *scope-value*

Because the **no ipv6 multicast group-range** command returns the router to its default configuration, existing multicast deployments are not broken.

## Examples

The following example ensures that the router disables multicast for groups or channels denied by an access list named list2:

```
Device(config)# ipv6 multicast group-range list2
```

The following example shows that the command in the previous example is overridden on an interface specified by int2:

```
Device(config)# interface int2
Device(config-if)# ipv6 mld access-group int-list2
```

On int2, MLD states are created for groups or channels permitted by int-list2 but are not created for groups or channels denied by int-list2. On all other interfaces, the access-list named list2 is used for access control.

In this example, list2 can be specified to deny all or most multicast groups or channels, and int-list2 can be specified to permit authorized groups or channels only for interface int2.

**Related Commands**

Command	Description
<b>ipv6 mld access-group</b>	Performs IPv6 multicast receiver access control.
<b>ipv6 multicast boundary scope</b>	Configures a multicast boundary on the interface for a specified scope.

# ipv6 multicast pim-passive-enable

To enable the Protocol Independent Multicast (PIM) passive feature on an IPv6 router, use the **ipv6 multicast pim-passive-enable** command in global configuration mode. To disable this feature, use the **no** form of this command.

```
ipv6 multicast pim-passive-enable
no ipv6 multicast pim-passive-enable
```

**Syntax Description** This command has no arguments or keywords.

**Command Default** PIM passive mode is not enabled on the router.

**Command Modes** Global configuration (config)

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **ipv6 multicast pim-passive-enable** command to configure IPv6 PIM passive mode on a router. Once PIM passive mode is configured globally, use the **ipv6 pim passive** command in interface configuration mode to configure PIM passive mode on a specific interface.

**Examples** The following example configures IPv6 PIM passive mode on a router:

```
Device(config)# ipv6 multicast pim-passive-enable
```

Command	Description
<b>ipv6 pim passive</b>	Configures PIM passive mode on a specific interface.



## ipv6 multicast rpf

To enable IPv6 multicast reverse path forwarding (RPF) check to use Border Gateway Protocol (BGP) unicast routes in the Routing Information Base (RIB), use the **ipv6 multicast rpf** command in global configuration mode. To disable this function, use the **no** form of this command.

**ipv6 multicast** [*vrf vrf-name*] **rpf backoff** *initial-delay max-delay* | **use-bgp**  
**no ipv6 multicast** [*vrf vrf-name*] **rpf backoff** *initial-delay max-delay* | **use-bgp**

Syntax Description	Parameter	Description
	<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
	<b>backoff</b>	Specifies the backoff delay after a unicast routing change.
	<i>initial-delay</i>	Initial RPF backoff delay, in milliseconds (ms). The range is from 200 to 65535.
	<i>max-delay</i>	Maximum RPF backoff delay, in ms. The range is from 200 to 65535.
	<b>use-bgp</b>	Specifies to use BGP routes for multicast RPF lookups.

**Command Default** The multicast RPF check does not use BGP unicast routes.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** When the **ipv6 multicast rpf** command is configured, multicast RPF check uses BGP unicast routes in the RIB. This is not done by default.

**Examples** The following example shows how to enable the multicast RPF check function:

```
Device(config)# ipv6 multicast rpf use-bgp
```

Related Commands	Command	Description
	<b>ipv6 multicast limit</b>	Configure per-interface multicast route (mroute) state limiters in IPv6.
	<b>ipv6 multicast multipath</b>	Enables load splitting of IPv6 multicast traffic across multiple equal-cost paths.

## ipv6 nd cache expire

To configure the length of time before an IPv6 neighbor discovery (ND) cache entry expires, use the **ipv6 nd cache expire** command in interface configuration mode. To remove this configuration, use the **no** form of this command.

```
ipv6 nd cache expire expire-time-in-seconds [refresh]
no ipv6 nd cache expire expire-time-in-seconds [refresh]
```

Syntax Description	
<i>expire-time-in-seconds</i>	The time range is from 1 through 65536 seconds. The default is 14400 seconds, or 4 hours.
<b>refresh</b>	(Optional) Automatically refreshes the ND cache entry.

**Command Default** This expiration time is 14400 seconds (4 hours)

**Command Modes** Interface configuration (config-if)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** By default, an ND cache entry is expired and deleted if it remains in the STALE state for 14,400 seconds, or 4 hours. The **ipv6 nd cache expire** command allows the user to vary the expiry time and to trigger autorefresh of an expired entry before the entry is deleted.

When the **refresh** keyword is used, an ND cache entry is autorefreshed. The entry moves into the DELAY state and the neighbor unreachability detection (NUD) process occurs, in which the entry transitions from the DELAY state to the PROBE state after 5 seconds. When the entry reaches the PROBE state, a neighbor solicitation (NS) is sent and then retransmitted as per the configuration.

### Examples

The following example shows that the ND cache entry is configured to expire in 7200 seconds, or 2 hours:

```
Device(config-if)# ipv6 nd cache expire 7200
```

## ipv6 nd cache interface-limit (global)

To configure a neighbor discovery cache limit on all interfaces on the device, use the **ipv6 nd cache interface-limit** command in global configuration mode. To remove the neighbor discovery from all interfaces on the device, use the **no** form of this command.

```
ipv6 nd cache interface-limit size [log rate]
no ipv6 nd cache interface-limit size [log rate]
```

Syntax Description	<i>size</i>	Cache size.
	<b>log rate</b>	(Optional) Adjustable logging rate, in seconds. The valid values are 0 and 1.

**Command Default** Default logging rate for the device is one entry every second.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 nd cache interface-limit** command in global configuration mode imposes a common per-interface cache size limit on all interfaces on the device.

Issuing the **no** or default form of the command will remove the neighbor discovery limit from every interface on the device that was configured using global configuration mode. It will not remove the neighbor discovery limit from any interface configured using the **ipv6 nd cache interface-limit** command in interface configuration mode.

The default (and maximum) logging rate for the device is one entry every second.

### Examples

The following example shows how to set a common per-interface cache size limit of 4 seconds on all interfaces on the device:

```
Device(config)# ipv6 nd cache interface-limit 4
```

Related Commands	Command	Description
	<b>ipv6 nd cache interface-limit (interface)</b>	Configures a neighbor discovery cache limit on a specified interface on the device.

# ipv6 nd host mode strict

To enable the conformant, or strict, IPv6 host mode, use the **ipv6 nd host mode strict** command in global configuration mode. To reenable conformant, or loose, IPv6 host mode, use the **no** form of this command.

**ipv6 nd host mode strict**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Nonconformant, or loose, IPv6 host mode is enabled.

**Command Modes** Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The default IPv6 host mode type is loose, or nonconformant. To enable IPv6 strict, or conformant, host mode, use the **ipv6 nd host mode strict** command. You can change between the two IPv6 host modes using the **no** form of this command.

The **ipv6 nd host mode strict** command selects the type of IPv6 host mode behavior and enters interface configuration mode. However, the **ipv6 nd host mode strict** command is ignored if you have configured IPv6 routing with the **ipv6 unicast-routing** command. In this situation, the default IPv6 host mode type, loose, is used.

## Examples

The following example shows how to configure the device as a strict IPv6 host and enables IPv6 address autoconfiguration on Ethernet interface 0/0:

```
Device(config)# ipv6 nd host mode strict
Device(config-if)# interface ethernet0/0
Device(config-if)# ipv6 address autoconfig
```

The following example shows how to configure the device as a strict IPv6 host and configures a static IPv6 address on Ethernet interface 0/0:

```
Device(config)# ipv6 nd host mode strict
Device(config-if)# interface ethernet0/0
Device(config-if)# ipv6 address 2001::1/64
```

## Related Commands

Command	Description
<b>ipv6 unicast-routing</b>	Enables the forwarding of IPv6 unicast datagrams.

## ipv6 nd ns-interval

To configure the interval between IPv6 neighbor solicitation (NS) retransmissions on an interface, use the **ipv6 nd ns-interval** command in interface configuration mode. To restore the default interval, use the **no** form of this command.

```
ipv6 nd ns-interval milliseconds
no ipv6 nd ns-interval
```

<b>Syntax Description</b>	<i>milliseconds</i>	The interval between IPv6 neighbor solicit transmissions for address resolution. The acceptable range is from 1000 to 3600000 milliseconds.
---------------------------	---------------------	---

**Command Default** 0 milliseconds (unspecified) is advertised in router advertisements and the value 1000 is used for the neighbor discovery activity of the router itself.

**Command Modes** Interface configuration (config-if)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1aCisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** By default, using the **ipv6 nd ns-interval** command changes the NS retransmission interval for both address resolution and duplicate address detection (DAD). To specify a different NS retransmission interval for DAD, use the **ipv6 nd dad time** command.

This value will be included in all IPv6 router advertisements sent out this interface. Very short intervals are not recommended in normal IPv6 operation. When a nondefault value is configured, the configured time is both advertised and used by the router itself.

### Examples

The following example configures an IPv6 neighbor solicit transmission interval of 9000 milliseconds for Ethernet interface 0/0:

```
Device(config)# interface ethernet 0/0
Device(config-if)# ipv6 nd ns-interval 9000
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>ipv6 nd dad time</b>	Configures the NS retransmit interval for DAD separately from the NS retransmit interval for address resolution.
	<b>show ipv6 interface</b>	Displays the usability status of interfaces configured for IPv6.

## ipv6 nd reachable-time

To configure the amount of time that a remote IPv6 node is considered reachable after some reachability confirmation event has occurred, use the **ipv6 nd reachable-time** command in interface configuration mode. To restore the default time, use the **no** form of this command.

**ipv6 nd reachable-time** *milliseconds*  
**no ipv6 nd reachable-time**

<b>Syntax Description</b>	<i>milliseconds</i>	The amount of time that a remote IPv6 node is considered reachable (in milliseconds).
---------------------------	---------------------	---

**Command Default** 0 milliseconds (unspecified) is advertised in router advertisements and the value 30000 (30 seconds) is used for the neighbor discovery activity of the router itself.

**Command Modes** Interface configuration (config-if)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The configured time enables the router to detect unavailable neighbors. Shorter configured times enable the router to detect unavailable neighbors more quickly; however, shorter times consume more IPv6 network bandwidth and processing resources in all IPv6 network devices. Very short configured times are not recommended in normal IPv6 operation.

The configured time is included in all router advertisements sent out of an interface so that nodes on the same link use the same time value. A value of 0 means indicates that the configured time is unspecified by this router.

**Examples** The following example configures an IPv6 reachable time of 1,700,000 milliseconds for Ethernet interface 0/0:

```
Device(config)# interface ethernet 0/0
Device(config-if)# ipv6 nd reachable-time 1700000
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>show ipv6 interface</b>	Displays the usability status of interfaces configured for IPv6.

# ipv6 nd resolution data limit

To configure the number of data packets queued pending Neighbor Discovery resolution, use the **ipv6 nd resolution data limit** command in global configuration mode.

**ipv6 nd resolution data limit** *number-of-packets*  
**no ipv6 nd resolution data limit** *number-of-packets*

<b>Syntax Description</b>	<i>number-of-packets</i>	The number of queued data packets. The range is from 16 to 2048 packets.
---------------------------	--------------------------	--

**Command Default** Queue limit is 16 packets.

**Command Modes** Global configuration (config)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 nd resolution data limit** command allows the customer to configure the number of data packets queued pending Neighbor Discovery resolution. IPv6 Neighbor Discovery queues a data packet that initiates resolution for an unresolved destination. Neighbor Discovery will only queue one packet per destination. Neighbor Discovery also enforces a global (per-router) limit on the number of packets queued. Once the global queue limit is reached, further packets to unresolved destinations are discarded. The minimum (and default) value is 16 packets, and the maximum value is 2048.

In most situations, the default value of 16 queued packets pending Neighbor Discovery resolution is sufficient. However, in some high-scalability scenarios in which the router needs to initiate communication with a very large number of neighbors almost simultaneously, then the value may be insufficient. This may lead to loss of the initial packet sent to some neighbors. In most applications, the initial packet is retransmitted, so initial packet loss generally is not a cause for concern. (Note that dropping the initial packet to an unresolved destination is normal in IPv4.) However, there may be some high-scale configurations where loss of the initial packet is inconvenient. In these cases, the customer can use the **ipv6 nd resolution data limit** command to prevent the initial packet loss by increasing the unresolved packet queue size.

## Examples

The following example configures the global number of data packets held awaiting resolution to be 32:

```
Device(config)# ipv6 nd resolution data limit 32
```

## ipv6 nd route-owner

To insert Neighbor Discovery-learned routes into the routing table with "ND" status and to enable ND autoconfiguration behavior, use the **ipv6 nd route-owner** command. To remove this information from the routing table, use the **no** form of this command.

### ipv6 ndroute-owner

**Syntax Description** This command has no arguments or keywords.

**Command Default** The status of Neighbor Discovery-learned routes is "Static."

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 nd route-owner** command inserts routes learned by Neighbor Discovery into the routing table with a status of "ND" rather than "Static" or "Connected."

This global command also enables you to use the **ipv6 nd autoconfig default** or **ipv6 nd autoconfig prefix** commands in interface configuration mode. If the **ipv6 nd route-owner** command is not issued, then the **ipv6 nd autoconfig default** and **ipv6 nd autoconfig prefix** commands are accepted by the router but will not work.

**Examples** Device(config)# **ipv6 nd route-owner**

Related Commands	Command	Description
	<b>ipv6 nd autoconfig default</b>	Allows Neighbor Discovery to install a default route to the Neighbor Discovery-derived default router.
	<b>ipv6 nd autoconfig prefix</b>	Uses Neighbor Discovery to install all valid on-link prefixes from RAs received on the interface.



# ipv6 neighbor

To configure a static entry in the IPv6 neighbor discovery cache, use the **ipv6 neighbor** command in global configuration mode. To remove a static IPv6 entry from the IPv6 neighbor discovery cache, use the **no** form of this command.

**ipv6 neighbor** *ipv6-address interface-type interface-number hardware-address*  
**no ipv6 neighbor** *ipv6-address interface-type interface-number*

Syntax Description		
<i>ipv6-address</i>	The IPv6 address that corresponds to the local data-link address. This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.	
<i>interface-type</i>	The specified interface type. For supported interface types, use the question mark (?) online help function.	
<i>interface-number</i>	The specified interface number.	
<i>hardware-address</i>	The local data-link address (a 48-bit address).	

**Command Default** Static entries are not configured in the IPv6 neighbor discovery cache.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 neighbor** command is similar to the **arp** (global) command.

If an entry for the specified IPv6 address already exists in the neighbor discovery cache--learned through the IPv6 neighbor discovery process--the entry is automatically converted to a static entry.

Use the **show ipv6 neighbors** command to view static entries in the IPv6 neighbor discovery cache. A static entry in the IPv6 neighbor discovery cache can have one of the following states:

- INCOMPLETE (Incomplete)--The interface for this entry is down.
- REACH (Reachable)--The interface for this entry is up.



**Note** Reachability detection is not applied to static entries in the IPv6 neighbor discovery cache; therefore, the descriptions for the INCOMPLETE and REACH states are different for dynamic and static cache entries. See the **show ipv6 neighbors** command for descriptions of the INCOMPLETE and REACH states for dynamic cache entries.

The **clear ipv6 neighbors** command deletes all entries in the IPv6 neighbor discovery cache, except static entries. The **no ipv6 neighbor** command deletes a specified static entry from the neighbor discovery cache; the command does not remove dynamic entries--learned from the IPv6 neighbor discovery process--from the

cache. Disabling IPv6 on an interface by using the **no ipv6 enable** command or the **no ipv6 unnumbered** command deletes all IPv6 neighbor discovery cache entries configured for that interface, except static entries (the state of the entry changes to INCMP).

Static entries in the IPv6 neighbor discovery cache are not modified by the neighbor discovery process.



**Note** Static entries for IPv6 neighbors can be configured only on IPv6-enabled LAN and ATM LAN Emulation interfaces.

### Examples

The following example configures a static entry in the IPv6 neighbor discovery cache for a neighbor with the IPv6 address 2001:0DB8::45A and link-layer address 0002.7D1A.9472 on Ethernet interface 1:

```
Device(config)# ipv6 neighbor 2001:0DB8::45A ethernet1 0002.7D1A.9472
```

### Related Commands

Command	Description
<b>arp (global)</b>	Adds a permanent entry in the ARP cache.
<b>clear ipv6 neighbors</b>	Deletes all entries in the IPv6 neighbor discovery cache, except static entries.
<b>no ipv6 enable</b>	Disables IPv6 processing on an interface that has not been configured with an explicit IPv6 address.
<b>no ipv6 unnumbered</b>	Disables IPv6 on an unnumbered interface.
<b>show ipv6 neighbors</b>	Displays IPv6 neighbor discovery cache information.

# ipv6 ospf name-lookup

To display Open Shortest Path First (OSPF) router IDs as Domain Naming System (DNS) names, use the **ipv6 ospf name-lookup** command in global configuration mode. To stop displaying OSPF router IDs as DNS names, use the **no** form of this command.

**ipv6 ospf name-lookup**  
**no ipv6 ospf name-lookup**

**Syntax Description** This command has no arguments or keywords.

**Command Default** This command is disabled by default

**Command Modes** Global configuration (config)

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command makes it easier to identify a router because the router is displayed by name rather than by its router ID or neighbor ID.

**Examples** The following example configures OSPF to look up DNS names for use in all OSPF show EXEC command displays:

```
Device(config)# ipv6 ospf name-lookup
```

# ipv6 pim

To reenable IPv6 Protocol Independent Multicast (PIM) on a specified interface, use the **ipv6 pim** command in interface configuration mode. To disable PIM on a specified interface, use the **no** form of the command.

**ipv6 pim**  
**no ipv6 pim**

**Syntax Description** This command has no arguments or keywords.

**Command Default** PIM is automatically enabled on every interface.

**Command Modes** Interface configuration (config-if)

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** After a user has enabled the **ipv6 multicast-routing** command, PIM is enabled to run on every interface. Because PIM is enabled on every interface by default, use the **no** form of the **ipv6 pim** command to disable PIM on a specified interface. When PIM is disabled on an interface, it does not react to any host membership notifications from the Multicast Listener Discovery (MLD) protocol.

**Examples** The following example turns off PIM on Fast Ethernet interface 1/0:

```
Device(config)# interface FastEthernet 1/0
Device(config-if)# no ipv6 pim
```

Command	Description
<b>ipv6 multicast-routing</b>	Enables multicast routing using PIM and MLD on all IPv6-enabled interfaces of the router and enables multicast forwarding.

## ipv6 pim accept-register

To accept or reject registers at the rendezvous point (RP), use the **ipv6 pim accept-register** command in global configuration mode. To return to the default value, use the **no** form of this command.

```
ipv6 pim [vrf vrf-name] accept-register list access-list | route-map map-name
no ipv6 pim [vrf vrf-name] accept-register list access-list | route-map map-name
```

Syntax Description		
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.	
<b>list</b> <i>access-list</i>	Defines the access list name.	
<b>route-map</b> <i>map-name</i>	Defines the route map.	

**Command Default** All sources are accepted at the RP.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **ipv6 pim accept-register** command to configure a named access list or route map with match attributes. When the permit conditions as defined by the *access-list* and *map-name* arguments are met, the register message is accepted. Otherwise, the register message is not accepted, and an immediate register-stop message is returned to the encapsulating designated router.

### Examples

The following example shows how to filter on all sources that do not have a local multicast Border Gateway Protocol (BGP) prefix:

```
ipv6 pim accept-register route-map reg-filter
route-map reg-filter permit 20
  match as-path 101
ip as-path access-list 101 permit
```

## ipv6 pim allow-rp

To enable the PIM Allow RP feature for all IP multicast-enabled interfaces in an IPv6 device, use the **ip pim allow-rp** command in global configuration mode. To return to the default value, use the **no** form of this command.

```
ipv6 pim allow-rp [group-list access-list | rp-list access-list [group-list access-list]]
no ipv6 pim allow-rp
```

Syntax Description	
<b>group-list</b>	(Optional) Identifies an access control list (ACL) of allowed group ranges for PIM Allow RP.
<b>rp-list</b>	(Optional) Specifies an ACL for allowed rendezvous-point (RP) addresses for PIM Allow RP.
<i>access-list</i>	(Optional) Unique number or name of a standard ACL.

**Command Default** PIM Allow RP is disabled.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use this command to enable the receiving device in an IP multicast network to accept a (\*, G) Join from an unexpected (different) RP address.

Before enabling PIM Allow RP, you must first use the **ipv6 pim rp-address** command to define an RP.

Related Commands	Command	Description
	<b>ipv6 pim rp-address</b>	Statically configures the address of a PIM RP for multicast groups.

## ipv6 pim anycast-RP

To configure the address of the Protocol-Independent Multicast (PIM) rendezvous point (RP) for an anycast group range, use the **ipv6 pim anycast-RP** command in global configuration mode. To remove an RP address for an anycast group range, use the **no** form of this command.

**ipv6 pim anycast-RP** {*rp-address peer-address*}  
**no ipv6 pim anycast-RP**

Syntax Description	
<i>anycast-rp-address</i>	Anycast RP set for the RP assigned to the group range. This is the address that first-hop and last-hop PIM routers use to register and join.
<i>peer-address</i>	The address to which register messages copies are sent. This address is any address assigned to the RP router, not including the address assigned using the <i>anycast-rp-address</i> variable.

**Command Default** No PIM RP address is configured for an anycast group range.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The anycast RP feature is useful when interdomain connection is not required. Use this command to configure the address of the PIM RP for an anycast group range.

### Examples

```
Device# ipv6 pim anycast-rp 2001:DB8::1:1 2001:DB8::3:3
```

Related Commands	Command	Description
	<b>show ipv6 pim anycast-RP</b>	Verifies IPv6 PIM RP anycast configuration.

## ipv6 pim neighbor-filter list

To filter Protocol Independent Multicast (PIM) neighbor messages from specific IPv6 addresses, use the **ipv6 pim neighbor-filter** command in the global configuration mode. To return to the router default, use the **no** form of this command.

```
ipv6 pim [vrf vrf-name] neighbor-filter list access-list
no ipv6 pim [vrf vrf-name] neighbor-filter list access-list
```

Syntax Description	
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<i>access-list</i>	Name of an IPv6 access list that denies PIM hello packets from a source.

**Command Default** PIM neighbor messages are not filtered.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ipv6 pim neighbor-filter list** command is used to prevent unauthorized routers on the LAN from becoming PIM neighbors. Hello messages from addresses specified in this command are ignored.

### Examples

The following example causes PIM to ignore all hello messages from IPv6 address FE80::A8BB:CCFF:FE03:7200:

```
Device(config)# ipv6 pim neighbor-filter list nbr_filter_acl
Device(config)# ipv6 access-list nbr_filter_acl
Device(config-ipv6-acl)# deny ipv6 host FE80::A8BB:CCFF:FE03:7200 any
Device(config-ipv6-acl)# permit any any
```



## ipv6 pim rp-address

To configure the address of a Protocol Independent Multicast (PIM) rendezvous point (RP) for a particular group range, use the **ipv6 pim rp-address** command in global configuration mode. To remove an RP address, use the **no** form of this command.

```
ipv6 pim [vrf vrf-name] rp-address ipv6-address [group-access-list] [bidir]  
no ipv6 pim rp-address ipv6-address [group-access-list] [bidir]
```

Syntax Description		
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.	
<i>ipv6-address</i>	The IPv6 address of a router to be a PIM RP. The <i>ipv6-address</i> argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.	
<i>group-access-list</i>	(Optional) Name of an access list that defines for which multicast groups the RP should be used.  If the access list contains any group address ranges that overlap the assigned source-specific multicast (SSM) group address range (FF3x::/96), a warning message is displayed, and the overlapping ranges are ignored. If no access list is specified, the specified RP is used for all valid multicast non-SSM address ranges.  To support embedded RP, the router configured as the RP must use a configured access list that permits the embedded RP group ranges derived from the embedded RP address.  Note that the embedded RP group ranges need not include all the scopes (for example, 3 through 7).	
<b>bidir</b>	(Optional) Indicates that the group range will be used for bidirectional shared-tree forwarding; otherwise, it will be used for sparse-mode forwarding. A single IPv6 address can be configured to be RP only for either bidirectional or sparse-mode group ranges. A single group-range list can be configured to operate either in bidirectional or sparse mode.	

**Command Default** No PIM RPs are preconfigured. Embedded RP support is enabled by default when IPv6 PIM is enabled (where embedded RP support is provided). Multicast groups operate in PIM sparse mode.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	Cisco IOS XE Everest 16.5.1a
		This command was introduced.

**Usage Guidelines** When PIM is configured in sparse mode, you must choose one or more routers to operate as the RP. An RP is a single common root of a shared distribution tree and is statically configured on each router.

Where embedded RP support is available, only the RP needs to be statically configured as the RP for the embedded RP ranges. No additional configuration is needed on other IPv6 PIM routers. The other routers will

discover the RP address from the IPv6 group address. If these routers want to select a static RP instead of the embedded RP, the specific embedded RP group range must be configured in the access list of the static RP.

The RP address is used by first-hop routers to send register packets on behalf of source multicast hosts. The RP address is also used by routers on behalf of multicast hosts that want to become members of a group. These routers send join and prune messages to the RP.

If the optional *group-access-list* argument is not specified, the RP is applied to the entire routable IPv6 multicast group range, excluding SSM, which ranges from FFX[3-f]::/8 to FF3X::/96. If the *group-access-list* argument is specified, the IPv6 address is the RP address for the group range specified in the *group-access-list* argument.

You can configure Cisco IOS software to use a single RP for more than one group. The conditions specified by the access list determine which groups the RP can be used for. If no access list is configured, the RP is used for all groups.

A PIM router can use multiple RPs, but only one per group.

## Examples

The following example shows how to set the PIM RP address to 2001::10:10 for all multicast groups:

```
Device(config)# ipv6 pim rp-address 2001::10:10
```

The following example sets the PIM RP address to 2001::10:10 for the multicast group FF04::/64 only:

```
Device(config)# ipv6 access-list acc-grp-1
Device(config-ipv6-acl)# permit ipv6 any ff04::/64
Device(config)# ipv6 pim rp-address 2001::10:10 acc-grp-1
```

The following example shows how to configure a group access list that permits the embedded RP ranges derived from the IPv6 RP address 2001:0DB8:2::2:

```
Device(config)# ipv6 pim rp-address 2001:0DB8:2::2 embd-ranges
Device(config)# ipv6 access-list embd-ranges
Device(config-ipv6-acl)# permit ipv6 any ff73:240:2:2:2::/96
Device(config-ipv6-acl)# permit ipv6 any ff74:240:2:2:2::/96
Device(config-ipv6-acl)# permit ipv6 any ff75:240:2:2:2::/96
Device(config-ipv6-acl)# permit ipv6 any ff76:240:2:2:2::/96
Device(config-ipv6-acl)# permit ipv6 any ff77:240:2:2:2::/96
Device(config-ipv6-acl)# permit ipv6 any ff78:240:2:2:2::/96
```

The following example shows how to enable the address 100::1 as the bidirectional RP for the entries multicast range FF::/8:

```
ipv6 pim rp-address 100::1 bidir
```

In the following example, the IPv6 address 200::1 is enabled as the bidirectional RP for the ranges permitted by the access list named bidir-grps. The ranges permitted by this list are ff05::/16 and ff06::/16.

```
Device(config)# ipv6 access-list bidir-grps
Device(config-ipv6-acl)# permit ipv6 any ff05::/16
Device(config-ipv6-acl)# permit ipv6 any ff06::/16
Device(config-ipv6-acl)# exit
Device(config)# ipv6 pim rp-address 200::1 bidir-grps bidir
```

Related Commands	Command	Description
	<b>debug ipv6 pim df-election</b>	Displays debug messages for PIM bidirectional DF-election message processing.
	<b>ipv6 access-list</b>	Defines an IPv6 access list and places the router in IPv6 access list configuration mode.
	<b>show ipv6 pim df</b>	Displays the DF -election state of each interface for each RP.
	<b>show ipv6 pim df winner</b>	Displays the DF-election winner on each interface for each RP.

# ipv6 pim rp embedded

To enable embedded rendezvous point (RP) support in IPv6 Protocol Independent Multicast (PIM), use the **ipv6 pim rp-embedded** command in global configuration mode. To disable embedded RP support, use the **no** form of this command.

```
ipv6 pim [vrf vrf-name] rp embedded
no ipv6 pim [vrf vrf-name] rp embedded
```

<b>Syntax Description</b>	<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
---------------------------	----------------------------	--

**Command Default** Embedded RP support is enabled by default.

**Command Modes** Global configuration (config)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Because embedded RP support is enabled by default, users will generally use the **no** form of this command to turn off embedded RP support.

The **ipv6 pim rp embedded** command applies only to the embedded RP group ranges ff7X::/16 and fffX::/16. When the router is enabled, it parses groups in the embedded RP group ranges ff7X::/16 and fffX::/16, and extracts the RP to be used from the group address.

## Examples

The following example disables embedded RP support in IPv6 PIM:

```
Device# no ipv6 pim rp embedded
```

## ipv6 pim spt-threshold infinity

To configure when a Protocol Independent Multicast (PIM) leaf router joins the shortest path tree (SPT) for the specified groups, use the **ipv6 pim spt-threshold infinity** command in global configuration mode. To restore the default value, use the **no** form of this command.

```
ipv6 pim [vrf vrf-name] spt-threshold infinity [group-list access-list-name]
no ipv6 pim spt-threshold infinity
```

Syntax Description		
	<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
	<b>group-list</b> <i>access-list-name</i>	(Optional) Indicates to which groups the threshold applies. Must be a standard IPv6 access list name. If the value is omitted, the threshold applies to all groups.

**Command Default** When this command is not used, the PIM leaf router joins the SPT immediately after the first packet arrives from a new source. Once the router has joined the SPT, configuring the **ipv6 pim spt-threshold infinity** command will not cause it to switch to the shared tree.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Using the **ipv6 pim spt-threshold infinity** command enables all sources for the specified groups to use the shared tree. The **group-list** keyword indicates to which groups the SPT threshold applies.

The *access-list-name* argument refers to an IPv6 access list. When the *access-list-name* argument is specified with a value of 0, or the **group-list** keyword is not used, the SPT threshold applies to all groups. The default setting (that is, when this command is not enabled) is to join the SPT immediately after the first packet arrives from a new source.

### Examples

The following example configures a PIM last-hop router to stay on the shared tree and not switch to the SPT for the group range ff04::/64.:

```
Device(config)# ipv6 access-list acc-grp-1
Device(config-ipv6-acl)# permit ipv6 any FF04::/64
Device(config-ipv6-acl)# exit
Device(config)# ipv6 pim spt-threshold infinity group-list acc-grp-1
```

## ipv6 prefix-list

To create an entry in an IPv6 prefix list, use the **ipv6 prefix-list** command in global configuration mode. To delete the entry, use the **no** form of this command.

```
ipv6 prefix-list list-name [seq seq-number] deny ipv6-prefix/prefix-length | permit
ipv6-prefix/prefix-length | description text [ge ge-value] [le le-value]
no ipv6 prefix-list list-name
```

### Syntax Description

<i>list-name</i>	Name of the prefix list. <ul style="list-style-type: none"> <li>• Cannot be the same name as an existing access list.</li> <li>• Cannot be the name “detail” or “summary” because they are keywords in the <b>show ipv6 prefix-list</b> command.</li> </ul>
<b>seq</b> <i>seq-number</i>	(Optional) Sequence number of the prefix list entry being configured.
<b>deny</b>	Denies networks that matches the condition.
<b>permit</b>	Permits networks that matches the condition.
<i>ipv6-prefix</i>	The IPv6 network assigned to the specified prefix list. This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
<i>/prefix-length</i>	The length of the IPv6 prefix. A decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash mark must precede the decimal value.
<b>description</b> <i>text</i>	A description of the prefix list that can be up to 80 characters in length.
<b>ge</b> <i>ge-value</i>	(Optional) Specifies a prefix length greater than or equal to the <i>ipv6-prefix/prefix-length</i> arguments. It is the lowest value of a range of the <i>length</i> (the “from” portion of the length range).
<b>le</b> <i>le-value</i>	(Optional) Specifies a prefix length less than or equal to the <i>ipv6-prefix /prefix-length</i> arguments. It is the highest value of a range of the <i>length</i> (the “to” portion of the length range).

### Command Default

No prefix list is created.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **ipv6 prefix-list** command is similar to the **ip prefix-list** command, except that it is IPv6-specific.

To suppress networks from being advertised in updates, use the **distribute-list out** command.

The sequence number of a prefix list entry determines the order of the entries in the list. The router compares network addresses to the prefix list entries. The router begins the comparison at the top of the prefix list, with the entry having the lowest sequence number.

If multiple entries of a prefix list match a prefix, the entry with the lowest sequence number is considered the real match. Once a match or deny occurs, the router does not go through the rest of the prefix list. For efficiency, you may want to put the most common permits or denies near the top of the list, using the *seq-number* argument.

The **show ipv6 prefix-list** command displays the sequence numbers of entries.

IPv6 prefix lists are used to specify certain prefixes or a range of prefixes that must be matched before a permit or deny statement can be applied. Two operand keywords can be used to designate a range of prefix lengths to be matched. A prefix length of less than, or equal to, a value is configured with the **le** keyword. A prefix length greater than, or equal to, a value is specified using the **ge** keyword. The **ge** and **le** keywords can be used to specify the range of the prefix length to be matched in more detail than the usual *ipv6-prefix/prefix-length* argument. For a candidate prefix to match against a prefix list entry three conditions can exist:

- The candidate prefix must match the specified prefix list and prefix length entry.
- The value of the optional **le** keyword specifies the range of allowed prefix lengths from the *prefix-length* argument up to, and including, the value of the **le** keyword.
- The value of the optional **ge** keyword specifies the range of allowed prefix lengths from the value of the **ge** keyword up to, and including, 128.



**Note** The first condition must match before the other conditions take effect.

An exact match is assumed when the **ge** or **le** keywords are not specified. If only one keyword operand is specified then the condition for that keyword is applied, and the other condition is not applied. The *prefix-length* value must be less than the **ge** value. The **ge** value must be less than, or equal to, the **le** value. The **le** value must be less than or equal to 128.

Every IPv6 prefix list, including prefix lists that do not have any permit and deny condition statements, has an implicit deny any any statement as its last match condition.

## Examples

The following example denies all routes with a prefix of `::/0`.

```
Device(config)# ipv6 prefix-list abc deny ::/0
```

The following example permits the prefix `2002::/16`:

```
Device(config)# ipv6 prefix-list abc permit 2002::/16
```

The following example shows how to specify a group of prefixes to accept any prefixes from prefix `5F00::/48` up to and including prefix `5F00::/64`.

```
Device(config)# ipv6 prefix-list abc permit 5F00::/48 le 64
```

The following example denies prefix lengths greater than 64 bits in routes that have the prefix 2001:0DB8::/64.

```
Device(config)# ipv6 prefix-list abc permit 2001:0DB8::/64 le 128
```

The following example permits mask lengths from 32 to 64 bits in all address space.

```
Device(config)# ipv6 prefix-list abc permit ::/0 ge 32 le 64
```

The following example denies mask lengths greater than 32 bits in all address space.

```
Device(config)# ipv6 prefix-list abc deny ::/0 ge 32
```

The following example denies all routes with a prefix of 2002::/128.

```
Device(config)# ipv6 prefix-list abc deny 2002::/128
```

The following example permits all routes with a prefix of ::/0.

```
Device(config)# ipv6 prefix-list abc permit ::/0
```

#### Related Commands

Command	Description
<b>clear ipv6 prefix-list</b>	Resets the hit count of the IPv6 prefix list entries.
<b>distribute-list out</b>	Suppresses networks from being advertised in updates.
<b>ipv6 prefix-list sequence-number</b>	Enables the generation of sequence numbers for entries in an IPv6 prefix list.
<b>match ipv6 address</b>	Distributes IPv6 routes that have a prefix permitted by a prefix list.
<b>show ipv6 prefix-list</b>	Displays information about an IPv6 prefix list or IPv6 prefix list entries.



## ipv6 source-guard attach-policy

To apply IPv6 source guard policy on an interface, use the **ipv6 source-guard attach-policy** in interface configuration mode. To remove this source guard from the interface, use the **no** form of this command.

**ipv6 source-guard attach-policy**[*source-guard-policy* ]

<b>Syntax Description</b>	<i>source-guard-policy</i>	(Optional) User-defined name of the source guard policy. The policy name can be a symbolic string (such as Engineering) or an integer (such as 0).
---------------------------	----------------------------	--

**Command Default** An IPv6 source-guard policy is not applied on the interface.

**Command Modes** Interface configuration (config-if)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** If no policy is specified using the *source-guard-policy* argument, then the default source-guard policy is applied.

A dependency exists between IPv6 source guard and IPv6 snooping. Whenever IPv6 source guard is configured, when the **ipv6 source-guard attach-policy** command is entered, it verifies that snooping is enabled and issues a warning if it is not. If IPv6 snooping is disabled, the software checks if IPv6 source guard is enabled and sends a warning if it is.

### Examples

The following example shows how to apply IPv6 source guard on an interface:

```
Device(config)# interface gigabitethernet 0/0/1
Device(config-if)# ipv6 source-guard attach-policy mysnoopingpolicy
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>ipv6 snooping policy</b>	Configures an IPv6 snooping policy and enters IPv6 snooping configuration mode.

# ipv6 source-route

To enable processing of the IPv6 type 0 routing header (the IPv6 source routing header), use the **ipv6 source-route** command in global configuration mode. To disable the processing of this IPv6 extension header, use the **no** form of this command.

**ipv6 source-route**  
**no ipv6 source-route**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The **no** version of the **ipv6 source-route** command is the default. When the router receives a packet with a type 0 routing header, the router drops the packet and sends an IPv6 Internet Control Message Protocol (ICMP) error message back to the source and logs an appropriate debug message.

**Command Modes** Global configuration (config)

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The default was changed to be the **no** version of the **ipv6 source-route** command, which means this functionality is not enabled. Before this change, this functionality was enabled automatically. User who had configured the **no ipv6 source-route** command before the default was changed will continue to see this configuration in their **show config** command output, even though the **no** version of the command is the default.

The **no ipv6 source-route** command (which is the default) prevents hosts from performing source routing using your routers. When the **no ipv6 source-route** command is configured and the router receives a packet with a type0 source routing header, the router drops the packet and sends an IPv6 ICMP error message back to the source and logs an appropriate debug message.

In IPv6, source routing is performed only by the destination of the packet. Therefore, in order to stop source routing from occurring inside your network, you need to configure an IPv6 access control list (ACL) that includes the following rule:

```
deny ipv6 any any routing
```

The rate at which the router generates all IPv6 ICMP error messages can be limited by using the **ipv6 icmp error-interval** command.

## Examples

The following example disables the processing of IPv6 type 0 routing headers:

```
no ipv6 source-route
```

## Related Commands

Command	Description
<b>deny (IPv6)</b>	Sets deny conditions for an IPv6 access list.
<b>ipv6 icmp error-interval</b>	Configures the interval for IPv6 ICMP error messages.

# ipv6 spd mode

To configure an IPv6 Selective Packet Discard (SPD) mode, use the **ipv6 spd mode** command in global configuration mode. To remove the IPv6 SPD mode, use the **no** form of this command.

**ipv6 spd mode aggressive | tos protocol ospf**  
**no ipv6 spd mode aggressive | tos protocol ospf**

Syntax Description	aggressive	Aggressive drop mode discards incorrectly formatted packets when the IPv6 SPD is in random drop state.
tos protocol o spf		OSPF mode allows OSPF packets to be handled with SPD priority.

**Command Default** No IPv6 SPD mode is configured.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The default setting for the IPv6 SPD mode is none, but you may want to use the **ipv6 spd mode** command to configure a mode to be used when a certain SPD state is reached.

The **aggressive** keyword enables aggressive drop mode, which drops deformed packets when IPv6 SPD is in random drop state. The **ospf** keyword enables OSPF mode, in which OSPF packets are handled with SPD priority.

The size of the process input queue governs the SPD state: normal (no drop), random drop, or max. When the process input queue is less than the SPD minimum threshold, SPD takes no action and enters normal state. In the normal state, no packets are dropped. When the input queue reaches the maximum threshold, SPD enters max state, in which normal priority packets are discarded. If the input queue is between the minimum and maximum thresholds, SPD enters the random drop state, in which normal packets may be dropped.

## Examples

The following example shows how to enable the router to drop deformed packets when the router is in the random drop state:

```
Device(config)# ipv6 spd mode aggressive
```

Related Commands	Command	Description
	<b>ipv6 spd queue max-threshold</b>	Configures the maximum number of packets in the IPv6 SPD process input queue.
	<b>ipv6 spd queue min-threshold</b>	Configures the minimum number of packets in the IPv6 SPD process input queue.
	<b>show ipv6 spd</b>	Displays the IPv6 SPD configuration.

## ipv6 spd queue max-threshold

To configure the maximum number of packets in the IPv6 Selective Packet Discard (SPD) process input queue, use the **ipv6 spd queue max-threshold** command in global configuration mode. To return to the default value, use the **no** form of this command.

**ipv6 spd queue max-threshold** *value*  
**no ipv6 spd queue max-threshold**

<b>Syntax Description</b>	<i>value</i> Number of packets. The range is from 0 through 65535.
---------------------------	--

**Command Default** No SPD queue maximum threshold value is configured.

**Command Modes** Global configuration (config)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	Cisco IOS XE Everest 16.5.1a
		This command was introduced.

**Usage Guidelines** Use the **ipv6 spd queue max-threshold** command to configure the SPD queue maximum threshold value.

The size of the process input queue governs the SPD state: normal (no drop), random drop, or max. When the process input queue is less than the SPD minimum threshold, SPD takes no action and enters normal state. In the normal state, no packets are dropped. When the input queue reaches the maximum threshold, SPD enters max state, in which normal priority packets are discarded. If the input queue is between the minimum and maximum thresholds, SPD enters the random drop state, in which normal packets may be dropped.

### Examples

The following example shows how to set the maximum threshold value of the queue to 60,000:

```
Device(config)# ipv6 spd queue max-threshold 60000
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>ipv6 spd queue min-threshold</b>	Configures the minimum number of packets in the IPv6 SPD process input queue.
	<b>show ipv6 spd</b>	Displays the IPv6 SPD configuration.

## ipv6 traffic interface-statistics

To collect IPv6 forwarding statistics for all interfaces, use the **ipv6 traffic interface-statistics** command in global configuration mode. To ensure that IPv6 forwarding statistics are not collected for any interface, use the **no** form of this command.

```
ipv6 traffic interface-statistics [unclearable]
no ipv6 traffic interface-statistics [unclearable]
```

<b>Syntax Description</b>	<b>unclearable</b> (Optional) IPv6 forwarding statistics are kept for all interfaces, but it is not possible to clear the statistics on any interface.
---------------------------	--

**Command Default** IPv6 forwarding statistics are collected for all interfaces.

**Command Modes** Global configuration (config)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Using the optional **unclearable** keyword halves the per-interface statistics storage requirements.

**Examples** The following example does not allow statistics to be cleared on any interface:

```
Device(config)# ipv6 traffic interface-statistics unclearable
```

# ipv6 unicast-routing

To enable the forwarding of IPv6 unicast datagrams, use the **ipv6 unicast-routing** command in global configuration mode. To disable the forwarding of IPv6 unicast datagrams, use the **no** form of this command.

**ipv6 unicast-routing**  
**no ipv6 unicast-routing**

**Syntax Description** This command has no arguments or keywords.

**Command Default** IPv6 unicast routing is disabled.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Configuring the **no ipv6 unicast-routing** command removes all IPv6 routing protocol entries from the IPv6 routing table.

**Examples** The following example enables the forwarding of IPv6 unicast datagrams:

```
Device(config)# ipv6 unicast-routing
```

Related Commands	Command	Description
	<b>ipv6 address link-local</b>	Configures an IPv6 link-local address for an interface and enables IPv6 processing on the interface.
	<b>ipv6 address eui-64</b>	Configures an IPv6 address and enables IPv6 processing on an interface using an EUI-64 interface ID in the low-order 64 bits of the address.
	<b>ipv6 enable</b>	Enables IPv6 processing on an interface that has not been configured with an explicit IPv6 address.
	<b>ipv6 unnumbered</b>	Enables IPv6 processing on an interface without assigning an explicit IPv6 address to the interface.
	<b>show ipv6 route</b>	Displays the current contents of the IPv6 routing table.

# show ipv6 access-list

To display the contents of all current IPv6 access lists, use the **show ipv6 access-list** command in user EXEC or privileged EXEC mode.

```
show ipv6 access-list [access-list-name]
```

<b>Syntax Description</b>	<i>access-list-name</i> (Optional) Name of access list.
---------------------------	---

**Command Default** All IPv6 access lists are displayed.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ipv6 access-list** command provides output similar to the **show ip access-list** command, except that it is IPv6-specific.

## Examples

The following output from the **show ipv6 access-list** command shows IPv6 access lists named inbound, tcptraffic, and outbound:

```
Device# show ipv6 access-list
IPv6 access list inbound
  permit tcp any any eq bgp reflect tcptraffic (8 matches) sequence 10
  permit tcp any any eq telnet reflect tcptraffic (15 matches) sequence 20
  permit udp any any reflect udptraffic sequence 30
IPv6 access list tcptraffic (reflexive) (per-user)
  permit tcp host 2001:0DB8:1::1 eq bgp host 2001:0DB8:1::2 eq 11000 timeout 300 (time
    left 243) sequence 1
  permit tcp host 2001:0DB8:1::1 eq telnet host 2001:0DB8:1::2 eq 11001 timeout 300
    (time left 296) sequence 2
IPv6 access list outbound
  evaluate udptraffic
  evaluate tcptraffic
```

The following sample output shows IPv6 access list information for use with IPsec:

```
Device# show ipv6 access-list
IPv6 access list Tunnel0-head-0-ACL (crypto)
  permit ipv6 any any (34 matches) sequence 1
IPv6 access list Ethernet2/0-ipsecv6-ACL (crypto)
  permit 89 FE80::/10 any (85 matches) sequence 1
```

The table below describes the significant fields shown in the display.

Table 18: show ipv6 access-list Field Descriptions

Field	Description
ipv6 access list inbound	Name of the IPv6 access list, for example, inbound.
permit	Permits any packet that matches the specified protocol type.
tcp	Transmission Control Protocol. The higher-level (Layer 4) protocol type that the packet must match.
any	Equal to ::/0.
eq	An equal operand that compares the source or destination ports of TCP or UDP packets.
bgp	Border Gateway Protocol. The lower-level (Layer 3) protocol type that the packet must be equal to.
reflect	Indicates a reflexive IPv6 access list.
tcptraffic (8 matches)	The name of the reflexive IPv6 access list and the number of matches for the access list. The <b>clear ipv6 access-list</b> privileged EXEC command resets the IPv6 access list match counters.
sequence 10	Sequence in which an incoming packet is compared to lines in an access list. Lines in an access list are ordered from first priority (lowest number, for example, 10) to last priority (highest number, for example, 80).
host 2001:0DB8:1::1	The source IPv6 host address that the source address of the packet must match.
host 2001:0DB8:1::2	The destination IPv6 host address that the destination address of the packet must match.
11000	The ephemeral source port number for the outgoing connection.
timeout 300	The total interval of idle time (in seconds) after which the temporary IPv6 reflexive access list named tcptraffic will time out for the indicated session.
(time left 243)	The amount of idle time (in seconds) remaining before the temporary IPv6 reflexive access list named tcptraffic is deleted for the indicated session. Additional received traffic that matches the indicated session resets this value to 300 seconds.
evaluate udptraffic	Indicates the IPv6 reflexive access list named udptraffic is nested in the IPv6 access list named outbound.

## Related Commands

Command	Description
<b>clear ipv6 access-list</b>	Resets the IPv6 access list match counters.
<b>hardware statistics</b>	Enables the collection of hardware statistics.
<b>show ip access-list</b>	Displays the contents of all current IP access lists.



Command	Description
<b>show ip prefix-list</b>	Displays information about a prefix list or prefix list entries.
<b>show ipv6 prefix-list</b>	Displays information about an IPv6 prefix list or IPv6 prefix list entries.

# show ipv6 destination-guard policy

To display destination guard information, use the **show ipv6 destination-guard policy** command in privileged EXEC mode.

**show ipv6 destination-guard policy** [*policy-name*]

<b>Syntax Description</b>	<i>policy-name</i> (Optional) Name of the destination guard policy.
---------------------------	---

**Command Modes** Privileged EXEC (#)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** If the *policy-name* argument is specified, only the specified policy information is displayed. If the *policy-name* argument is not specified, information is displayed for all policies.

## Examples

The following is sample output from the **show ipv6 destination-guard policy** command when the policy is applied to a VLAN:

```
Device# show ipv6 destination-guard policy poll
Destination guard policy destination:
  enforcement always
  Target: vlan 300
```

The following is sample output from the **show ipv6 destination-guard policy** command when the policy is applied to an interface:

```
Device# show ipv6 destination-guard policy poll
Destination guard policy destination:
  enforcement always
  Target: Gi0/0/1
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>ipv6 destination-guard policy</b>	Defines the destination guard policy.

# show ipv6 dhcp

To display the Dynamic Host Configuration Protocol (DHCP) unique identifier (DUID) on a specified device, use the **show ipv6 dhcp** command in user EXEC or privileged EXEC mode.

**show ipv6 dhcp**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ipv6 dhcp** command uses the DUID based on the link-layer address for both client and server identifiers. The device uses the MAC address from the lowest-numbered interface to form the DUID. The network interface is assumed to be permanently attached to the device. Use the **show ipv6 dhcp** command to display the DUID of a device.

**Examples** The following is sample output from the **show ipv6 dhcp** command. The output is self-explanatory:

```
Device# show ipv6 dhcp
This device's DHCPv6 unique identifier(DUID): 000300010002FCA5DC1C
```

# show ipv6 dhcp binding

To display automatic client bindings from the Dynamic Host Configuration Protocol (DHCP) for IPv6 server binding table, use the **show ipv6 dhcp binding** command in user EXEC or privileged EXEC mode.

**show ipv6 dhcp binding** [*ipv6-address*] [**vrf** *vrf-name*]

## Syntax Description

<i>ipv6-address</i>	(Optional) The address of a DHCP for IPv6 client.
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **show ipv6 dhcp binding** command displays all automatic client bindings from the DHCP for IPv6 server binding table if the *ipv6-address* argument is not specified. When the *ipv6-address* argument is specified, only the binding for the specified client is displayed.

If the **vrf** *vrf-name* keyword and argument combination is specified, all bindings that belong to the specified VRF are displayed.



### Note

The **ipv6 dhcp server vrf enable** command must be enabled for the configured VRF to work. If the command is not configured, the output of the **show ipv6 dhcp binding** command will not display the configured VRF; it will only display the default VRF details.

## Examples

The following sample output displays all automatic client bindings from the DHCP for IPv6 server binding table:

```
Device# show ipv6 dhcp binding

Client: FE80::A8BB:CCFF:FE00:300
DUID: 00030001AABBCC000300
Username : client_1
Interface: Virtual-Access2.1
IA PD: IA ID 0x000C0001, T1 75, T2 135
Prefix: 2001:380:E00::/64
        preferred lifetime 150, valid lifetime 300
        expires at Dec 06 2007 12:57 PM (262 seconds)
Client: FE80::A8BB:CCFF:FE00:300 (Virtual-Access2.2)
DUID: 00030001AABBCC000300
IA PD: IA ID 0x000D0001, T1 75, T2 135
Prefix: 2001:0DB8:E00:1::/64
```

```
preferred lifetime 150, valid lifetime 300
expires at Dec 06 2007 12:58 PM (288 seconds)
```

The table below describes the significant fields shown in the display.

**Table 19: show ipv6 dhcp binding Field Descriptions**

Field	Description
Client	Address of a specified client.
DUID	DHCP unique identifier (DUID).
Virtual-Access2.1	First virtual client. When an IPv6 DHCP client requests two prefixes with the same DUID but a different identity association for prefix delegation (IAPD ) on two different interfaces, these prefixes are considered to be for two different clients, and interface information is maintained for both.
Username : client_1	The username associated with the binding.
IA PD	Collection of prefixes assigned to a client.
IA ID	Identifier for this IAPD.
Prefix	Prefixes delegated to the indicated IAPD on the specified client.
preferred lifetime, valid lifetime	The preferred lifetime and valid lifetime settings, in seconds, for the specified client.
Expires at	Date and time at which the valid lifetime expires.
Virtual-Access2.2	Second virtual client. When an IPv6 DHCP client requests two prefixes with the same DUID but different IAIDs on two different interfaces, these prefixes are considered to be for two different clients, and interface information is maintained for both.

When the DHCPv6 pool on the Cisco IOS DHCPv6 server is configured to obtain prefixes for delegation from an authentication, authorization, and accounting (AAA) server, it sends the PPP username from the incoming PPP session to the AAA server for obtaining the prefixes. The PPP username is associated with the binding is displayed in output from the **show ipv6 dhcp binding** command. If there is no PPP username associated with the binding, this field value is displayed as "unassigned."

The following example shows that the PPP username associated with the binding is "client\_1":

```
Device# show ipv6 dhcp binding

Client: FE80::2AA:FF:FE8B:CC
DUID: 0003000100AA00BB00CC
Username : client_1
Interface : Virtual-Access2
IA PD: IA ID 0x00130001, T1 75, T2 135
Prefix: 2001:0DB8:1:3::/80
        preferred lifetime 150, valid lifetime 300
        expires at Aug 07 2008 05:19 AM (225 seconds)
```

The following example shows that the PPP username associated with the binding is unassigned:

```

Device# show ipv6 dhcp binding

Client: FE80::2AA:FF:FE8B:CC
DUID: 0003000100AA00BB00CC
Username : unassigned
Interface : Virtual-Access2
IA PD: IA ID 0x00130001, T1 150, T2 240
Prefix: 2001:0DB8:1:1::/80
        preferred lifetime 300, valid lifetime 300
        expires at Aug 11 2008 06:23 AM (233 seconds)

```

**Related Commands**

Command	Description
<b>ipv6 dhcp server vrf enable</b>	Enables the DHCPv6 server VRF-aware feature.
<b>clear ipv6 dhcp binding</b>	Deletes automatic client bindings from the DHCP for IPv6 binding table.

## show ipv6 dhcp conflict

To display address conflicts found by a Dynamic Host Configuration Protocol for IPv6 (DHCPv6) server when addresses are offered to the client, use the **show ipv6 dhcp conflict** command in privileged EXEC mode.

```
show ipv6 dhcp conflict [ipv6-address] [vrf vrf-name]
```

Syntax Description	
<i>ipv6-address</i>	(Optional) The address of a DHCP for IPv6 client.
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** When you configure the DHCPv6 server to detect conflicts, it uses ping. The client uses neighbor discovery to detect clients and reports to the server through a DECLINE message. If an address conflict is detected, the address is removed from the pool, and the address is not assigned until the administrator removes the address from the conflict list.

### Examples

The following is a sample output from the **show ipv6 dhcp conflict** command. This command shows the pool and prefix values for DHCP conflicts.:

```
Device# show ipv6 dhcp conflict
Pool 350, prefix 2001:0DB8:1005::/48
      2001:0DB8:1005::10
```

Related Commands	Command	Description
	clear ipv6 dhcp conflict	Clears an address conflict from the DHCPv6 server database.

# show ipv6 dhcp database

To display the Dynamic Host Configuration Protocol (DHCP) for IPv6 binding database agent information, use the **show ipv6 dhcp database** command in user EXEC or privileged EXEC mode.

**show ipv6 dhcp database** [*agent-URL*]

## Syntax Description

<i>agent-URL</i>	(Optional) A flash, NVRAM, FTP, TFTP, or remote copy protocol (RCP) uniform resource locator.
------------------	---

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Each permanent storage to which the binding database is saved is called the database agent. An agent can be configured using the **ipv6 dhcp database** command. Supported database agents include FTP and TFTP servers, RCP, Flash file system, and NVRAM.

The **show ipv6 dhcp database** command displays DHCP for IPv6 binding database agent information. If the *agent-URL* argument is specified, only the specified agent is displayed. If the *agent-URL* argument is not specified, all database agents are shown.

## Examples

The following is sample output from the **show ipv6 dhcp database** command:

```
Device# show ipv6 dhcp database
Database agent tftp://172.19.216.133/db.tftp:
  write delay: 69 seconds, transfer timeout: 300 seconds
  last written at Jan 09 2003 01:54 PM,
    write timer expires in 56 seconds
  last read at Jan 06 2003 05:41 PM
  successful read times 1
  failed read times 0
  successful write times 3172
  failed write times 2
Database agent nvram:/dhcpv6-binding:
  write delay: 60 seconds, transfer timeout: 300 seconds
  last written at Jan 09 2003 01:54 PM,
    write timer expires in 37 seconds
  last read at never
  successful read times 0
  failed read times 0
  successful write times 3325
  failed write times 0
Database agent flash:/dhcpv6-db:
  write delay: 82 seconds, transfer timeout: 3 seconds
  last written at Jan 09 2003 01:54 PM,
    write timer expires in 50 seconds
  last read at never
```



```

successful read times 0
failed read times 0
successful write times 2220
failed write times 614

```

The table below describes the significant fields shown in the display.

**Table 20: show ipv6 dhcp database Field Descriptions**

Field	Description
Database agent	Specifies the database agent.
Write delay	The amount of time (in seconds) to wait before updating the database.
transfer timeout	Specifies how long (in seconds) the DHCP server should wait before terminating a database transfer. Transfers that exceed the timeout period are terminated.
Last written	The last date and time bindings were written to the file server.
Write timer expires...	The length of time, in seconds, before the write timer expires.
Last read	The last date and time bindings were read from the file server.
Successful/failed read times	The number of successful or failed read times.
Successful/failed write times	The number of successful or failed write times.

#### Related Commands

Command	Description
<b>ipv6 dhcp database</b>	Specifies DHCP for IPv6 binding database agent parameters.

# show ipv6 dhcp guard policy

To display Dynamic Host Configuration Protocol for IPv6 (DHCPv6) guard information, use the **show ipv6 dhcp guard policy** command in privileged EXEC mode.

```
show ipv6 dhcp guard policy [policy-name]
```

<b>Syntax Description</b>	<i>policy-name</i> (Optional) DHCPv6 guard policy name.
---------------------------	---

**Command Modes** Privileged EXEC (#)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** If the *policy-name* argument is specified, only the specified policy information is displayed. If the *policy-name* argument is not specified, information is displayed for all policies.

## Examples

The following is sample output from the **show ipv6 dhcp guard guard** command:

```
Device# show ipv6 dhcp guard policy

Dhcp guard policy: default
  Device Role: dhcp client
  Target: Et0/3

Dhcp guard policy: test1
  Device Role: dhcp server
  Target: vlan 0    vlan 1    vlan 2    vlan 3    vlan 4
  Max Preference: 200
  Min Preference: 0
  Source Address Match Access List: acl1
  Prefix List Match Prefix List: pfxlist1

Dhcp guard policy: test2
  Device Role: dhcp relay
  Target: Et0/0 Et0/1 Et0/2
```

The table below describes the significant fields shown in the display.

**Table 21: show ipv6 dhcp guard Field Descriptions**

Field	Description
Device Role	The role of the device. The role is either client, server or relay.
Target	The name of the target. The target is either an interface or a VLAN.

**Related Commands**

Command	Description
ipv6 dhcp guard policy	Defines the DHCPv6 guard policy name.

# show ipv6 dhcp interface

To display Dynamic Host Configuration Protocol (DHCP) for IPv6 interface information, use the **show ipv6 dhcp interface** command in user EXEC or privileged EXEC mode.

**show ipv6 dhcp interface** [*type number*]

## Syntax Description

<i>type number</i>	(Optional) Interface type and number. For more information, use the question mark (?) online help function.
--------------------	---

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

If no interfaces are specified, all interfaces on which DHCP for IPv6 (client or server) is enabled are shown. If an interface is specified, only information about the specified interface is displayed.

## Examples

The following is sample output from the **show ipv6 dhcp interface** command. In the first example, the command is used on a router that has an interface acting as a DHCP for IPv6 server. In the second example, the command is used on a router that has an interface acting as a DHCP for IPv6 client:

```
Device# show ipv6 dhcp interface
Ethernet2/1 is in server mode
  Using pool: svr-pl
  Preference value: 20
  Rapid-Commit is disabled
Router2# show ipv6 dhcp interface
Ethernet2/1 is in client mode
  State is OPEN (1)
  List of known servers:
    Address: FE80::202:FCFF:FEA1:7439, DUID 000300010002FCA17400
    Preference: 20
      IA PD: IA ID 0x00040001, T1 120, T2 192
        Prefix: 3FFE:C00:C18:1::/72
          preferred lifetime 240, valid lifetime 54321
          expires at Nov 08 2002 09:10 AM (54319 seconds)
        Prefix: 3FFE:C00:C18:2::/72
          preferred lifetime 300, valid lifetime 54333
          expires at Nov 08 2002 09:11 AM (54331 seconds)
        Prefix: 3FFE:C00:C18:3::/72
          preferred lifetime 280, valid lifetime 51111
          expires at Nov 08 2002 08:17 AM (51109 seconds)
    DNS server: 1001::1
    DNS server: 1001::2
    Domain name: domain1.net
    Domain name: domain2.net
    Domain name: domain3.net
```

```
Prefix name is cli-p1
Rapid-Commit is enabled
```

The table below describes the significant fields shown in the display.

**Table 22: show ipv6 dhcp interface Field Descriptions**

Field	Description
Ethernet2/1 is in server/client mode	Displays whether the specified interface is in server or client mode.
Preference value:	The advertised (or default of 0) preference value for the indicated server.
Prefix name is cli-p1	Displays the IPv6 general prefix pool name, in which prefixes successfully acquired on this interface are stored.
Using pool: svr-p1	The name of the pool that is being used by the interface.
State is OPEN	State of the DHCP for IPv6 client on this interface. "Open" indicates that configuration information has been received.
List of known servers	Lists the servers on the interface.
Address, DUID	Address and DHCP unique identifier (DUID) of a server heard on the specified interface.
Rapid commit is disabled	Displays whether the <b>rapid-commit</b> keyword has been enabled on the interface.

The following example shows the DHCP for IPv6 relay agent configuration on FastEthernet interface 0/0, and use of the **show ipv6 dhcp interface** command displays relay agent information on FastEthernet interface 0/0:

```
Device(config-if)# ipv6 dhcp relay destination FE80::250:A2FF:FEBF:A056 FastEthernet0/1
Device# show ipv6 dhcp interface FastEthernet 0/0
FastEthernet0/0 is in relay mode
Relay destinations:
FE80::250:A2FF:FEBF:A056 via FastEthernet0/1
```

#### Related Commands

Command	Description
<b>ipv6 dhcp client pd</b>	Enables the DHCP for IPv6 client process and enables requests for prefix delegation through a specified interface.
<b>ipv6 dhcp relay destination</b>	Specifies a destination address to which client messages are forwarded and enables DHCP for IPv6 relay service on the interface.
<b>ipv6 dhcp server</b>	Enables DHCP for IPv6 service on an interface.

# show ipv6 dhcp relay binding

To display DHCPv6 Internet Assigned Numbers Authority (IANA) and DHCPv6 Identity Association for Prefix Delegation (IAPD) bindings on a relay agent, use the **show ipv6 dhcp relay binding** command in user EXEC or privileged EXEC mode.

**show ipv6 dhcp relay binding** [*vrf vrf-name*]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
----------------------------	--

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

If the **vrf** *vrf-name* keyword-argument pair is specified, all bindings belonging to the specified VRF are displayed.



### Note

Only the DHCPv6 IAPD bindings on a relay agent are displayed on the Cisco uBR10012 and Cisco uBR7200 series universal broadband devices.

## Examples

The following is sample output from the **show ipv6 dhcp relay binding** command:

```
Device# show ipv6 dhcp relay binding
```

The following example shows output from the **show ipv6 dhcp relay binding** command with a specified VRF name on a Cisco uBR10012 universal broadband device:

```
Device# show ipv6 dhcp relay binding vrf vrf1
```

```
Prefix: 2001:DB8:0:1:/64 (Bundle100.600)
  DUID: 000300010023BED94D31
  IAID: 3201912114
  lifetime: 600
```

The table below describes the significant fields shown in the display.

**Table 23: show ipv6 dhcp relay binding Field Descriptions**

Field	Description
Prefix	IPv6 prefix for DHCP.
DUID	DHCP Unique Identifier (DUID) for the IPv6 relay binding.

Field	Description
IAID	Identity Association Identification (IAID) for DHCP.
lifetime	Lifetime of the prefix, in seconds.

**Related Commands**

Command	Description
<b>clear ipv6 dhcp relay binding</b>	Clears a specific IPv6 address or IPv6 prefix of a DHCP for IPv6 relay binding.

# show ipv6 eigrp events

To display Enhanced Interior Gateway Routing Protocol (EIGRP) events logged for IPv6, use the **show ipv6 eigrp events** command in user EXEC or privileged EXEC mode.

**show ipv6 eigrp events** [[**errmsg** | **sia**] [*event-num-start event-num-end*] | **type**]

Syntax Description	Parameter	Description
	<b>errmsg</b>	(Optional) Displays error messages being logged.
	<b>sia</b>	(Optional) Displays Stuck In Active (SIA) messages.
	<i>event-num-start</i>	(Optional) Starting number of the event range. The range is from 1 to 4294967295.
	<i>event-num-end</i>	(Optional) Ending number of the event range. The range is from 1 to 4294967295.
	<b>type</b>	(Optional) Displays event types being logged.

**Command Default** If no event range is specified, information for all IPv6 EIGRP events is displayed.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ipv6 eigrp events** command is used to analyze a network failure by the Cisco support team and is not intended for general use. This command provides internal state information about EIGRP and how it processes route notifications and changes.

**Examples** The following is sample output from the **show ipv6 eigrp events** command. The fields are self-explanatory.

```
Device# show ipv6 eigrp events
Event information for AS 65535:
 1 00:56:41.719 State change: Successor Origin Local origin
 2 00:56:41.719 Metric set: 2555:5555::/32 4294967295
 3 00:56:41.719 Poison squashed: 2555:5555::/32 lost if
 4 00:56:41.719 Poison squashed: 2555:5555::/32 rt gone
 5 00:56:41.719 Route installing: 2555:5555::/32 FE80::ABCD:4:EF00:1
 6 00:56:41.719 RDB delete: 2555:5555::/32 FE80::ABCD:4:EF00:2
 7 00:56:41.719 Send reply: 2555:5555::/32 FE80::ABCD:4:EF00:1
 8 00:56:41.719 Find FS: 2555:5555::/32 4294967295
 9 00:56:41.719 Free reply status: 2555:5555::/32
10 00:56:41.719 Clr handle num/bits: 0 0x0
11 00:56:41.719 Clr handle dest/cnt: 2555:5555::/32 0
12 00:56:41.719 Rcv reply met/succ met: 4294967295 4294967295
13 00:56:41.719 Rcv reply dest/nh: 2555:5555::/32 FE80::ABCD:4:EF00:2
14 00:56:41.687 Send reply: 2555:5555::/32 FE80::ABCD:4:EF00:2
15 00:56:41.687 Rcv query met/succ met: 4294967295 4294967295
```



```
16 00:56:41.687 Rcv query dest/nh: 2555:5555::/32 FE80::ABCD:4:EF00:2
17 00:56:41.687 State change: Local origin Successor Origin
18 00:56:41.687 Metric set: 2555:5555::/32 4294967295
19 00:56:41.687 Active net/peers: 2555:5555::/32 65536
20 00:56:41.687 FC not sat Dmin/met: 4294967295 2588160
21 00:56:41.687 Find FS: 2555:5555::/32 2588160
22 00:56:41.687 Rcv query met/succ met: 4294967295 4294967295
23 00:56:41.687 Rcv query dest/nh: 2555:5555::/32 FE80::ABCD:4:EF00:1
24 00:56:41.659 Change queue emptied, entries: 1
25 00:56:41.659 Metric set: 2555:5555::/32 2588160
```

**Related Commands**

Command	Description
<b>clear ipv6 eigrp</b>	Deletes entries from EIGRP for IPv6 routing tables.
<b>debug ipv6 eigrp</b>	Displays information about EIGRP for IPv6 protocol.
<b>ipv6 eigrp</b>	Enables EIGRP for IPv6 on a specified interface.

# show ipv6 eigrp interfaces

To display information about interfaces configured for the Enhanced Interior Gateway Routing Protocol (EIGRP) in IPv6 topologies, use the **show ipv6 eigrp interfaces** command in user EXEC or privileged EXEC mode.

**show ipv6 eigrp** [*as-number*] **interfaces** [*type number*] [**detail**]

Syntax Description	
<i>as-number</i>	(Optional) Autonomous system number.
<i>type</i>	(Optional) Interface type. For more information, use the question mark (?) online help function.
<i>number</i>	(Optional) Interface number. For more information about the numbering syntax for your networking device, use the question mark (?) online help function.
<b>detail</b>	(Optional) Displays detailed interface information.

**Command Modes**

User EXEC (>)

Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

Use the **show ipv6 eigrp interfaces** command to determine the interfaces on which EIGRP is active and to get information about EIGRP processes related to those interfaces. The optional *type number* argument and the **detail** keyword can be entered in any order.

If an interface is specified, only that interface is displayed. Otherwise, all interfaces on which EIGRP is running are displayed.

If an autonomous system is specified, only the routing process for the specified autonomous system is displayed. Otherwise, all EIGRP processes are displayed.

## Examples

The following is sample output from the **show ipv6 eigrp interfaces** command:

```
Device# show ipv6 eigrp 1 interfaces

IPv6-EIGRP interfaces for process 1
Interface      Peers    Xmit Queue  Mean    Pacing Time  Multicast    Pending
              Un/Reliable SRTT      Un/Reliable  Flow Timer   Routes
Et0/0          0        0/0         0       0/10         0           0
```

The following is sample output from the **show ipv6 eigrp interfaces detail** command:

```
Device# show ipv6 eigrp interfaces detail

IPv6-EIGRP interfaces for process 1
Interface      Peers    Xmit Queue  Mean    Pacing Time  Multicast    Pending
              Un/Reliable SRTT      Un/Reliable  Flow Timer   Routes
Et0/0          0        0/0         0       0/10         0           0
```

```

Hello interval is 5 sec
Next xmit serial <none>
Un/reliable mcasts: 0/0 Un/reliable ucasts: 0/0
Mcast exceptions: 0 CR packets: 0 ACKs suppressed: 0
Retransmissions sent: 0 Out-of-sequence rcvd: 0
Authentication mode is not set

```

The following sample output from the **show ipv6 eigrp interface detail** command displays detailed information about a specific interface on which the **no ipv6 next-hop self** command is configured with the **no-ecmp-mode** option:

```

DeviceDevice# show ipv6 eigrp interfaces detail tunnel 0

EIGRP-IPv6 Interfaces for AS(1)
          Xmit Queue  PeerQ      Mean  Pacing Time  Multicast  Pending
Interface  Peers Un/Reliable Un/Reliable SRTT  Un/Reliable  Flow Timer  Routes
Tu0/0      2     0/0         0/0         29    0/0         136         0
Hello-interval is 5, Hold-time is 15
  Split-horizon is disabled
  Next xmit serial <none>
  Packetized sent/expedited: 48/1
  Hello's sent/expedited: 13119/49
  Un/reliable mcasts: 0/20 Un/reliable ucasts: 31/398
  Mcast exceptions: 5 CR packets: 5 ACKs suppressed: 1
  Retransmissions sent: 355 Out-of-sequence rcvd: 6
  Next-hop-self disabled, next-hop info forwarded, ECMP mode Enabled
  Topology-ids on interface - 0
  Authentication mode is not set

```

The table below describes the significant fields shown in the displays.

**Table 24: show ipv6 eigrp interfaces Field Descriptions**

Field	Description
Interface	Interface over which EIGRP is configured.
Peers	Number of directly connected EIGRP neighbors.
Xmit Queue Un/Reliable	Number of packets remaining in the Unreliable and Reliable transmit queues.
Mean SRTT	Mean smooth round-trip time (SRTT) interval (in seconds).
Pacing Time Un/Reliable	Pacing time (in seconds) used to determine when EIGRP packets (unreliable and reliable) should be sent out of the interface.
Multicast Flow Timer	Maximum number of seconds in which the device will send multicast EIGRP packets.
Pending Routes	Number of routes in the transmit queue waiting to be sent.
Hello interval is 5 sec	Length (in seconds) of the hello interval.

# show ipv6 eigrp topology

To display Enhanced Interior Gateway Routing Protocol (EIGRP) IPv6 topology table entries, use the **show ipv6 eigrp topology** command in user EXEC or privileged EXEC mode.

**show ipv6 eigrp topology** [*as-number ipv6-address*] [**active** | **all-links** | **pending** | **summary** | **zero-successors**]

## Syntax Description

<i>as-number</i>	(Optional) Autonomous system number.
<i>ipv6-address</i>	(Optional) IPv6 address.
<b>active</b>	(Optional) Displays only active entries in the EIGRP topology table.
<b>all-links</b>	(Optional) Displays all entries in the EIGRP topology table (including nonfeasible-successor sources).
<b>pending</b>	(Optional) Displays all entries in the EIGRP topology table that are either waiting for an update from a neighbor or waiting to reply to a neighbor.
<b>summary</b>	(Optional) Displays a summary of the EIGRP topology table.
<b>zero-successors</b>	(Optional) Displays the available routes that have zero successors.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

If this command is used without any keywords or arguments, only routes that are feasible successors are displayed. The **show ipv6 eigrp topology** command can be used to determine Diffusing Update Algorithm (DUAL) states and to debug possible DUAL problems.

## Examples

The following is sample output from the **show ipv6 eigrp topology** command. The fields in the display are self-explanatory.

```
Device# show ipv6 eigrp topology

IPv6-EIGRP Topology Table for AS(1)/ID(2001:0DB8:10::/64)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
r - reply Status, s - sia Status
P 2001:0DB8:3::/64, 1 successors, FD is 281600
via Connected, Ethernet1/0
```

The following sample output from the **show ipv6 eigrp topology prefix** command displays ECMP mode information when the **no ipv6 next-hop-self** command is configured without the **no-ecmp-mode** option in the EIGRP topology. The ECMP mode provides information about the path that is being

advertised. If there is more than one successor, the top most path will be advertised as the default path over all interfaces, and the message “ECMP Mode: Advertise by default” will be displayed in the output. If any path other than the default path is advertised, the message “ECMP Mode: Advertise out <Interface name>” will be displayed. The fields in the display are self-explanatory.

```
Device# show ipv6 eigrp topology 2001:DB8:10::1/128

EIGRP-IPv6 Topology Entry for AS(1)/ID(192.0.2.100) for 2001:DB8:10::1/128
  State is Passive, Query origin flag is 1, 2 Successor(s), FD is 284160
  Descriptor Blocks:
    FE80::A8BB:CCFF:FE01:2E01 (Tunnel0), from FE80::A8BB:CCFF:FE01:2E01, Send flag is 0x0
      Composite metric is (284160/281600), route is Internal
      Vector metric:
        Minimum bandwidth is 10000 Kbit
        Total delay is 1100 microseconds
        Reliability is 255/255
        Load is 1/55
        Minimum MTU is 1400
        Hop count is 1
        Originating router is 10.10.1.1
      ECMP Mode: Advertise by default
    FE80::A8BB:CCFF:FE01:3E01 (Tunnel1), from FE80::A8BB:CCFF:FE01:3E01, Send flag is 0x0
      Composite metric is (284160/281600), route is Internal
      Vector metric:
        Minimum bandwidth is 10000 Kbit
        Total delay is 1100 microseconds
        Reliability is 255/255
        Load is 1/55
        Minimum MTU is 1400
        Hop count is 1
        Originating router is 10.10.2.2
      ECMP Mode: Advertise out Tunnel1
```

#### Related Commands

Command	Description
<code>show eigrp address-family topology</code>	Displays entries in the EIGRP topology table.

# show ipv6 eigrp traffic

To display the number of Enhanced Interior Gateway Routing Protocol (EIGRP) for IPv6 packets sent and received, use the **show ipv6 eigrp traffic** command in user EXEC or privileged EXEC mode.

**show ipv6 eigrp traffic** [*as-number*]

## Syntax Description

<i>as-number</i>	(Optional) Autonomous system number.
------------------	--------------------------------------

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **show ipv6 eigrp traffic** command to provide information on packets received and sent.

## Examples

The following is sample output from the **show ipv6 eigrp traffic** command:

```
Device# show ipv6 eigrp traffic
IPv6-EIGRP Traffic Statistics for process 9
  Hellos sent/received: 218/205
  Updates sent/received: 7/23
  Queries sent/received: 2/0
  Replies sent/received: 0/2
  Acks sent/received: 21/14
```

The table below describes the significant fields shown in the display.

**Table 25: show ipv6 eigrp traffic Field Descriptions**

Field	Description
process 9	Autonomous system number specified in the <b>ipv6 router eigrp</b> command.
Hellos sent/received	Number of hello packets sent and received.
Updates sent/received	Number of update packets sent and received.
Queries sent/received	Number of query packets sent and received.
Replies sent/received	Number of reply packets sent and received.
Acks sent/received	Number of acknowledgment packets sent and received.

**Related Commands**

Command	Description
<b>ipv6 router eigrp</b>	Configures the EIGRP for IPv6 routing process.

## show ipv6 general-prefix

To display information on IPv6 general prefixes, use the **show ipv6 general-prefix** command in user EXEC or privileged EXEC mode.

**show ipv6 general-prefix**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **show ipv6 general-prefix** command to view information on IPv6 general prefixes.

### Examples

The following example shows an IPv6 general prefix called my-prefix, which has been defined based on a 6to4 interface. The general prefix is also being used to define an address on interface loopback42.

```
Device# show ipv6 general-prefix
IPv6 Prefix my-prefix, acquired via 6to4
2002:B0B:B0B::/48
  Loopback42 (Address command)
```

The table below describes the significant fields shown in the display.

**Table 26: show ipv6 general-prefix Field Descriptions**

Field	Description
IPv6 Prefix	User-defined name of the IPv6 general prefix.
Acquired via	The general prefix has been defined based on a 6to4 interface. A general prefix can also be defined manually or acquired using DHCP for IPv6 prefix delegation.
2002:B0B:B0B::/48	The prefix value for this general prefix.
Loopback42 (Address command)	List of interfaces where this general prefix is used.

### Related Commands

Command	Description
<b>ipv6 general-prefix</b>	Defines a general prefix for an IPv6 address manually.



# show ipv6 interface

To display the usability status of interfaces configured for IPv6, use the **show ipv6 interface** command in user EXEC or privileged EXEC mode.

**show ipv6 interface** [**brief** ][*type number*][**prefix**]

Syntax Description	Parameter	Description
	<b>brief</b>	(Optional) Displays a brief summary of IPv6 status and configuration for each interface.
	<i>type</i>	(Optional) The interface type about which to display information.
	<i>number</i>	(Optional) The interface number about which to display information.
	<b>prefix</b>	(Optional) Prefix generated from a local IPv6 prefix pool.

**Command Default** All IPv6 interfaces are displayed.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ipv6 interface** command provides output similar to the show ip interface command, except that it is IPv6-specific.

Use the **show ipv6 interface** command to validate the IPv6 status of an interface and its configured addresses. The show ipv6 interface command also displays the parameters that IPv6 is using for operation on this interface and any configured features.

If the interface's hardware is usable, the interface is marked up. If the interface can provide two-way communication for IPv6, the line protocol is marked up.

If you specify an optional interface type and number, the command displays information only about that specific interface. For a specific interface, you can enter the prefix keyword to see the IPv6 neighbor discovery (ND) prefixes that are configured on the interface.

## Interface Information for a Specific Interface with IPv6 Configured

The **show ipv6 interface** command displays information about the specified interface.

```
Device(config)# show ipv6 interface ethernet0/0
Ethernet0/0 is up, line protocol is up
  IPv6 is enabled, link-local address is FE80::A8BB:CCFF:FE00:6700
  No Virtual link-local address(es):
  Global unicast address(es):
    2001::1, subnet is 2001::/64 [DUP]
    2001::A8BB:CCFF:FE00:6700, subnet is 2001::/64 [EUI]
    2001:100::1, subnet is 2001:100::/64
```

```

Joined group address(es):
  FF02::1
  FF02::2
  FF02::1:FF00:1
  FF02::1:FF00:6700
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
ICMP unreachable are sent
ND DAD is enabled, number of DAD attempts: 1
ND reachable time is 30000 milliseconds (using 30000)
ND advertised reachable time is 0 (unspecified)
ND advertised retransmit interval is 0 (unspecified)
ND router advertisements are sent every 200 seconds
ND router advertisements live for 1800 seconds
ND advertised default router preference is Medium
Hosts use stateless autoconfig for addresses.

```

The table below describes the significant fields shown in the display.

**Table 27: show ipv6 interface Field Descriptions**

Field	Description
Ethernet0/0 is up, line protocol is up	Indicates whether the interface hardware is active (whether line signal is present) and whether it has been taken down by an administrator. If the interface hardware is usable, the interface is marked "up." For an interface to be usable, both the interface hardware and line protocol must be up.
line protocol is up, down (down is not shown in sample output)	Indicates whether the software processes that handle the line protocol consider the line usable (that is, whether keepalives are successful or IPv6 CP has been negotiated). If the interface can provide two-way communication, the line protocol is marked up. For an interface to be usable, both the interface hardware and line protocol must be up.
IPv6 is enabled, stalled, disabled (stalled and disabled are not shown in sample output)	Indicates that IPv6 is enabled, stalled, or disabled on the interface. If IPv6 is enabled, the interface is marked "enabled." If duplicate address detection processing identified the link-local address of the interface as being a duplicate address, the processing of IPv6 packets is disabled on the interface and the interface is marked "stalled." If IPv6 is not enabled, the interface is marked "disabled."
link-local address	Displays the link-local address assigned to the interface.
Global unicast address(es):	Displays the global unicast addresses assigned to the interface.
Joined group address(es):	Indicates the multicast groups to which this interface belongs.
MTU	Maximum transmission unit of the interface.
ICMP error messages	Specifies the minimum interval (in milliseconds) between error messages sent on this interface.
ICMP redirects	The state of Internet Control Message Protocol (ICMP) IPv6 redirect messages on the interface (the sending of the messages is enabled or disabled).

Field	Description
ND DAD	The state of duplicate address detection on the interface (enabled or disabled).
number of DAD attempts:	Number of consecutive neighbor solicitation messages that are sent on the interface while duplicate address detection is performed.
ND reachable time	Displays the neighbor discovery reachable time (in milliseconds) assigned to this interface.
ND advertised reachable time	Displays the neighbor discovery reachable time (in milliseconds) advertised on this interface.
ND advertised retransmit interval	Displays the neighbor discovery retransmit interval (in milliseconds) advertised on this interface.
ND router advertisements	Specifies the interval (in seconds) for neighbor discovery router advertisements (RAs) sent on this interface and the amount of time before the advertisements expire.  As of Cisco IOS Release 12.4(2)T, this field displays the default router preference (DRP) value sent by this device on this interface.
ND advertised default router preference is Medium	The DRP for the device on a specific interface.

The **show ipv6 interface** command displays information about attributes that may be associated with an IPv6 address assigned to the interface.

Attribute	Description
ANY	Anycast. The address is an anycast address, as specified when configured using the <b>ipv6 address</b> command.
CAL	Calendar. The address is timed and has valid and preferred lifetimes.
DEP	Deprecated. The timed address is deprecated.
DUP	Duplicate. The address is a duplicate, as determined by duplicate address detection (DAD). To re-attempt DAD, the user must use the <b>shutdown</b> or <b>no shutdown</b> command on the interface.
EUI	EUI-64 based. The address was generated using EUI-64.
OFF	Offlink. The address is offlink.

Attribute	Description
OOD	Overly optimistic DAD. DAD will not be performed for this address. This attribute applies to virtual addresses.
PRE	Preferred. The timed address is preferred.
TEN	Tentative. The address is in a tentative state per DAD.
UNA	Unactivated. The virtual address is not active and is in a standby state.
VIRT	Virtual. The address is virtual and is managed by HSRP, VRRP, or GLBP.

### show ipv6 interface Command Using the brief Keyword

The following is sample output from the **show ipv6 interface** command when entered with the **brief** keyword:

```
Device# show ipv6 interface brief
Ethernet0 is up, line protocol is up
Ethernet0          [up/up]
    unassigned
Ethernet1          [up/up]
    2001:0DB8:1000:/29
Ethernet2          [up/up]
    2001:0DB8:2000:/29
Ethernet3          [up/up]
    2001:0DB8:3000:/29
Ethernet4          [up/down]
    2001:0DB8:4000:/29
Ethernet5          [administratively down/down]
    2001:123::210:7BFF:FEC2:ACD8
Interface          Status          IPv6 Address
Ethernet0          up              3FFE:C00:0:1:260:3EFF:FE11:6770
Ethernet1          up              unassigned
Fddi0              up              3FFE:C00:0:2:260:3EFF:FE11:6772
Serial0            administratively down unassigned
Serial1            administratively down unassigned
Serial2            administratively down unassigned
Serial3            administratively down unassigned
Tunnel0            up              unnumbered (Ethernet0)
Tunnel1            up              3FFE:700:20:1::12
```

### IPv6 Interface with ND Prefix Configured

This sample output shows the characteristics of an interface that has generated a prefix from a local IPv6 prefix pool:

```
Device# show ipv6 interface Ethernet 0/0 prefix

interface Ethernet0/0
  ipv6 address 2001:0DB8::1/64
  ipv6 address 2001:0DB8::2/64
```

```

ipv6 nd prefix 2001:0DB8:2::/64
ipv6 nd prefix 2001:0DB8:3::/64 2592000 604800 off-link
end
.
.
.
IPv6 Prefix Advertisements Ethernet0/0
Codes: A - Address, P - Prefix-Advertisement, O - Pool
       U - Per-user prefix, D - Default
       N - Not advertised, C - Calendar
       default [LA] Valid lifetime 2592000, preferred lifetime 604800
AD    2001:0DB8:1::/64 [LA] Valid lifetime 2592000, preferred lifetime 604800
APD   2001:0DB8:2::/64 [LA] Valid lifetime 2592000, preferred lifetime 604800
P     2001:0DB8:3::/64 [A] Valid lifetime 2592000, preferred lifetime 604800

```

The default prefix shows the parameters that are configured using the `ipv6 nd prefix default` command.

### IPv6 Interface with DRP Configured

This sample output shows the state of the DRP preference value as advertised by this device through an interface:

```

Device# show ipv6 interface gigabitethernet 0/1
GigabitEthernet0/1 is up, line protocol is up
IPv6 is enabled, link-local address is FE80::130
Description: Management network (dual stack)
Global unicast address(es):
  FEC0:240:104:1000::130, subnet is FEC0:240:104:1000::/64
Joined group address(es):
  FF02::1
  FF02::2
  FF02::1:FF00:130
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
ND DAD is enabled, number of DAD attempts: 1
ND reachable time is 30000 milliseconds
ND advertised reachable time is 0 milliseconds
ND advertised retransmit interval is 0 milliseconds
ND router advertisements are sent every 200 seconds
ND router advertisements live for 1800 seconds
ND advertised default router preference is Low
Hosts use stateless autoconfig for addresses.

```

### IPv6 Interface with HSRP Configured

When HSRP IPv6 is first configured on an interface, the interface IPv6 link-local address is marked unactive (UNA) because it is no longer advertised, and the HSRP IPv6 virtual link-local address is added to the virtual link-local address list with the UNA and tentative DAD (TEN) attributes set. The interface is also programmed to listen for the HSRP IPv6 multicast address.

This sample output shows the status of UNA and TEN attributes, when HSRP IPv6 is configured on an interface:

```

Device# show ipv6 interface ethernet 0/0
Ethernet0/0 is up, line protocol is up
IPv6 is enabled, link-local address is FE80:2::2 [UNA]
Virtual link-local address(es):

```

```

FE80::205:73FF:FEA0:1 [UNA/TEN]
Global unicast address(es):
 2001:2::2, subnet is 2001:2::/64
Joined group address(es):
 FF02::1
 FF02::2
 FF02::66
 FF02::1:FF00:2
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ND DAD is enabled, number of DAD attempts: 1

```

After the HSRP group becomes active, the UNA and TEN attributes are cleared, and the overly optimistic DAD (OOD) attribute is set. The solicited node multicast address for the HSRP virtual IPv6 address is also added to the interface.

This sample output shows the status of UNA, TEN and OOD attributes, when HSRP group is activated:

```

# show ipv6 interface ethernet 0/0
Ethernet0/0 is up, line protocol is up
IPv6 is enabled, link-local address is FE80:2::2 [UNA]
Virtual link-local address(es):
 FE80::205:73FF:FEA0:1 [OPT]
Global unicast address(es):
 2001:2::2, subnet is 2001:2::/64
Joined group address(es):
 FF02::1
 FF02::2
 FF02::66
 FF02::1:FF00:2
 FF02::1:FFA0:1
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
ND DAD is enabled, number of DAD attempts: 1

```

The table below describes additional significant fields shown in the displays for the **show ipv6 interface** command with HSRP configured.

**Table 28: show ipv6 interface Command with HSRP Configured Field Descriptions**

Field	Description
IPv6 is enabled, link-local address is FE80:2::2 [UNA]	The interface IPv6 link-local address is marked UNA because it is no longer advertised.
FE80::205:73FF:FEA0:1 [UNA/TEN]	The virtual link-local address list with the UNA and TEN attributes set.
FF02::66	HSRP IPv6 multicast address.
FE80::205:73FF:FEA0:1 [OPT]	HSRP becomes active, and the HSRP virtual address marked OPT.
FF02::1:FFA0:1	HSRP solicited node multicast address.

### IPv6 Interface with Minimum RA Interval Configured

When you enable Mobile IPv6 on an interface, you can configure a minimum interval between IPv6 router advertisement (RA) transmissions. The **show ipv6 interface** command output reports the minimum RA interval, when configured. If the minimum RA interval is not explicitly configured, then it is not displayed.

In the following example, the maximum RA interval is configured as 100 seconds, and the minimum RA interval is configured as 60 seconds on Ethernet interface 1/0:

```
Device(config-if)# ipv6 nd ra-interval 100 60
```

Subsequent use of the **show ipv6 interface** then displays the interval as follows:

```
Device(config)# show ipv6 interface ethernet 1/0
Ethernet1/0 is administratively down, line protocol is down
IPv6 is enabled, link-local address is FE80::A8BB:CCFF:FE00:5A01 [TEN]
No Virtual link-local address(es):
No global unicast address is configured
Joined group address(es):
  FF02::1
  FF02::2
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
ICMP unreachable are sent
ND DAD is enabled, number of DAD attempts: 1
ND reachable time is 30000 milliseconds
ND advertised reachable time is 0 milliseconds
ND advertised retransmit interval is 0 milliseconds
ND router advertisements are sent every 60 to 100 seconds
ND router advertisements live for 1800 seconds
ND advertised default router preference is Medium
Hosts use stateless autoconfig for addresses.
```

In the following example, the maximum RA interval is configured as 100 milliseconds (ms), and the minimum RA interval is configured as 60 ms on Ethernet interface 1/0:

```
Device(config)# show ipv6 interface ethernet 1/0
Ethernet1/0 is administratively down, line protocol is down
IPv6 is enabled, link-local address is FE80::A8BB:CCFF:FE00:5A01 [TEN]
No Virtual link-local address(es):
No global unicast address is configured
Joined group address(es):
  FF02::1
  FF02::2
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
ICMP unreachable are sent
ND DAD is enabled, number of DAD attempts: 1
ND reachable time is 30000 milliseconds
ND advertised reachable time is 0 milliseconds
ND advertised retransmit interval is 0 milliseconds
ND router advertisements are sent every 60 to 100 milliseconds
ND router advertisements live for 1800 seconds
ND advertised default router preference is Medium
Hosts use stateless autoconfig for addresses.
```

The table below describes additional significant fields shown in the displays for the **show ipv6 interface** command with minimum RA interval information configured.

**Table 29: show ipv6 interface Command with Minimum RA Interval Information Configuration Field Descriptions**

Field	Description
ND router advertisements are sent every 60 to 100 seconds	ND RAs are sent at an interval randomly selected from a value between the minimum and maximum values. In this example, the minimum value is 60 seconds, and the maximum value is 100 seconds.
ND router advertisements are sent every 60 to 100 milliseconds	ND RAs are sent at an interval randomly selected from a value between the minimum and maximum values. In this example, the minimum value is 60 ms, and the maximum value is 100 ms.

#### Related Commands

Command	Description
<b>ipv6 nd prefix</b>	Configures which IPv6 prefixes are included in IPv6 router advertisements.
<b>ipv6 nd ra interval</b>	Configures the interval between IPv6 RA transmissions on an interface.
<b>show ip interface</b>	Displays the usability status of interfaces configured for IP.



# show ipv6 mfib

To display the forwarding entries and interfaces in the IPv6 Multicast Forwarding Information Base (MFIB), use the **show ipv6 mfib** command in user EXEC or privileged EXEC mode.

**show ipv6 mfib** [*vrf vrf-name*] [**all** | **linkscope** | **verbose** *group-address-name* | *ipv6-prefix/ prefix-length source-address-name*] **interface** | **status** | **summary**]

**show ipv6 mfib** [*vrf vrf-name*] [**all** | **linkscope** | **verbose** | **interface** | **status** | **summary**]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<b>all</b>	(Optional) Displays all forwarding entries and interfaces in the IPv6 MFIB.
<b>linkscope</b>	(Optional) Displays the link-local groups.
<b>verbose</b>	(Optional) Provides additional information, such as the MAC encapsulation header and platform-specific information.
<i>ipv6-prefix</i>	(Optional) The IPv6 network assigned to the interface. The default IPv6 prefix is 128.  This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
<i>/ prefix-length</i>	(Optional) The length of the IPv6 prefix. A decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash mark must precede the decimal value.
<i>group-address-name</i>	(Optional) IPv6 address or name of the multicast group.
<i>source-address-name</i>	(Optional) IPv6 address or name of the multicast group.
<b>interface</b>	(Optional) Interface settings and status.
<b>status</b>	(Optional) General settings and status.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **show ipv6 mfib** command to display MFIB entries; and forwarding interfaces, and their traffic statistics. This command can be enabled on virtual IP (VIP) if the router is operating in distributed mode.

A forwarding entry in the MFIB has flags that determine the default forwarding and signaling behavior to use for packets matching the entry. The entry also has per-interface flags that further specify the forwarding

behavior for packets received or forwarded on specific interfaces. The table below describes the MFIB forwarding entries and interface flags.

**Table 30: MFIB Entries and Interface Flags**

Flag	Description
F	Forward--Data is forwarded out of this interface.
A	Accept--Data received on this interface is accepted for forwarding.
IC	Internal copy--Deliver to the router a copy of the packets received or forwarded on this interface.
NS	Negate signal--Reverse the default entry signaling behavior for packets received on this interface.
DP	Do not preserve--When signaling the reception of a packet on this interface, do not preserve a copy of it (discard it instead).
SP	Signal present--The reception of a packet on this interface was just signaled.
S	Signal--By default, signal the reception of packets matching this entry.
C	Perform directly connected check for packets matching this entry. Signal the reception if packets were originated by a directly connected source.

## Examples

The following example displays the forwarding entries and interfaces in the MFIB. The router is configured for fast switching, and it has a receiver joined to FF05::1 on Ethernet1/1 and a source (2001::1:1:20) sending on Ethernet1/2:

```
Device# show ipv6 mfib
IP Multicast Forwarding Information Base
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
             AR - Activity Required, D - Drop
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts: Total/RPF failed/Other drops
Interface Flags: A - Accept, F - Forward, NS - Negate Signalling
                IC - Internal Copy, NP - Not platform switched
                SP - Signal Present
Interface Counts: FS Pkt Count/PS Pkt Count
(*,FF00::/8) Flags: C
  Forwarding: 0/0/0/0, Other: 0/0/0
  Tunnel0 Flags: NS
(*,FF00::/15) Flags: D
  Forwarding: 0/0/0/0, Other: 0/0/0
(*,FF05::1) Flags: C
  Forwarding: 2/0/100/0, Other: 0/0/0
  Tunnel0 Flags: A NS
  Ethernet1/1 Flags: F NS
    Pkts: 0/2
(2001::1:1:20,FF05::1) Flags:
  Forwarding: 5/0/100/0, Other: 0/0/0
  Ethernet1/2 Flags: A
  Ethernet1/1 Flags: F NS
    Pkts: 3/2
(*,FF10::/15) Flags: D
  Forwarding: 0/0/0/0, Other: 0/0/0
```

The table below describes the significant fields shown in the display.

Table 31: show ipv6 mfib Field Descriptions

Field	Description
Entry Flags	Information about the entry.
Forwarding Counts	Statistics on the packets that are received from and forwarded to at least one interface.
Pkt Count/	Total number of packets received and forwarded since the creation of the multicast forwarding state to which this counter applies.
Pkts per second/	Number of packets received and forwarded per second.
Avg Pkt Size/	Total number of bytes divided by the total number of packets for this multicast forwarding state. There is no direct display for the total number of bytes. You can calculate the total number of bytes by multiplying the average packet size by the packet count.
Kbits per second	Bytes per second divided by packets per second divided by 1000.
Other counts:	Statistics on the received packets. These counters include statistics about the packets received and forwarded and packets received but not forwarded.
Interface Flags:	Information about the interface.
Interface Counts:	Interface statistics.

The following example shows forwarding entries and interfaces in the MFIB, with a group address of FF03:1::1 specified:

```

Device# show ipv6 mfib FF03:1::1
IP Multicast Forwarding Information Base
Entry Flags:C - Directly Connected, S - Signal, IA - Inherit A
flag,
          AR - Activity Required, D - Drop
Forwarding Counts:Pkt Count/Pkts per second/Avg Pkt Size/Kbits per
second
Other counts:Total/RPF failed/Other drops
Interface Flags:A - Accept, F - Forward, NS - Negate Signalling
          IC - Internal Copy, NP - Not platform switched
          SP - Signal Present
Interface Counts:FS Pkt Count/PS Pkt Count
*,FF03:1::1) Flags:C
  Forwarding:0/0/0/0, Other:0/0/0
  Tunnel Flags:A NS
  GigabitEthernet5/0.25 Flags:F NS
    Pkts:0/0
  GigabitEthernet5/0.24 Flags:F NS
    Pkts:0/0
(5002:1::2,FF03:1::1) Flags:
  Forwarding:71505/0/50/0, Other:42/0/42
  GigabitEthernet5/0 Flags:A
  GigabitEthernet5/0.19 Flags:F NS
    Pkts:239/24
  GigabitEthernet5/0.20 Flags:F NS
    Pkts:239/24
  GigabitEthernet5/0.21 Flags:F NS
    Pkts:238/24

```

```
.
.
GigabitEthernet5/0.16 Flags:F NS
Pkts:71628/24
```

The following example shows forwarding entries and interfaces in the MFIB, with a group address of FF03:1::1 and a source address of 5002:1::2 specified:

```
Device# show ipv6 mfib FF03:1::1 5002:1::2

IP Multicast Forwarding Information Base
Entry Flags:C - Directly Connected, S - Signal, IA - Inherit A flag,
          AR - Activity Required, D - Drop
Forwarding Counts:Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:Total/RPF failed/Other drops
Interface Flags:A - Accept, F - Forward, NS - Negate Signalling
          IC - Internal Copy, NP - Not platform switched
          SP - Signal Present
Interface Counts:FS Pkt Count/PS Pkt Count
(5002:1::2,FF03:1::1) Flags:
  Forwarding:71505/0/50/0, Other:42/0/42
  GigabitEthernet5/0 Flags:A
  GigabitEthernet5/0.19 Flags:F NS
    Pkts:239/24
  GigabitEthernet5/0.20 Flags:F NS
    Pkts:239/24
.
.
.
  GigabitEthernet5/0.16 Flags:F NS
    Pkts:71628/24
```

The following example shows forwarding entries and interfaces in the MFIB, with a group address of FF03:1::1 and a default prefix of 128:

```
Device# show ipv6 mfib FF03:1::1/128

IP Multicast Forwarding Information Base
Entry Flags:C - Directly Connected, S - Signal, IA - Inherit A flag,
          AR - Activity Required, D - Drop
Forwarding Counts:Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:Total/RPF failed/Other drops
Interface Flags:A - Accept, F - Forward, NS - Negate Signalling
          IC - Internal Copy, NP - Not platform switched
          SP - Signal Present
Interface Counts:FS Pkt Count/PS Pkt Count
(*,FF03:1::1) Flags:C
  Forwarding:0/0/0/0, Other:0/0/0
  Tunnell Flags:A NS
  GigabitEthernet5/0.25 Flags:F NS
    Pkts:0/0
  GigabitEthernet5/0.24 Flags:F NS
    Pkts:0/0
.
.
.
  GigabitEthernet5/0.16 Flags:F NS
    Pkts:0/0
```

The following example shows forwarding entries and interfaces in the MFIB, with a group address of FFE0 and a prefix of 15:

```
Device# show ipv6 mfib FFE0::/15
```

```

IP Multicast Forwarding Information Base
Entry Flags:C - Directly Connected, S - Signal, IA - Inherit A flag,
          AR - Activity Required, D - Drop
Forwarding Counts:Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts:Total/RPF failed/Other drops
Interface Flags:A - Accept, F - Forward, NS - Negate Signalling
          IC - Internal Copy, NP - Not platform switched
          SP - Signal Present
Interface Counts:FS Pkt Count/PS Pkt Count
(*,FFE0::/15) Flags:D
  Forwarding:0/0/0/0, Other:0/0/0

```

The following example shows output of the **show ipv6 mfib** command used with the **verbose** keyword. It shows forwarding entries and interfaces in the MFIB and additional information such as the MAC encapsulation header and platform-specific information.

```

Device# show ipv6 mfib ff33::1:1 verbose
IP Multicast Forwarding Information Base
Entry Flags: C - Directly Connected, S - Signal, IA - Inherit A flag,
          AR - Activity Required, K - Keepalive
Forwarding Counts: Pkt Count/Pkts per second/Avg Pkt Size/Kbits per second
Other counts: Total/RPF failed/Other drops
Platform per slot HW-Forwarding Counts: Pkt Count/Byte Count
Platform flags: HF - Forwarding entry,HB - Bridge entry,HD - NonRPF Drop entry,
          NP - Not platform switchable,RPL - RPF-rtl linkage,
          MCG - Metset change,ERR - S/w Error Flag,RTY - In RetryQ,
          LP - L3 pending,MP - Met pending,AP - ACL pending
Interface Flags: A - Accept, F - Forward, NS - Negate Signalling
          IC - Internal Copy, NP - Not platform switched
          SP - Signal Present
Interface Counts: Distributed FS Pkt Count/FS Pkt Count/PS Pkt Count
(10::2,FF33::1:1) Flags: K
  RP Forwarding: 0/0/0/0, Other: 0/0/0
  LC Forwarding: 0/0/0/0, Other: 0/0/0
  HW Forwd: 0/0/0/0, Other: NA/NA/NA
  Slot 6: HW Forwarding: 0/0, Platform Flags: HF RPL
  Slot 1: HW Forwarding: 0/0, Platform Flags: HF RPL
Vlan10 Flags: A
Vlan30 Flags: F NS
  Pkts: 0/0/0 MAC: 33330001000100D0FFFE180086DD

```

The table below describes the fields shown in the display.

**Table 32: show ipv6 mfib verbose Field Descriptions**

Field	Description
Platform flags	Information about the platform.
Platform per slot HW-Forwarding Counts	Total number of packets per bytes forwarded.

#### Related Commands

Command	Description
<b>show ipv6 mfib active</b>	Displays the rate at which active sources are sending to multicast groups.
<b>show ipv6 mfib count</b>	Displays summary traffic statistics from the MFIB about the group and source.
<b>show ipv6 mfib interface</b>	Displays information about IPv6 multicast-enabled interfaces and their forwarding status.

Command	Description
<b>show ipv6 mfib status</b>	Displays the general MFIB configuration and operational status.
<b>show ipv6 mfib summary</b>	Displays summary information about the number of IPv6 MFIB entries (including link-local groups) and interfaces.

# show ipv6 mld groups

To display the multicast groups that are directly connected to the router and that were learned through Multicast Listener Discovery (MLD), use the **show ipv6 mld groups** command in user EXEC or privileged EXEC mode.

**show ipv6 mld** [*vrf vrf-name*] **groups** [**link-local**] [*group-name* *group-address*] [*interface-type interface-number*] [**detail** | **explicit**]

Syntax Description		
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.	
<b>link-local</b>	(Optional) Displays the link-local groups.	
<i>group-name</i>   <i>group-address</i>	(Optional) IPv6 address or name of the multicast group.	
<i>interface-type interface-number</i>	(Optional) Interface type and number.	
<b>detail</b>	(Optional) Displays detailed information about individual sources.	
<b>explicit</b>	(Optional) Displays information about the hosts being explicitly tracked on each interface for each group.	

**Command Modes**

User EXEC (>)

Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

If you omit all optional arguments, the **show ipv6 mld groups** command displays by group address and interface type and number all directly connected multicast groups, including link-local groups (where the **link-local** keyword is not available) used.

## Examples

The following is sample output from the **show ipv6 mld groups** command. It shows all of the groups joined by Fast Ethernet interface 2/1, including link-local groups used by network protocols.

```
Device# show ipv6 mld groups FastEthernet 2/1
MLD Connected Group Membership
Group Address          Interface              Uptime              Expires
FF02::2                FastEthernet2/1       3d18h              never
FF02::D                FastEthernet2/1       3d18h              never
FF02::16               FastEthernet2/1       3d18h              never
FF02::1:FF00:1         FastEthernet2/1       3d18h              00:00:27
FF02::1:FF00:79        FastEthernet2/1       3d18h              never
FF02::1:FF23:83C2      FastEthernet2/1       3d18h              00:00:22
FF02::1:FFAF:2C39      FastEthernet2/1       3d18h              never
FF06:7777::1          FastEthernet2/1       3d18h              00:00:26
```

The following is sample output from the **show ipv6 mld groups** command using the **detail** keyword:

```

Device# show ipv6 mld groups detail
Interface:      Ethernet2/1/1
Group:          FF33::1:1:1
Uptime:         00:00:11
Router mode:    INCLUDE
Host mode:      INCLUDE
Last reporter:  FE80::250:54FF:FE60:3B14
Group source list:
Source Address          Uptime    Expires    Fwd  Flags
2004:4::6              00:00:11  00:04:08  Yes  Remote Ac 4

```

The following is sample output from the **show ipv6 mld groups** command using the **explicit** keyword:

```

Device# show ipv6 mld groups explicit
Ethernet1/0, FF05::1
  Up:00:43:11 EXCLUDE(0/1) Exp:00:03:17
  Host Address          Uptime    Expires
  FE80::A8BB:CCFF:FE00:800  00:43:11  00:03:17
  Mode:EXCLUDE
Ethernet1/0, FF05::6
  Up:00:42:22 INCLUDE(1/0) Exp:not used
  Host Address          Uptime    Expires
  FE80::A8BB:CCFF:FE00:800  00:42:22  00:03:17
  Mode:INCLUDE
  300::1
  300::2
  300::3
Ethernet1/0 - Interface
ff05::1 - Group address
Up:Uptime for the group
EXCLUDE/INCLUDE - The mode the group is in on the router.
(0/1) (1/0) - (Number of hosts in INCLUDE mode/Number of hosts in EXCLUDE moe)
Exp:Expiry time for the group.
FE80::A8BB:CCFF:FE00:800 - Host ipv6 address.
00:43:11 - Uptime for the host.
00:03:17 - Expiry time for the host
Mode:INCLUDE/EXCLUDE - Mode the Host is operating in.
300::1, 300::2, 300::3 - Sources that the host has joined in the above specified mode.

```

The table below describes the significant fields shown in the display.

**Table 33: show ipv6 mld groups Field Descriptions**

Field	Description
Group Address	Address of the multicast group.
Interface	Interface through which the group is reachable.
Uptime	How long (in hours, minutes, and seconds) this multicast group has been known.
Expires	How long (in hours, minutes, and seconds) until the entry is removed from the MLD groups table.  The expiration timer shows "never" if the router itself has joined the group, and the expiration timer shows "not used" when the router mode of the group is INCLUDE. In this situation, the expiration timers on the source entries are used.
Last reporter:	Last host to report being a member of the multicast group.



Field	Description
Flags Ac 4	Flags counted toward the MLD state limits configured.

**Related Commands**

Command	Description
<b>ipv6 mld query-interval</b>	Configures the frequency at which the Cisco IOS software sends MLD host-query messages.

# show ipv6 mld interface

To display multicast-related information about an interface, use the **show ipv6 mld interface** command in user EXEC or privileged EXEC mode.

**show ipv6 mld** [*vrf vrf-name*] **interface** [*type number*]

Syntax Description	
<b>vrf vrf-name</b>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<b>type number</b>	(Optional) Interface type and number.

**Command Modes**  
User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**  
If you omit the optional *type* and *number* arguments, the **show ipv6 mld interface** command displays information about all interfaces.

## Examples

The following is sample output from the **show ipv6 mld interface** command for Ethernet interface 2/1/1:

```
Device# show ipv6 mld interface Ethernet 2/1/1
Global State Limit : 2 active out of 2 max
Loopback0 is administratively down, line protocol is down
  Internet address is ::/0
.
.
.
Ethernet2/1/1 is up, line protocol is up
  Internet address is FE80::260:3EFF:FE86:5649/10
  MLD is enabled on interface
  Current MLD version is 2
  MLD query interval is 125 seconds
  MLD querier timeout is 255 seconds
  MLD max query response time is 10 seconds
  Last member query response interval is 1 seconds
  Interface State Limit : 2 active out of 3 max
  State Limit permit access list:
  MLD activity: 83 joins, 63 leaves
  MLD querying router is FE80::260:3EFF:FE86:5649 (this system)
```

The table below describes the significant fields shown in the display.

**Table 34: show ipv6 mld interface Field Descriptions**

Field	Description
Global State Limit: 2 active out of 2 max	Two globally configured MLD states are active.

Field	Description
Ethernet2/1/1 is up, line protocol is up	Interface type, number, and status.
Internet address is...	Internet address of the interface and subnet mask being applied to the interface.
MLD is enabled in interface	Indicates whether Multicast Listener Discovery (MLD) has been enabled on the interface with the <b>ipv6 multicast-routing</b> command.
Current MLD version is 2	The current MLD version.
MLD query interval is 125 seconds	Interval (in seconds) at which the Cisco IOS software sends MLD query messages, as specified with the <b>ipv6 mld query-interval</b> command.
MLD querier timeout is 255 seconds	The length of time (in seconds) before the router takes over as the querier for the interface, as specified with the <b>ipv6 mld query-timeout</b> command.
MLD max query response time is 10 seconds	The length of time (in seconds) that hosts have to answer an MLD Query message before the router deletes their group, as specified with the <b>ipv6 mld query-max-response-time</b> command.
Last member query response interval is 1 seconds	Used to calculate the maximum response code inserted in group and source-specific query. Also used to tune the "leave latency" of the link. A lower value results in reduced time to detect the last member leaving the group.
Interface State Limit : 2 active out of 3 max	Two out of three configured interface states are active.
State Limit permit access list: change	Activity for the state permit access list.
MLD activity: 83 joins, 63 leaves	Number of groups joins and leaves that have been received.
MLD querying router is FE80::260:3EFF:FE86:5649 (this system)	IPv6 address of the querying router.

#### Related Commands

Command	Description
<b>ipv6 mld join-group</b>	Configures MLD reporting for a specified group and source.
<b>ipv6 mld query-interval</b>	Configures the frequency at which the Cisco IOS software sends MLD host-query messages.

# show ipv6 mld snooping

Use the **show ipv6 mld snooping** command in EXEC mode to display IP version 6 (IPv6) Multicast Listener Discovery (MLD) snooping configuration of the switch or the VLAN.

**show ipv6 mld snooping** [**vlan** *vlan-id*]

<b>Syntax Description</b>	<b>vlan</b> <i>vlan-id</i> (Optional) Specify a VLAN; the range is 1 to 1001 and 1006 to 4094.
---------------------------	--

<b>Command Modes</b>	User EXEC (>) Privileged EXEC (#)
----------------------	--------------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	<p>Use this command to display MLD snooping configuration for the switch or for a specific VLAN.</p> <p>VLAN numbers 1002 through 1005 are reserved for Token Ring and FDDI VLANs and cannot be used in MLD snooping.</p> <p>To configure the dual IPv4 and IPv6 template, enter the <b>sdm prefer dual-ipv4-and-ipv6</b> global configuration command and reload the switch.</p>
-------------------------	---

<b>Examples</b>	<p>This is an example of output from the show ipv6 mld snooping vlan command. It shows snooping characteristics for a specific VLAN.</p>
-----------------	--

```
Device# show ipv6 mld snooping vlan 100
Global MLD Snooping configuration:
-----
MLD snooping : Enabled
MLDv2 snooping (minimal) : Enabled
Listener message suppression : Enabled
TCN solicit query : Disabled
TCN flood query count : 2
Robustness variable : 3
Last listener query count : 2
Last listener query interval : 1000
Vlan 100:
-----
MLD snooping : Disabled
MLDv1 immediate leave : Disabled
Explicit host tracking : Enabled
Multicast router learning mode : pim-dvmrp
Robustness variable : 3
Last listener query count : 2
Last listener query interval : 1000
```

This is an example of output from the **show ipv6 mld snooping** command. It displays snooping characteristics for all VLANs on the switch.

```

Device# show ipv6 mld snooping
Global MLD Snooping configuration:
-----
MLD snooping : Enabled
MLDv2 snooping (minimal) : Enabled
Listener message suppression : Enabled
TCN solicit query : Disabled
TCN flood query count : 2
Robustness variable : 3
Last listener query count : 2
Last listener query interval : 1000

Vlan 1:
-----
MLD snooping : Disabled
MLDv1 immediate leave : Disabled
Explicit host tracking : Enabled
Multicast router learning mode : pim-dvmrp
Robustness variable : 1
Last listener query count : 2
Last listener query interval : 1000

<output truncated>

Vlan 951:
-----
MLD snooping : Disabled
MLDv1 immediate leave : Disabled
Explicit host tracking : Enabled
Multicast router learning mode : pim-dvmrp
Robustness variable : 3
Last listener query count : 2
Last listener query interval : 1000

```

**Related Commands**

Command	Description
<b>ipv6 mld snooping</b>	Enables and configures MLD snooping on the switch or on a VLAN.
<b>sdm prefer</b>	Configures an SDM template to optimize system resources based on how the switch is being used.

# show ipv6 mld ssm-map

To display Source Specific Multicast (SSM) mapping information, use the **show ipv6 mld ssm-map static** command in user EXEC or privileged EXEC mode.

```
show ipv6 mld [vrf vrf-name] ssm-map [source-address]
```

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<i>source-address</i>	(Optional) Source address associated with an MLD membership for a group identified by the access list.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

If the optional *source-address* argument is not used, all SSM mapping information is displayed.

## Examples

The following example shows all SSM mappings for the router:

```
Device# show ipv6 mld ssm-map
SSM Mapping : Enabled
DNS Lookup  : Enabled
```

The following examples show SSM mapping for the source address 2001:0DB8::1:

```
Device# show ipv6 mld ssm-map 2001:0DB8::1
Group address : 2001:0DB8::1
Group mode ssm : TRUE
Database      : STATIC
Source list   : 2001:0DB8::2
               2001:0DB8::3

Router# show ipv6 mld ssm-map 2001:0DB8::2
Group address : 2001:0DB8::2
Group mode ssm : TRUE
Database      : DNS
Source list   : 2001:0DB8::3
               2001:0DB8::1
```

The table below describes the significant fields shown in the displays.

**Table 35: show ipv6 mld ssm-map Field Descriptions**

Field	Description
SSM Mapping	The SSM mapping feature is enabled.

Field	Description
DNS Lookup	The DNS lookup feature is automatically enabled when the SSM mapping feature is enabled.
Group address	Group address identified by a specific access list.
Group mode ssm : TRUE	The identified group is functioning in SSM mode.
Database : STATIC	The router is configured to determine source addresses by checking static SSM mapping configurations.
Database : DNS	The router is configured to determine source addresses using DNS-based SSM mapping.
Source list	Source address associated with a group identified by the access list.

**Related Commands**

Command	Description
<b>debug ipv6 mld ssm-map</b>	Displays debug messages for SSM mapping.
<b>ipv6 mld ssm-map enable</b>	Enables the SSM mapping feature for groups in the configured SSM range
<b>ipv6 mld ssm-map query dns</b>	Enables DNS-based SSM mapping.
<b>ipv6 mld ssm-map static</b>	Configures static SSM mappings.

## show ipv6 mld traffic

To display the Multicast Listener Discovery (MLD) traffic counters, use the **show ipv6 mld traffic** command in user EXEC or privileged EXEC mode.

**show ipv6 mld** [**vrf vrf-name**] **traffic**

### Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
----------------------------	--

### Command Modes

User EXEC (>)

Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **show ipv6 mld traffic** command to check if the expected number of MLD protocol messages have been received and sent.

### Examples

The following example displays the MLD protocol messages received and sent.

```
Device# show ipv6 mld traffic

MLD Traffic Counters
Elapsed time since counters cleared:00:00:21

Valid MLD Packets          Received      Sent
Queries                    1             0
Reports                    2             1
Leaves                     0             0
Mtrace packets             0             0
Errors:
Malformed Packets                    0
Bad Checksums                        0
Martian source                       0
Packets Received on MLD-disabled Interface 0
```

The table below describes the significant fields shown in the display.

**Table 36: show ipv6 mld traffic Field Descriptions**

Field	Description
Elapsed time since counters cleared	Indicates the amount of time (in hours, minutes, and seconds) since the counters cleared.
Valid MLD packets	Number of valid MLD packets received and sent.
Queries	Number of valid queries received and sent.



<b>Field</b>	<b>Description</b>
Reports	Number of valid reports received and sent.
Leaves	Number of valid leaves received and sent.
Mtrace packets	Number of multicast trace packets received and sent.
Errors	Types of errors and the number of errors that have occurred.

# show ipv6 mrib client

To display information about the clients of the Multicast Routing Information Base (MRIB), use the **show ipv6 mrib client** command in user EXEC or privileged EXEC mode.

**show ipv6 mrib** [**vrf** *vrf-name*] **client** [**filter**] [**name** *client-name* | *client-name* : *client-id*]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<b>filter</b>	(Optional) Displays information about MRIB flags that each client owns and that each client is interested in.
<b>name</b>	(Optional) The name of a multicast routing protocol that acts as a client of MRIB, such as Multicast Listener Discovery (MLD) and Protocol Independent Multicast (PIM).
<i>client-name</i> : <i>client-id</i>	The name and ID of a multicast routing protocol that acts as a client of MRIB, such as MLD and PIM. The colon is required.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **filter** keyword to display information about the MRIB flags each client owns and the flags in which each client is interested.

## Examples

The following is sample output from the **show ipv6 mrib client** command:

```
Device# show ipv6 mrib client
IP MRIB client-connections
igmp:145          (connection id 0)
pim:146 (connection id 1)
mfib ipv6:3      (connection id 2)
slot 3 mfib ipv6 rp agent:16 (connection id 3)
slot 1 mfib ipv6 rp agent:16 (connection id 4)
slot 0 mfib ipv6 rp agent:16 (connection id 5)
slot 4 mfib ipv6 rp agent:16 (connection id 6)
slot 2 mfib ipv6 rp agent:16 (connection id 7)
```

The table below describes the significant fields shown in the display.

**Table 37: show ipv6 mrib client Field Descriptions**

Field	Description
igmp:145 (connection id 0) pim:146 (connection id 1) mrib ipv6:3 (connection id 2) mrib ipv6 rp agent:16 (connection id 3)	Client ID (client name:process ID)

## show ipv6 mrib route

To display Multicast Routing Information Base (MRIB) route information, use the **show ipv6 mrib route** command in user EXEC or privileged EXEC mode.

```
show ipv6 mrib [vrf vrf-name] route [link-local | summary | [source-addresssource-name | *]
[groupname-or-address [prefix-length]]]
```

### Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<b>link-local</b>	(Optional) Displays the link-local groups.
<b>summary</b>	(Optional) Displays the number of MRIB entries (including link-local groups) and interfaces present in the MRIB table.
<i>source address-or-name</i>	(Optional) IPv6 address or name of the source.
*	(Optional) Displays all MRIB route information.
<i>groupname or-address</i>	(Optional) IPv6 address or name of the multicast group.
<i>prefix-length</i>	(Optional) IPv6 prefix length.

### Command Modes

User EXEC (>)

Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

All entries are created by various clients of the MRIB, such as Multicast Listener Discovery (MLD), Protocol Independent Multicast (PIM), and Multicast Forwarding Information Base (MFIB). The flags on each entry or interface serve as a communication mechanism between various clients of the MRIB. The entries reveal how PIM sends register messages for new sources and the action taken.

The **summary** keyword shows the count of all entries, including link-local entries.

The interface flags are described in the table below.

**Table 38: Description of Interface Flags**

Flag	Description
F	Forward--Data is forwarded out of this interface
A	Accept--Data received on this interface is accepted for forwarding
IC	Internal copy
NS	Negate signal

Flag	Description
DP	Do not preserve
SP	Signal present
II	Internal interest
ID	Internal uninterest
LI	Local interest
LD	Local uninterest
C	Perform directly connected check

Special entries in the MRIB indicate exceptions from the normal behavior. For example, no signaling or notification is necessary for arriving data packets that match any of the special group ranges. The special group ranges are as follows:

- Undefined scope (FFX0::/16)
- Node local groups (FFX1::/16)
- Link-local groups (FFX2::/16)
- Source Specific Multicast (SSM) groups (FF3X::/32).

For all the remaining (usually sparse-mode) IPv6 multicast groups, a directly connected check is performed and the PIM notified if a directly connected source arrives. This procedure is how PIM sends register messages for new sources.

## Examples

The following is sample output from the **show ipv6 mrib route** command using the **summary** keyword:

```
Device# show ipv6 mrib route summary
MRIB Route-DB Summary
  No. of (*,G) routes = 52
  No. of (S,G) routes = 0
  No. of Route x Interfaces (RxI) = 10
```

The table below describes the significant fields shown in the display.

**Table 39: show ipv6 mrib route Field Descriptions**

Field	Description
No. of (*, G) routes	Number of shared tree routes in the MRIB.
No. of (S, G) routes	Number of source tree routes in the MRIB.
No. of Route x Interfaces (RxI)	Sum of all the interfaces on each MRIB route entry.

# show ipv6 mroute

To display the information in the PIM topology table in a format similar to the **show ip mroute** command, use the **show ipv6 mroute** command in user EXEC or privileged EXEC mode.

**show ipv6 mroute** [**vrf** *vrf-name*] [**link-local** | [*group-name* | *group-address* [*source-address* | *source-name*]]] [**summary**] [**count**]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<b>link-local</b>	(Optional) Displays the link-local groups.
<i>group-name</i>   <i>group-address</i>	(Optional) IPv6 address or name of the multicast group.
<i>source-address</i>   <i>source-name</i>	(Optional) IPv6 address or name of the source.
<b>summary</b>	(Optional) Displays a one-line, abbreviated summary of each entry in the IPv6 multicast routing table.
<b>count</b>	(Optional) Displays statistics from the Multicast Forwarding Information Base (MFIB) about the group and source, including number of packets, packets per second, average packet size, and bytes per second.

## Command Default

The **show ipv6 mroute** command displays all groups and sources.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The IPv6 multicast implementation does not have a separate mroute table. For this reason, the **show ipv6 mroute** command enables you to display the information in the PIM topology table in a format similar to the **show ip mroute** command.

If you omit all optional arguments and keywords, the **show ipv6 mroute** command displays all the entries in the PIM topology table (except link-local groups where the **link-local** keyword is available).

The Cisco IOS software populates the PIM topology table by creating (S,G) and (\*,G) entries based on PIM protocol messages, MLD reports, and traffic. The asterisk (\*) refers to all source addresses, the "S" refers to a single source address, and the "G" is the destination multicast group address. In creating (S, G) entries, the software uses the best path to that destination group found in the unicast routing table (that is, through Reverse Path Forwarding [RPF]).

Use the **show ipv6 mroute** command to display the forwarding status of each IPv6 multicast route.

## Examples

The following is sample output from the **show ipv6 mroute** command:

```

Device# show ipv6 mroute ff07::1
Multicast Routing Table
Flags:D - Dense, S - Sparse, B - Bidir Group, s - SSM Group,
      C - Connected, L - Local, I - Received Source Specific Host Report,
      P - Pruned, R - RP-bit set, F - Register flag, T - SPT-bit set,
      J - Join SPT
Timers:Uptime/Expires
Interface state:Interface, State
(*, FF07::1), 00:04:45/00:02:47, RP 2001:0DB8:6::6, flags:S
  Incoming interface:Tunnel5
  RPF nbr:6:6:6::6
  Outgoing interface list:
    POS4/0, Forward, 00:04:45/00:02:47
(2001:0DB8:999::99, FF07::1), 00:02:06/00:01:23, flags:SFT
  Incoming interface:POS1/0
  RPF nbr:2001:0DB8:999::99
  Outgoing interface list:
    POS4/0, Forward, 00:02:06/00:03:27

```

The following is sample output from the **show ipv6 mroute** command with the **summary** keyword:

```

Device# show ipv6 mroute ff07::1 summary
Multicast Routing Table
Flags:D - Dense, S - Sparse, B - Bidir Group, s - SSM Group,
      C - Connected, L - Local, I - Received Source Specific Host Report,
      P - Pruned, R - RP-bit set, F - Register flag, T - SPT-bit set,
      J - Join SPT
Timers:Uptime/Expires
Interface state:Interface, State
(*, FF07::1), 00:04:55/00:02:36, RP 2001:0DB8:6::6, OIF count:1, flags:S
(2001:0DB8:999::99, FF07::1), 00:02:17/00:01:12, OIF count:1, flags:SFT

```

The following is sample output from the **show ipv6 mroute** command with the **count** keyword:

```

Device# show ipv6 mroute ff07::1 count
IP Multicast Statistics
71 routes, 24 groups, 0.04 average sources per group
Forwarding Counts:Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts:Total/RPF failed/Other drops(OIF-null, rate-limit etc)
Group:FF07::1
  RP-tree:
    RP Forwarding:0/0/0/0, Other:0/0/0
    LC Forwarding:0/0/0/0, Other:0/0/0
  Source:2001:0DB8:999::99,
    RP Forwarding:0/0/0/0, Other:0/0/0
    LC Forwarding:0/0/0/0, Other:0/0/0
  HW Forwd: 20000/0/92/0, Other:0/0/0
  Tot. shown:Source count:1, pkt count:20000

```

The table below describes the significant fields shown in the display.

Table 40: show ipv6 mroute Field Descriptions

Field	Description
Flags:	<p>Provides information about the entry.</p> <ul style="list-style-type: none"> <li>• S--sparse. Entry is operating in sparse mode.</li> <li>• s--SSM group. Indicates that a multicast group is within the SSM range of IP addresses. This flag is reset if the SSM range changes.</li> <li>• C--connected. A member of the multicast group is present on the directly connected interface.</li> <li>• L--local. The router itself is a member of the multicast group.</li> <li>• I--received source specific host report. Indicates that an (S, G) entry was created by an (S, G) report. This flag is set only on the designated router (DR).</li> <li>• P--pruned. Route has been pruned. The Cisco IOS software keeps this information so that a downstream member can join the source.</li> <li>• R--RP-bit set. Indicates that the (S, G) entry is pointing toward the RP. This is typically prune state along the shared tree for a particular source.</li> <li>• F--register flag. Indicates that the software is registering for a multicast source.</li> <li>• T--SPT-bit set. Indicates that packets have been received on the shortest path source tree.</li> <li>• J--join SPT. For (*, G) entries, indicates that the rate of traffic flowing down the shared tree is exceeding the SPT-Threshold value set for the group. (The default SPT-Threshold setting is 0 kbps.) When the J - Join shortest path tree (SPT) flag is set, the next (S, G) packet received down the shared tree triggers an (S, G) join in the direction of the source, thereby causing the router to join the source tree. The default SPT-Threshold value of 0 kbps is used for the group, and the J - Join SPT flag is always set on (*, G) entries and is never cleared. The router immediately switches to the shortest path source tree when traffic from a new source is received</li> </ul>
Timers: Uptime/Expires	<p>"Uptime" indicates per interface how long (in hours, minutes, and seconds) the entry has been in the IPv6 multicast routing table. "Expires" indicates per interface how long (in hours, minutes, and seconds) until the entry will be removed from the IPv6 multicast routing table.</p>
Interface state:	<p>Indicates the state of the incoming or outgoing interface.</p> <ul style="list-style-type: none"> <li>• Interface. Indicates the type and number of the interface listed in the incoming or outgoing interface list.</li> <li>• Next-Hop. "Next-Hop" specifies the IP address of the downstream neighbor.</li> <li>• State/Mode. "State" indicates that packets will either be forwarded, pruned, or null on the interface depending on whether there are restrictions due to access lists. "Mode" indicates that the interface is operating in sparse mode.</li> </ul>



Field	Description
(* , FF07::1) and (2001:0DB8:999::99)	Entry in the IPv6 multicast routing table. The entry consists of the IPv6 address of the source router followed by the IPv6 address of the multicast group. An asterisk (*) in place of the source router indicates all sources.  Entries in the first format are referred to as (*, G) or "star comma G" entries. Entries in the second format are referred to as (S, G) or "S comma G" entries; (*, G) entries are used to build (S, G) entries.
RP	Address of the RP router.
flags:	Information set by the MRIB clients on this MRIB entry.
Incoming interface:	Expected interface for a multicast packet from the source. If the packet is not received on this interface, it is discarded.
RPF nbr	IP address of the upstream router to the RP or source.
Outgoing interface list:	Interfaces through which packets will be forwarded. For (S,G) entries, this list will not include the interfaces inherited from the (*,G) entry.

**Related Commands**

Command	Description
<b>ipv6 multicast-routing</b>	Enables multicast routing using PIM and MLD on all IPv6-enabled interfaces of the router and enables multicast forwarding.
<b>show ipv6 mfib</b>	Displays the forwarding entries and interfaces in the IPv6 MFIB.

# show ipv6 mtu

To display maximum transmission unit (MTU) cache information for IPv6 interfaces, use the **show ipv6 mtu** command in user EXEC or privileged EXEC mode.

**show ipv6 mtu** [**vrf** *vrfname*]

## Syntax Description

<b>vrf</b>	(Optional) Displays an IPv6 Virtual Private Network (VPN) routing/forwarding instance (VRF).
<i>vrfname</i>	(Optional) Name of the IPv6 VRF.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **vrf** keyword and *vrfname* argument allow you to view MTUs related to a specific VRF.

## Examples

The following is sample output from the **show ipv6 mtu** command:

```
Device# show ipv6 mtu
MTU      Since      Destination Address
1400     00:04:21  5000:1::3
1280     00:04:50  FE80::203:A0FF:FED6:141D
```

The following is sample output from the **show ipv6 mtu** command using the **vrf** keyword and *vrfname* argument. This example provides information about the VRF named *vrfname1*:

```
Device# show ipv6 mtu vrf vrfname1
MTU      Since      Source Address      Destination Address
1300     00:00:04   2001:0DB8:2         2001:0DB8:7
```

The table below describes the significant fields shown in the display.

**Table 41: show ipv6 mtu Field Descriptions**

Field	Description
MTU	MTU, which was contained in the Internet Control Message Protocol (ICMP) packet-too-big message, used for the path to the destination address.
Since	Age of the entry since the ICMP packet-too-big message was received.
Destination Address	Address contained in the received ICMP packet-too-big message. Packets originating from this router to this address should be no bigger than the given MTU.

**Related Commands**

Command	Description
<b>ipv6 mtu</b>	Sets the MTU size of IPv6 packets sent on an interface.

# show ipv6 nd destination

To display information about IPv6 host-mode destination cache entries, use the **show ipv6 nd destination** command in user EXEC or privileged EXEC mode.

**show ipv6 nd destination**[*vrf vrf-name*][*interface-type interface-number*]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<i>interface-type</i>	(Optional) Specifies the Interface type.
<i>interface-number</i>	(Optional) Specifies the Interface number.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **show ipv6 nd destination** command to display information about IPv6 host-mode destination cache entries. If the **vrf vrf-name** keyword and argument pair is used, then only information about the specified VRF is displayed. If the *interface-type* and *interface-number* arguments are used, then only information about the specified interface is displayed.

## Examples

```
Device# show ipv6 nd destination

IPv6 ND destination cache (table: default)
Code: R - Redirect
  2001::1 [8]
    via FE80::A8BB:CCFF:FE00:5B00/Ethernet0/0
```

The following table describes the significant fields shown in the display.

**Table 42: show ipv6 nd destination Field Descriptions**

Field	Description
Code: R - Redirect	Destinations learned through redirect.
2001::1 [8]	The value displayed in brackets is the time, in seconds, since the destination cache entry was last used.

## Related Commands

Command	Description
<b>ipv6 nd host mode strict</b>	Enables the conformant, or strict, IPv6 host mode.

# show ipv6 nd on-link prefix

To display information about on-link prefixes learned through router advertisements (RAs), use the **show ipv6 nd on-link prefix** command in user EXEC or privileged EXEC mode.

```
show ipv6 nd on-link prefix[vrf vrf-name][interface-type interface-number]
```

Syntax Description	Parameter	Description
	<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
	<i>interface-type</i>	(Optional) Specifies the Interface type.
	<i>interface-number</i>	(Optional) Specifies the Interface number.

Command Modes	Mode
	User EXEC (>)
	Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **show ipv6 nd on-link prefix** command to display information about on-link prefixes learned through RAs.

Prefixes learned from an RA may be inspected using the **show ipv6 nd on-link prefix** command. If the **vrf vrf-name** keyword and argument pair is used, then only information about the specified VRF is displayed. If the *interface-type* and *interface-number* arguments are used, then only information about the specified interface is displayed.

## Examples

The following example displays information about on-link prefixes learned through RAs:

```
Device# show ipv6 nd on-link prefix

IPv6 ND on-link Prefix (table: default), 2 prefixes
Code: A - Autonomous Address Config
A 2001::/64 [2591994/604794]
router FE80::A8BB:CCFF:FE00:5A00/Ethernet0/0
2001:1:2::/64 [2591994/604794]
router FE80::A8BB:CCFF:FE00:5A00/Ethernet0/0
```

Related Commands	Command	Description
	<b>ipv6 nd host mode strict</b>	Enables the conformant, or strict, IPv6 host mode.

# show ipv6 neighbors

To display IPv6 neighbor discovery (ND) cache information, use the **show ipv6 neighbors** command in user EXEC or privileged EXEC mode.

**show ipv6 neighbors** [*interface-type interface-number* *ipv6-address* *ipv6-hostname* | **statistics**]

## Syntax Description

<i>interface-type</i>	(Optional) Specifies the type of the interface from which IPv6 neighbor information is to be displayed.
<i>interface-number</i>	(Optional) Specifies the number of the interface from which IPv6 neighbor information is to be displayed.
<i>ipv6-address</i>	(Optional) Specifies the IPv6 address of the neighbor. This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
<i>ipv6-hostname</i>	(Optional) Specifies the IPv6 hostname of the remote networking device.
<b>statistics</b>	(Optional) Displays ND cache statistics.

## Command Default

All IPv6 ND cache entries are listed.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

When the *interface-type* and *interface-number* arguments are not specified, cache information for all IPv6 neighbors is displayed. Specifying the *interface-type* and *interface-number* arguments displays only cache information about the specified interface.

Specifying the **statistics** keyword displays ND cache statistics.

The following is sample output from the **show ipv6 neighbors** command when entered with an interface type and number:

```
Device# show ipv6 neighbors ethernet 2
IPv6 Address                               Age Link-layer Addr State Interface
2000:0:0:4::2                             0 0003.a0d6.141e REACH Ethernet2
FE80::203:A0FF:FED6:141E                   0 0003.a0d6.141e REACH Ethernet2
3001:1::45a                                - 0002.7d1a.9472 REACH Ethernet2
```

The following is sample output from the **show ipv6 neighbors** command when entered with an IPv6 address:

```
Device# show ipv6 neighbors 2000:0:0:4::2
IPv6 Address                               Age Link-layer Addr State Interface
2000:0:0:4::2                             0 0003.a0d6.141e REACH Ethernet2
```

The table below describes the significant fields shown in the displays.

**Table 43: show ipv6 neighbors Field Descriptions**

Field	Description
IPv6 Address	IPv6 address of neighbor or interface.
Age	Time (in minutes) since the address was confirmed to be reachable. A hyphen (-) indicates a static entry.
Link-layer Addr	MAC address. If the address is unknown, a hyphen (-) is displayed.
State	<p>The state of the neighbor cache entry. Following are the states for dynamic entries in the IPv6 neighbor discovery cache:</p> <ul style="list-style-type: none"> <li>• <b>INCMP</b> (Incomplete)--Address resolution is being performed on the entry. A neighbor solicitation message has been sent to the solicited-node multicast address of the target, but the corresponding neighbor advertisement message has not yet been received.</li> <li>• <b>REACH</b> (Reachable)--Positive confirmation was received within the last ReachableTime milliseconds that the forward path to the neighbor was functioning properly. While in REACH state, the device takes no special action as packets are sent.</li> <li>• <b>STALE</b>--More than ReachableTime milliseconds have elapsed since the last positive confirmation was received that the forward path was functioning properly. While in STALE state, the device takes no action until a packet is sent.</li> <li>• <b>DELAY</b>--More than ReachableTime milliseconds have elapsed since the last positive confirmation was received that the forward path was functioning properly. A packet was sent within the last DELAY_FIRST_PROBE_TIME seconds. If no reachability confirmation is received within DELAY_FIRST_PROBE_TIME seconds of entering the DELAY state, send a neighbor solicitation message and change the state to PROBE.</li> <li>• <b>PROBE</b>--A reachability confirmation is actively sought by resending neighbor solicitation messages every RetransTimer milliseconds until a reachability confirmation is received.</li> <li>• <b>???</b>--Unknown state.</li> </ul> <p>Following are the possible states for static entries in the IPv6 neighbor discovery cache:</p> <ul style="list-style-type: none"> <li>• <b>INCMP</b> (Incomplete)--The interface for this entry is down.</li> <li>• <b>REACH</b> (Reachable)--The interface for this entry is up.</li> </ul> <p><b>Note</b> Reachability detection is not applied to static entries in the IPv6 neighbor discovery cache; therefore, the descriptions for the INCMP (Incomplete) and REACH (Reachable) states are different for dynamic and static cache entries.</p>
Interface	Interface from which the address was reachable.

The following is sample output from the **show ipv6 neighbors** command with the **statistics** keyword:

```
Device# show ipv6 neighbor statistics

IPv6 ND Statistics
  Entries 2, High-water 2, Gleaned 1, Scavenged 0
  Entry States
    INCMP 0 REACH 0 STALE 2 GLEAN 0 DELAY 0 PROBE 0
  Resolutions (INCMP)
    Requested 1, timeouts 0, resolved 1, failed 0
    In-progress 0, High-water 1, Throttled 0, Data discards 0
  Resolutions (PROBE)
    Requested 3, timeouts 0, resolved 3, failed 0
```

The table below describes the significant fields shown in this display:

**Table 44: show ipv6 neighbors statistics Field Descriptions**

Field	Description
Entries	Total number of ND neighbor entries in the ND cache.
High-Water	Maximum amount (so far) of ND neighbor entries in ND cache.
Gleaned	Number of ND neighbor entries gleaned (that is, learned from a neighbor NA or other ND packet).
Scavenged	Number of stale ND neighbor entries that have timed out and been removed from the cache.
Entry States	Number of ND neighbor entries in each state.
Resolutions (INCMP)	<p>Statistics for neighbor resolutions attempted in INCMP state (that is, resolutions prompted by a data packet). Details about the resolutions attempted in INCMP state are follows:</p> <ul style="list-style-type: none"> <li>• Requested--Total number of resolutions requested.</li> <li>• Timeouts--Number of timeouts during resolutions.</li> <li>• Resolved--Number of successful resolutions.</li> <li>• Failed--Number of unsuccessful resolutions.</li> <li>• In-progress--Number of resolutions in progress.</li> <li>• High-water--Maximum number (so far) of resolutions in progress.</li> <li>• Throttled--Number of times resolution request was ignored due to maximum number of resolutions in progress limit.</li> <li>• Data discards--Number of data packets discarded that are awaiting neighbor resolution.</li> </ul>



Field	Description
Resolutions (PROBE)	<p>Statistics for neighbor resolutions attempted in PROBE state (that is, re-resolutions of existing entries prompted by a data packet):</p> <ul style="list-style-type: none"><li>• Requested--Total number of resolutions requested.</li><li>• Timeouts--Number of timeouts during resolutions.</li><li>• Resolved--Number of successful resolutions.</li><li>• Failed--Number of unsuccessful resolutions.</li></ul>

# show ipv6 nhrp

To display Next Hop Resolution Protocol (NHRP) mapping information, use the **show ipv6 nhrp** command in user EXEC or privileged EXEC mode.

**show ipv6 nhrp** [**dynamic** [*ipv6-address*] | **incomplete** | **static**] [**address** | **interface**] [**brief** | **detail**] [**purge**]

## Syntax Description

<b>dynamic</b>	(Optional) Displays dynamic (learned) IPv6-to-nonbroadcast multiaccess address (NBMA) mapping entries. Dynamic NHRP mapping entries are obtained from NHRP resolution/registration exchanges. See the table below for types, number ranges, and descriptions.
<i>ipv6-address</i>	(Optional) The IPv6 address of the cache entry.
<b>incomplete</b>	(Optional) Displays information about NHRP mapping entries for which the IPv6-to-NBMA is not resolved. See the table below for types, number ranges, and descriptions.
<b>static</b>	(Optional) Displays static IPv6-to-NBMA address mapping entries. Static NHRP mapping entries are configured using the <b>ipv6 nhrp map</b> command. See the table below for types, number ranges, and descriptions.
<i>address</i>	(Optional) NHRP mapping entry for specified protocol addresses.
<i>interface</i>	(Optional) NHRP mapping entry for the specified interface. See the table below for types, number ranges, and descriptions.
<b>brief</b>	(Optional) Displays a short output of the NHRP mapping.
<b>detail</b>	(Optional) Displays detailed information about NHRP mapping.
<b>purge</b>	(Optional) Displays NHRP purge information.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The table below lists the valid types, number ranges, and descriptions for the optional *interface* argument.



### Note

The valid types can vary according to the platform and interfaces on the platform.

Table 45: Valid Types, Number Ranges, and Interface Description

Valid Types	Number Ranges	Interface Descriptions
async	1	Async
atm	0 to 6	ATM
bvi	1 to 255	Bridge-Group Virtual Interface
cdma-ix	1	CDMA Ix
ctunnel	0 to 2147483647	C-Tunnel
dialer	0 to 20049	Dialer
ethernet	0 to 4294967295	Ethernet
fastethernet	0 to 6	FastEthernet IEEE 802.3
lex	0 to 2147483647	Lex
loopback	0 to 2147483647	Loopback
mfr	0 to 2147483647	Multilink Frame Relay bundle
multilink	0 to 2147483647	Multilink-group
null	0	Null
port-channel	1 to 64	Port channel
tunnel	0 to 2147483647	Tunnel
vif	1	PGM multicast host
virtual-ppp	0 to 2147483647	Virtual PPP
virtual-template	1 to 1000	Virtual template
virtual-tokenring	0 to 2147483647	Virtual Token Ring
xtagatm	0 to 2147483647	Extended tag ATM

## Examples

The following is sample output from the **show ipv6 nhrp** command:

```
Device# show ipv6 nhrp
2001:0db8:3c4d:0015::1a2f:3d2c/48 via
2001:0db8:3c4d:0015::1a2f:3d2c
Tunnel0 created 6d05h, never expire
```

The table below describes the significant fields shown in the display.

**Table 46: show ipv6 nhrp Field Descriptions**

Field	Description
2001:0db8:3c4d:0015::1a2f:3d2c/48	Target network.
2001:0db8:3c4d:0015::1a2f:3d2c	Next hop to reach the target network.
Tunnel0	Interface through which the target network is reached.
created 6d05h	Length of time since the entry was created (dayshours).
never expire	Indicates that static entries never expire.

The following is sample output from the **show ipv6 nhrp** command using the **brief** keyword:

```
Device# show ipv6 nhrp brief
2001:0db8:3c4d:0015:0000:0000:1a2f:3d2c/48
  via 2001:0db8:3c4d:0015:0000:0000:1a2f:3d2c
Interface: Tunnel0 Type: static
NBMA address: 10.11.11.99
```

The table below describes the significant fields shown in the display.

**Table 47: show ipv6 nhrp brief Field Descriptions**

Field	Description
2001:0db8:3c4d:0015:0000:0000:1a2f:3d2c/48	Target network.
via 2001:0db8:3c4d:0015:0000:0000:1a2f:3d2c	Next Hop to reach the target network.
Interface: Tunnel0	Interface through which the target network is reached.
Type: static	Type of tunnel. The types can be one of the following: <ul style="list-style-type: none"> <li>dynamic--NHRP mapping is obtained dynamically. The mapping entry is created using information from the NHRP resolution and registrations.</li> <li>static--NHRP mapping is configured statically. Entries configured by the <b>ipv6 nhrp map</b> command are marked static.</li> <li>incomplete--The NBMA address is not known for the target network.</li> </ul>

**Related Commands**

Command	Description
<b>ipv6 nhrp map</b>	Statically configures the IPv6-to-NBMA address mapping of IP destinations connected to an NBMA network.

# show ipv6 ospf

To display general information about Open Shortest Path First (OSPF) routing processes, use the **show ipv6 ospf** command in user EXEC or privileged EXEC mode.

**show ipv6 ospf** [*process-id*] [*area-id*] [**rate-limit**]

Syntax Description	
<i>process-id</i>	(Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when the OSPF routing process is enabled.
<i>area-id</i>	(Optional) Area ID. This argument displays information about a specified area only.
<b>rate-limit</b>	(Optional) Rate-limited link-state advertisements (LSAs). This keyword displays LSAs that are currently being rate limited, together with the remaining time to the next generation.

Command Modes	
	User EXEC (>)
	Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## show ipv6 ospf Output Example

The following is sample output from the **show ipv6 ospf** command:

```
Device# show ipv6 ospf
Routing Process "ospfv3 1" with ID 10.10.10.1
  SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
  Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
  LSA group pacing timer 240 secs
  Interface flood pacing timer 33 msec
  Retransmission pacing timer 66 msec
  Number of external LSA 0. Checksum Sum 0x000000
  Number of areas in this device is 1. 1 normal 0 stub 0 nssa
    Area BACKBONE(0)
      Number of interfaces in this area is 1
      MD5 Authentication, SPI 1000
      SPF algorithm executed 2 times
      Number of LSA 5. Checksum Sum 0x02A005
      Number of DCbitless LSA 0
      Number of indication LSA 0
      Number of DoNotAge LSA 0
      Flood list length 0
```

The table below describes the significant fields shown in the display.

**Table 48: show ipv6 ospf Field Descriptions**

Field	Description
Routing process "ospfv3 1" with ID 10.10.10.1	Process ID and OSPF device ID.
LSA group pacing timer	Configured LSA group pacing timer (in seconds).
Interface flood pacing timer	Configured LSA flood pacing timer (in milliseconds).
Retransmission pacing timer	Configured LSA retransmission pacing timer (in milliseconds).
Number of areas	Number of areas in device, area addresses, and so on.

**show ipv6 ospf With Area Encryption Example**

The following sample output shows the **show ipv6 ospf** command with area encryption information:

```

Device# show ipv6 ospf
Routing Process "ospfv3 1" with ID 10.0.0.1
It is an area border device
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msec
Retransmission pacing timer 66 msec
Number of external LSA 0. Checksum Sum 0x000000
Number of areas in this device is 2. 2 normal 0 stub 0 nssa
Reference bandwidth unit is 100 mbps
  Area BACKBONE(0)
    Number of interfaces in this area is 2
    SPF algorithm executed 3 times
    Number of LSA 31. Checksum Sum 0x107493
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 20
    Flood list length 0
  Area 1
    Number of interfaces in this area is 2
    NULL Encryption SHA-1 Auth, SPI 1001
    SPF algorithm executed 7 times
    Number of LSA 20. Checksum Sum 0x095E6A
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0

```

The table below describes the significant fields shown in the display.

**Table 49: show ipv6 ospf with Area Encryption Information Field Descriptions**

Field	Description
Area 1	Subsequent fields describe area 1.

Field	Description
NULL Encryption SHA-1 Auth, SPI 1001	Displays the encryption algorithm (in this case, null, meaning no encryption algorithm is used), the authentication algorithm (SHA-1), and the security policy index (SPI) value (1001).

The following example displays the configuration values for SPF and LSA throttling timers:

```
Device# show ipv6 ospf
Routing Process "ospfv3 1" with ID 10.9.4.1
Event-log enabled, Maximum number of events: 1000, Mode: cyclic
It is an autonomous system boundary device
Redistributing External Routes from,
  ospf 2
Initial SPF schedule delay 5000 msec
Minimum hold time between two consecutive SPF 10000 msec
Maximum wait time between two consecutive SPF 10000 msec
Minimum LSA interval 5 sec
Minimum LSA arrival 1000 msec
```

The table below describes the significant fields shown in the display.

**Table 50: show ipv6 ospf with SPF and LSA Throttling Timer Field Descriptions**

Field	Description
Initial SPF schedule delay	Delay time of SPF calculations.
Minimum hold time between two consecutive SPF	Minimum hold time between consecutive SPF calculations.
Maximum wait time between two consecutive SPF 10000 msec	Maximum hold time between consecutive SPF calculations.
Minimum LSA interval 5 sec	Minimum time interval (in seconds) between link-state advertisements.
Minimum LSA arrival 1000 msec	Maximum arrival time (in milliseconds) of link-state advertisements.

The following example shows information about LSAs that are currently being rate limited:

```
Device# show ipv6 ospf rate-limit
List of LSAs that are in rate limit Queue
LSAID: 0.0.0.0 Type: 0x2001 Adv Rtr: 10.55.55.55 Due in: 00:00:00.500
LSAID: 0.0.0.0 Type: 0x2009 Adv Rtr: 10.55.55.55 Due in: 00:00:00.500
```

The table below describes the significant fields shown in the display.

**Table 51: show ipv6 ospf rate-limit Field Descriptions**

Field	Description
LSAID	Link-state ID of the LSA.
Type	Description of the LSA.

Field	Description
Adv Rtr	ID of the advertising device.
Due in:	Remaining time until the generation of the next event.



## show ipv6 ospf border-routers

To display the internal Open Shortest Path First (OSPF) routing table entries to an Area Border Router (ABR) and Autonomous System Boundary Router (ASBR), use the **show ipv6 ospf border-routers** command in user EXEC or privileged EXEC mode.

**show ip ospf** [*process-id*] **border-routers**

<b>Syntax Description</b>	<i>process-id</i> (Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when the OSPF routing process is enabled.
---------------------------	--

<b>Command Modes</b>	User EXEC (>) Privileged EXEC (#)
----------------------	--------------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Examples

The following is sample output from the **show ipv6 ospf border-routers** command:

```
Device# show ipv6 ospf border-routers

OSPFv3 Process 1 internal Routing Table
Codes: i - Intra-area route, I - Inter-area route
i 172.16.4.4 [2] via FE80::205:5FFF:FED3:5808, FastEthernet0/0, ABR, Area 1, SPF 13
i 172.16.4.4 [1] via FE80::205:5FFF:FED3:5406, POS4/0, ABR, Area 0, SPF 8
i 172.16.3.3 [1] via FE80::205:5FFF:FED3:5808, FastEthernet0/0, ASBR, Area 1, SPF 3
```

The table below describes the significant fields shown in the display.

**Table 52: show ipv6 ospf border-routers Field Descriptions**

Field	Description
i - Intra-area route, I - Inter-area route	The type of this route.
172.16.4.4, 172.16.3.3	Router ID of the destination router.
[2], [1]	Metric used to reach the destination router.
FE80::205:5FFF:FED3:5808, FE80::205:5FFF:FED3:5406, FE80::205:5FFF:FED3:5808	Link-local routers.
FastEthernet0/0, POS4/0	The interface on which the IPv6 OSPF protocol is configured.
ABR	Area border router.

Field	Description
ASBR	Autonomous system boundary router.
Area 0, Area 1	The area ID of the area from which this route is learned.
SPF 13, SPF 8, SPF 3	The internal number of the shortest path first (SPF) calculation that installs this route.

# show ipv6 ospf event

To display detailed information about IPv6 Open Shortest Path First (OSPF) events, use the **show ipv6 ospf event** command in privileged EXEC mode.

**show ipv6 ospf** [*process-id*] **event** [**generic** | **interface** | **lsa** | **neighbor** | **reverse** | **rib** | **spf**]

Syntax Description	
<i>process-id</i>	(Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when the OSPF routing process is enabled.
<b>generic</b>	(Optional) Generic information regarding OSPF for IPv6 events.
<b>interface</b>	(Optional) Interface state change events, including old and new states.
<b>lsa</b>	(Optional) LSA arrival and LSA generation events.
<b>neighbor</b>	(Optional) Neighbor state change events, including old and new states.
<b>reverse</b>	(Optional) Keyword to allow the display of events in reverse-from the latest to the oldest or from oldest to the latest.
<b>rib</b>	(Optional) Routing Information Base (RIB) update, delete, and redistribution events.
<b>spf</b>	(Optional) Scheduling and SPF run events.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** An OSPF event log is kept for every OSPF instance. If you enter no keywords with the **show ipv6 ospf event** command, all information in the OSPF event log is displayed. Use the keywords to filter specific information.

## Examples

The following example shows scheduling and SPF run events, LSA arrival and LSA generation events, in order from the oldest events to the latest generated events:

```
Device# show ipv6 ospf event spf lsa reverse

OSPFv3 Router with ID (10.0.0.1) (Process ID 1)
1 *Sep 29 11:59:18.367: Rcv Changed Type-0x2009 LSA, LSID 10.0.0.0, Adv-Rtr 192.168.0.1,
Seq# 80007699, Age 3600
3 *Sep 29 11:59:18.367: Schedule SPF, Area 0, Change in LSID 10.0.0.0, LSA type P
4 *Sep 29 11:59:18.367: Rcv Changed Type-0x2001 LSA, LSID 10.0.0.0, Adv-Rtr 192.168.0.1,
Seq# 80007699, Age 2
5 *Sep 29 11:59:18.367: Schedule SPF, Area 0, Change in LSID 10.0.0.0, LSA type R
6 *Sep 29 11:59:18.367: Rcv Changed Type-0x2002 LSA, LSID 10.1.0.1, Adv-Rtr 192.168.0.1,
Seq# 80007699, Age 3600
8 *Sep 29 11:59:18.367: Schedule SPF, Area 0, Change in LSID 10.1.0.1, LSA type N
```

```

9 *Sep 29 11:59:18.367: Rcv Changed Type-0x2001 LSA, LSID 10.0.0.0, Adv-Rtr 1.1.1.1, Seq#
80007699, Age 2
10 *Sep 29 11:59:18.367: Schedule SPF, Area 0, Change in LSID 10.0.0.0, LSA type R
11 *Sep 29 11:59:18.867: Starting SPF
12 *Sep 29 11:59:18.867: Starting Intra-Area SPF in Area 0
16 *Sep 29 11:59:18.867: Starting Inter-Area SPF in area 0
17 *Sep 29 11:59:18.867: Starting External processing
18 *Sep 29 11:59:18.867: Starting External processing in area 0
19 *Sep 29 11:59:18.867: Starting External processing in area 1
20 *Sep 29 11:59:18.867: End of SPF
21 *Sep 29 11:59:19.367: Generate Changed Type-0x2003 LSA, LSID 10.0.0.4, Seq# 80000002,
Age 3600, Area 1, Prefix 3000:11:22::/64
23 *Sep 29 11:59:20.367: Rcv Changed Type-0x2009 LSA, LSID 10.0.0.0, Adv-Rtr 192.168.0.1,
Seq# 8000769A, Age 2
24 *Sep 29 11:59:20.367: Schedule SPF, Area 0, Change in LSID 10.0.0.0, LSA type P
25 *Sep 29 11:59:20.367: Rcv Changed Type-0x2001 LSA, LSID 10.0.0.0, Adv-Rtr 192.168.0.1,
Seq# 8000769A, Age 2
26 *Sep 29 11:59:20.367: Schedule SPF, Area 0, Change in LSID 10.0.0.0, LSA type R
27 *Sep 29 11:59:20.367: Rcv Changed Type-0x2002 LSA, LSID 10.1.0.1, Adv-Rtr 192.168.0.1,
Seq# 8000769A, Age 2
28 *Sep 29 11:59:20.367: Schedule SPF, Area 0, Change in LSID 10.1.0.1, LSA type N
29 *Sep 29 11:59:20.367: Rcv Changed Type-0x2001 LSA, LSID 10.0.0.0, Adv-Rtr 1.1.1.1, Seq#
8000769A, Age 2
30 *Sep 29 11:59:20.367: Schedule SPF, Area 0, Change in LSID 10.0.0.0, LSA type R
31 *Sep 29 11:59:20.867: Starting SPF
32 *Sep 29 11:59:20.867: Starting Intra-Area SPF in Area 0
36 *Sep 29 11:59:20.867: Starting Inter-Area SPF in area 0
37 *Sep 29 11:59:20.867: Starting External processing
38 *Sep 29 11:59:20.867: Starting External processing in area 0
39 *Sep 29 11:59:20.867: Starting External processing in area 1
40 *Sep 29 11:59:20.867: End of SPF

```

The table below describes the significant fields shown in the display.

**Table 53: show ip ospf Field Descriptions**

Field	Description
OSPFv3 Router with ID (10.0.0.1) (Process ID 1)	Process ID and OSPF router ID.
Rcv Changed Type-0x2009 LSA	Description of newly arrived LSA.
LSID	Link-state ID of the LSA.
Adv-Rtr	ID of the advertising router.
Seq#	Link state sequence number (detects old or duplicate link state advertisements).
Age	Link state age (in seconds).
Schedule SPF	Enables SPF to run.
Area	OSPF area ID.
Change in LSID	Changed link-state ID of the LSA.
LSA type	LSA type.



# show ipv6 ospf graceful-restart

To display Open Shortest Path First for IPv6 (OSPFv3) graceful restart information, use the **show ipv6 ospf graceful-restart** command in privileged EXEC mode.

**show ipv6 ospf graceful-restart**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **show ipv6 ospf graceful-restart** command to discover information about the OSPFv3 graceful restart feature.

## Examples

The following example displays OSPFv3 graceful restart information:

```
Device# show ipv6 ospf graceful-restart
Routing Process "ospf 1"
  Graceful Restart enabled
    restart-interval limit: 120 sec, last restart 00:00:15 ago (took 36 secs)
  Graceful Restart helper support enabled
  Router status : Active
  Router is running in SSO mode
  OSPF restart state : NO_RESTART
  Router ID 10.1.1.1, checkpoint Router ID 10.0.0.0
```

The table below describes the significant fields shown in the display.

**Table 54: show ipv6 ospf graceful-restart Field Descriptions**

Field	Description
Routing Process "ospf 1"	The OSPFv3 routing process ID.
Graceful Restart enabled	The graceful restart feature is enabled on this router.
restart-interval limit: 120 sec	The restart-interval limit.
last restart 00:00:15 ago (took 36 secs)	How long ago the last graceful restart occurred, and how long it took to occur.
Graceful Restart helper support enabled	Graceful restart helper mode is enabled. Because graceful restart mode is also enabled on this router, you can identify this router as being graceful-restart capable. A router that is graceful-restart-aware cannot be configured in graceful-restart mode.

Field	Description
Router status : Active	This router is in active, as opposed to standby, mode.
Router is running in SSO mode	The router is in stateful switchover mode.
OSPF restart state : NO_RESTART	The current OSPFv3 restart state.
Router ID 10.1.1.1, checkpoint Router ID 10.0.0.0	The IPv6 addresses of the current router and the checkpoint router.

**Related Commands**

Command	Description
<b>show ipv6 ospf interface</b>	Displays OSPFv3-related interface information.

# show ipv6 ospf interface

To display Open Shortest Path First (OSPF)-related interface information, use the **showipv6ospfinterface** command in user EXEC or privileged mode.

**show ipv6 ospf** [*process-id*] [*area-id*] **interface** [*type number*] [**brief**]

## Syntax Description

<i>process-id</i>	(Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when the OSPF routing process is enabled.
<i>area-id</i>	(Optional) Displays information about a specified area only.
<i>type number</i>	(Optional) Interface type and number.
<b>brief</b>	(Optional) Displays brief overview information for OSPF interfaces, states, addresses and masks, and areas on the router.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

### show ipv6 ospf interface Standard Output Example

The following is sample output from the **showipv6ospfinterface** command:

```
Device# show ipv6 ospf interface
ATM3/0 is up, line protocol is up
  Link Local Address 2001:0DB1:205:5FFF:FED3:5808, Interface ID 13
  Area 1, Process ID 1, Instance ID 0, Router ID 172.16.3.3
  Network Type POINT_TO_POINT, Cost: 1
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:06
  Index 1/2/2, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 12, maximum is 12
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 172.16.4.4
  Suppress hello for 0 neighbor(s)
FastEthernet0/0 is up, line protocol is up
  Link Local Address 2001:0DB1:205:5FFF:FED3:5808, Interface ID 3
  Area 1, Process ID 1, Instance ID 0, Router ID 172.16.3.3
  Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 172.16.6.6, local address 2001:0DB1:205:5FFF:FED3:6408
  Backup Designated router (ID) 172.16.3.3, local address 2001:0DB1:205:5FFF:FED3:5808
```



```

Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Hello due in 00:00:05
Index 1/1/1, flood queue length 0
Next 0x0(0)/0x0(0)/0x0(0)
Last flood scan length is 12, maximum is 12
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 172.16.6.6 (Designated Router)
Suppress hello for 0 neighbor(s)

```

The table below describes the significant fields shown in the display.

**Table 55: show ipv6 ospf interface Field Descriptions**

Field	Description
ATM3/0	Status of the physical link and operational status of protocol.
Link Local Address	Interface IPv6 address.
Area 1, Process ID 1, Instance ID 0, Router ID 172.16.3.3	The area ID, process ID, instance ID, and router ID of the area from which this route is learned.
Network Type POINT_TO_POINT, Cost: 1	Network type and link-state cost.
Transmit Delay	Transmit delay, interface state, and router priority.
Designated Router	Designated router ID and respective interface IP address.
Backup Designated router	Backup designated router ID and respective interface IP address.
Timer intervals configured	Configuration of timer intervals.
Hello	Number of seconds until the next hello packet is sent out this interface.
Neighbor Count	Count of network neighbors and list of adjacent neighbors.

### Cisco IOS Release 12.2(33)SRB Example

The following is sample output of the **show ipv6 ospf interface** command when the **brief** keyword is entered.

```
Device# show ipv6 ospf interface brief
```

```

Interface  PID  Area           Intf ID   Cost  State  Nbrs  F/C
VL0        6   0              21       65535 DOWN  0/0
Se3/0      6   0              14        64   P2P   0/0
Lo1        6   0              20         1   LOOP  0/0
Se2/0      6   6              10         62   P2P   0/0
Tu0       1000 0              19       11111 DOWN  0/0

```

### OSPF with Authentication on the Interface Example

The following is sample output from the **showipv6ospfinterface** command with authentication enabled on the interface:

```
Device# show ipv6 ospf interface
Ethernet0/0 is up, line protocol is up
  Link Local Address 2001:0DB1:A8BB:CCFF:FE00:6E00, Interface ID 2
  Area 0, Process ID 1, Instance ID 0, Router ID 10.10.10.1
  Network Type BROADCAST, Cost:10
  MD5 Authentication SPI 500, secure socket state UP (errors:0)
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 10.11.11.1, local address 2001:0DB1:A8BB:CCFF:FE00:6F00
  Backup Designated router (ID) 10.10.10.1, local address
2001:0DB1:A8BB:CCFF:FE00:6E00
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Hello due in 00:00:01
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 10.11.11.1 (Designated Router)
  Suppress hello for 0 neighbor(s)
```

### OSPF with Null Authentication Example

The following is sample output from the **showipv6ospfinterface** command with null authentication configured on the interface:

```
Device# show ipv6 ospf interface
Ethernet0/0 is up, line protocol is up
  Link Local Address 2001:0DB1:A8BB:CCFF:FE00:6E00, Interface ID 2
  Area 0, Process ID 1, Instance ID 0, Router ID 10.10.10.1
  Network Type BROADCAST, Cost:10
  Authentication NULL
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 10.11.11.1, local address 2001:0DB1:A8BB:CCFF:FE00:6F00
  Backup Designated router (ID) 10.10.10.1, local address
2001:0DB1:A8BB:CCFF:FE00:6E00
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Hello due in 00:00:03
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 10.11.11.1 (Designated Router)
  Suppress hello for 0 neighbor(s)
```

### OSPF with Authentication for the Area Example

The following is sample output from the **showipv6ospfinterface** command with authentication configured for the area:

```
Device# show ipv6 ospf interface
```

```

Ethernet0/0 is up, line protocol is up
  Link Local Address 2001:0DB1:A8BB:CCFF:FE00:6E00, Interface ID 2
  Area 0, Process ID 1, Instance ID 0, Router ID 10.10.10.1
  Network Type BROADCAST, Cost:10
  MD5 Authentication (Area) SPI 1000, secure socket state UP (errors:0)
  Transmit Delay is 1 sec, State BDR, Priority 1
  Designated Router (ID) 10.11.11.1, local address 2001:0DB1:A8BB:CCFF:FE00:6F00
  Backup Designated router (ID) 10.10.10.1, local address
  FE80::A8BB:CCFF:FE00:6E00
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Hello due in 00:00:03
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 10.11.11.1 (Designated Router)
  Suppress hello for 0 neighbor(s)

```

### OSPF with Dynamic Cost Example

The following display shows sample output from the **show ipv6 ospf interface** command when the OSPF cost dynamic is configured.

```

Device# show ipv6 ospf interface serial 2/0
Serial2/0 is up, line protocol is up
  Link Local Address 2001:0DB1:A8BB:CCFF:FE00:100, Interface ID 10
  Area 1, Process ID 1, Instance ID 0, Router ID 172.1.1.1
  Network Type POINT_TO_MULTIPOINT, Cost: 64 (dynamic), Cost Hysteresis: 200
  Cost Weights: Throughput 100, Resources 20, Latency 80, L2-factor 100
  Transmit Delay is 1 sec, State POINT_TO_MULTIPOINT,
  Timer intervals configured, Hello 30, Dead 120, Wait 120, Retransmit 5
  Hello due in 00:00:19
  Index 1/2/3, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 0, maximum is 0
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)

```

### OSPF Graceful Restart Example

The following display shows sample output from the **show ipv6 ospf interface** command when the OSPF graceful restart feature is configured:

```

Device# show ipv6 ospf interface
Ethernet0/0 is up, line protocol is up
  Link Local Address FE80::A8BB:CCFF:FE00:300, Interface ID 2
  Area 0, Process ID 1, Instance ID 0, Router ID 10.3.3.3
  Network Type POINT_TO_POINT, Cost: 10
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Graceful Restart p2p timeout in 00:00:19
  Hello due in 00:00:02
  Graceful Restart helper support enabled
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1

```

**show ipv6 ospf interface**

```

Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 10.1.1.1
Suppress hello for 0 neighbor(s)

```

**Example of an Enabled Protocol**

The following display shows that the OSPF interface is enabled for Bidirectional Forwarding Detection (BFD):

```

Device# show ipv6 ospf interface
Serial10/0 is up, line protocol is up
  Link Local Address FE80::A8BB:CCFF:FE00:6500, Interface ID 42
  Area 1, Process ID 1, Instance ID 0, Router ID 10.0.0.1
  Network Type POINT_TO_POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT_TO_POINT, BFD enabled
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:07
  Index 1/1/1, flood queue length 0
  Next 0x0(0)/0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 10.1.0.1
  Suppress hello for 0 neighbor(s)

```

**Related Commands**

Command	Description
<b>show ipv6 ospf graceful-restart</b>	Displays OSPFv3 graceful restart information.

# show ipv6 ospf request-list

To display a list of all link-state advertisements (LSAs) requested by a router, use the **show ipv6 ospf request-list** command in user EXEC or privileged EXEC mode.

**show ipv6 ospf** [*process-id*] [*area-id*] **request-list** [*neighbor*] [*interface*] [*interface-neighbor*]

Syntax Description		
<i>process-id</i>	(Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when the Open Shortest Path First (OSPF) routing process is enabled.	
<i>area-id</i>	(Optional) Displays information only about a specified area.	
<i>neighbor</i>	(Optional) Displays the list of all LSAs requested by the router from this neighbor.	
<i>interface</i>	(Optional) Displays the list of all LSAs requested by the router from this interface.	
<i>interface-neighbor</i>	(Optional) Displays the list of all LSAs requested by the router on this interface, from this neighbor.	

Command Modes	
	User EXEC (>)
	Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The information displayed by the **show ipv6 ospf request-list** command is useful in debugging OSPF routing operations.

**Examples** The following example shows information about the LSAs requested by the router:

```
Device# show ipv6 ospf request-list

          OSPFv3 Router with ID (192.168.255.5) (Process ID 1)
Neighbor 192.168.255.2, interface Ethernet0/0 address
FE80::A8BB:CCFF:FE00:6600
Type   LS ID      ADV RTR      Seq NO      Age      Checksum
  1     0.0.0.0     192.168.255.3 0x800000C2  1       0x0014C5
  1     0.0.0.0     192.168.255.2 0x800000C8  0       0x000BCA
  1     0.0.0.0     192.168.255.1 0x800000C5  1       0x008CD1
  2     0.0.0.3     192.168.255.3 0x800000A9  774    0x0058C0
  2     0.0.0.2     192.168.255.3 0x800000B7  1       0x003A63
```

The table below describes the significant fields shown in the display.

*Table 56: show ipv6 ospf request-list Field Descriptions*

<b>Field</b>	<b>Description</b>
OSPFv3 Router with ID (192.168.255.5) (Process ID 1)	Identification of the router for which information is displayed.
Interface Ethernet0/0	Interface for which information is displayed.
Type	Type of LSA.
LS ID	Link-state ID of the LSA.
ADV RTR	IP address of advertising router.
Seq NO	Sequence number of LSA.
Age	Age of LSA (in seconds).
Checksum	Checksum of LSA.

# show ipv6 ospf retransmission-list

To display a list of all link-state advertisements (LSAs) waiting to be re-sent, use the **show ipv6 ospf retransmission-list** command in user EXEC or privileged EXEC mode.

**show ipv6 ospf** [*process-id*] [*area-id*] **retransmission-list** [*neighbor*] [*interface*] [*interface-neighbor*]

Syntax Description		
	<i>process-id</i>	(Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when the OSPF routing process is enabled.
	<i>area-id</i>	(Optional) Displays information only about a specified area.
	<i>neighbor</i>	(Optional) Displays the list of all LSAs waiting to be re-sent for this neighbor.
	<i>interface</i>	(Optional) Displays the list of all LSAs waiting to be re-sent on this interface.
	<i>interface neighbor</i>	(Optional) Displays the list of all LSAs waiting to be re-sent on this interface, from this neighbor.

Command Modes	
	User EXEC (>)
	Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The information displayed by the **show ipv6 ospf retransmission-list** command is useful in debugging Open Shortest Path First (OSPF) routing operations.

**Examples** The following is sample output from the **show ipv6 ospf retransmission-list** command:

```
Device# show ipv6 ospf retransmission-list

      OSPFv3 Router with ID (192.168.255.2) (Process ID 1)
Neighbor 192.168.255.1, interface Ethernet0/0
Link state retransmission due in 3759 msec, Queue length 1
Type   LS ID      ADV RTR      Seq NO      Age      Checksum
0x2001 0           192.168.255.2 0x80000222 1        0x00AE52
```

The table below describes the significant fields shown in the display.

**Table 57: show ipv6 ospf retransmission-list Field Descriptions**

Field	Description
OSPFv3 Router with ID (192.168.255.2) (Process ID 1)	Identification of the router for which information is displayed.

Field	Description
Interface Ethernet0/0	Interface for which information is displayed.
Link state retransmission due in	Length of time before next link-state transmission.
Queue length	Number of elements in the retransmission queue.
Type	Type of LSA.
LS ID	Link-state ID of the LSA.
ADV RTR	IP address of advertising router.
Seq NO	Sequence number of the LSA.
Age	Age of LSA (in seconds).
Checksum	Checksum of LSA.



# show ipv6 ospf statistics

To display Open Shortest Path First for IPv6 (OSPFv6) shortest path first (SPF) calculation statistics, use the **show ipv6 ospf statistics** command in user EXEC or privileged EXEC mode.

**show ipv6 ospf statistics [detail]**

<b>Syntax Description</b>	<b>detail</b> (Optional) Displays statistics separately for each OSPF area and includes additional, more detailed statistics.
---------------------------	---

<b>Command Modes</b>	User EXEC (>) Privileged EXEC (#)
----------------------	--------------------------------------

<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines** The **show ipv6 ospf statistics** command provides important information about SPF calculations and the events that trigger them. This information can be meaningful for both OSPF network maintenance and troubleshooting. For example, entering the **show ipv6 ospf statistics** command is recommended as the first troubleshooting step for link-state advertisement (LSA) flapping.

## Examples

The following example provides detailed statistics for each OSPFv6 area:

```
Device# show ipv6 ospf statistics detail
Area 0: SPF algorithm executed 3 times
SPF 1 executed 00:06:57 ago, SPF type Full
SPF calculation time (in msec):
SPT   Prefix D-Int  Sum   D-Sum  Ext   D-Ext  Total
0     0       0     0     0     0     0     0
RIB manipulation time (in msec):
RIB Update   RIB Delete
0             0
LSIDs processed R:1 N:0 Prefix:0 SN:0 SA:0 X7:0
Change record R N SN SA L
LSAs changed 1
Changed LSAs. Recorded is Advertising Router, LSID and LS type:
10.2.2.2/0(R)
SPF 2 executed 00:06:47 ago, SPF type Full
SPF calculation time (in msec):
SPT   Prefix D-Int  Sum   D-Sum  Ext   D-Ext  Total
0     0       0     0     0     0     0     0
RIB manipulation time (in msec):
RIB Update   RIB Delete
0             0
LSIDs processed R:1 N:0 Prefix:1 SN:0 SA:0 X7:0
Change record R L P
LSAs changed 4
Changed LSAs. Recorded is Advertising Router, LSID and LS type:
10.2.2.2/2(L) 10.2.2.2/0(R) 10.2.2.2/2(L) 10.2.2.2/0(P)
```

The table below describes the significant fields shown in the display.

**Table 58: show ipv6 ospf statistics Field Descriptions**

Field	Description
Area	OSPF area ID.
SPF	Number of SPF algorithms executed in the OSPF area. The number increases by one for each SPF algorithm that is executed in the area.
Executed ago	Time in milliseconds that has passed between the start of the SPF algorithm execution and the current time.
SPF type	SPF type can be Full or Incremental.
SPT	Time in milliseconds required to compute the first stage of the SPF algorithm (to build a short path tree). The SPT time plus the time required to process links to stub networks equals the Intra time.
Ext	Time in milliseconds for the SPF algorithm to process external and not so stubby area (NSSA) LSAs and to install external and NSSA routes in the routing table.
Total	Total duration time in milliseconds for the SPF algorithm process.
LSIDs processed	Number of LSAs processed during the SPF calculation: <ul style="list-style-type: none"> <li>• N--Network LSA.</li> <li>• R--Router LSA.</li> <li>• SA--Summary Autonomous System Boundary Router (ASBR) (SA) LSA.</li> <li>• SN--Summary Network (SN) LSA.</li> <li>• Stub--Stub links.</li> <li>• X7--External Type-7 (X7) LSA.</li> </ul>

## show ipv6 ospf summary-prefix

To display a list of all summary address redistribution information configured under an OSPF process, use the **show ipv6 ospf summary-prefix** command in user EXEC or privileged EXEC mode.

**show ipv6 ospf** [*process-id*] **summary-prefix**

<b>Syntax Description</b>	<i>process-id</i> (Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when the OSPF routing process is enabled.
---------------------------	--

<b>Command Modes</b>	User EXEC (>) Privileged EXEC (#)
----------------------	--------------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	The <i>process-id</i> argument can be entered as a decimal number or as an IPv6 address format.
-------------------------	---

**Examples** The following is sample output from the **show ipv6 ospf summary-prefix** command:

```
Device# show ipv6 ospf summary-prefix
OSPFv3 Process 1, Summary-prefix
FE00::/24 Metric 16777215, Type 0, Tag 0
```

The table below describes the significant fields shown in the display.

**Table 59: show ipv6 ospf summary-prefix Field Descriptions**

Field	Description
OSPFv3 Process	Process ID of the router for which information is displayed.
Metric	Metric used to reach the destination router.
Type	Type of link-state advertisement (LSA).
Tag	LSA tag.

# show ipv6 ospf timers rate-limit

To display all of the link-state advertisements (LSAs) in the rate limit queue, use the **show ipv6 ospf timers rate-limit** command in privileged EXEC mode.

**show ipv6 ospf timers rate-limit**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **show ipv6 ospf timers rate-limit** command to discover when LSAs in the queue will be sent.

## Examples

### show ipv6 ospf timers rate-limit Output Example

The following is sample output from the **show ipv6 ospf timers rate-limit** command:

```
Device# show ipv6 ospf timers rate-limit
List of LSAs that are in rate limit Queue
  LSAID: 0.0.0.0 Type: 0x2001 Adv Rtr: 55.55.55.55 Due in: 00:00:00.500
  LSAID: 0.0.0.0 Type: 0x2009 Adv Rtr: 55.55.55.55 Due in: 00:00:00.500
```

The table below describes the significant fields shown in the display.

*Table 60: show ipv6 ospf timers rate-limit Field Descriptions*

Field	Description
LSAID	ID of the LSA.
Type	Type of LSA.
Adv Rtr	ID of the advertising router.
Due in:	When the LSA is scheduled to be sent (in hours:minutes:seconds).

# show ipv6 ospf traffic

To display IPv6 Open Shortest Path First Version 3 (OSPFv3) traffic statistics, use the **show ipv6 ospf traffic** command in privileged EXEC mode.

```
show ipv6 ospf [process-id] traffic [interface-type interface-number]
```

Syntax Description		
	<i>process-id</i>	(Optional) OSPF process ID for which you want traffic statistics (for example, queue statistics, statistics for each interface under the OSPF process, and per OSPF process statistics).
	<i>interface-type interface-number</i>	(Optional) Type and number associated with a specific OSPF interface.

**Command Default** When the **show ipv6 ospf traffic** command is entered without any arguments, global OSPF traffic statistics are displayed, including queue statistics for each OSPF process, statistics for each interface, and per OSPF process statistics.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You can limit the displayed traffic statistics to those for a specific OSPF process by entering a value for the *process-id* argument, or you can limit output to traffic statistics for a specific interface associated with an OSPF process by entering values for the *interface-type* and *interface-number* arguments. To reset counters and clear statistics, use the **clear ipv6 ospf traffic** command.

## Examples

The following example shows the display output for the **show ipv6 ospf traffic** command for OSPFv3:

```
Device# show ipv6 ospf traffic
OSPFv3 statistics:
  Rcvd: 32 total, 0 checksum errors
        10 hello, 7 database desc, 2 link state req
        9 link state updates, 4 link state acks
        0 LSA ignored
  Sent: 45 total, 0 failed
        17 hello, 12 database desc, 2 link state req
        8 link state updates, 6 link state acks
        OSPFv3 Router with ID (10.1.1.4) (Process ID 6)
OSPFv3 queues statistic for process ID 6
  Hello queue size 0, no limit, max size 2
  Router queue size 0, limit 200, drops 0, max size 2
Interface statistics:
  Interface Serial2/0
OSPFv3 packets received/sent
  Type           Packets      Bytes
  RX Invalid     0             0
  RX Hello       5            196
  RX DB des      4            172
```

## show ipv6 ospf traffic

```

RX LS req      1          52
RX LS upd      4          320
RX LS ack      2          112
RX Total       16          852
TX Failed      0           0
TX Hello       8          304
TX DB des      3          144
TX LS req      1          52
TX LS upd      3          252
TX LS ack      3          148
TX Total       18          900
OSPFv3 header errors
Length 0, Checksum 0, Version 0, No Virtual Link 0,
Area Mismatch 0, Self Originated 0, Duplicate ID 0,
Instance ID 0, Hello 0, MTU Mismatch 0,
Nbr Ignored 0, Authentication 0,
OSPFv3 LSA errors
Type 0, Length 0, Data 0, Checksum 0,
Interface Ethernet0/0
OSPFv3 packets received/sent
Type           Packets           Bytes
RX Invalid     0                 0
RX Hello       6                 240
RX DB des      3                 144
RX LS req      1                 52
RX LS upd      5                 372
RX LS ack      2                 152
RX Total       17                960
TX Failed      0                 0
TX Hello       11                420
TX DB des      9                 312
TX LS req      1                 52
TX LS upd      5                 376
TX LS ack      3                 148
TX Total       29                1308
OSPFv3 header errors
Length 0, Checksum 0, Version 0, No Virtual Link 0,
Area Mismatch 0, Self Originated 0, Duplicate ID 0,
Instance ID 0, Hello 0, MTU Mismatch 0,
Nbr Ignored 0, Authentication 0,
OSPFv3 LSA errors
Type 0, Length 0, Data 0, Checksum 0,
Summary traffic statistics for process ID 6:
OSPFv3 packets received/sent
Type           Packets           Bytes
RX Invalid     0                 0
RX Hello       11                436
RX DB des      7                 316
RX LS req      2                 104
RX LS upd      9                 692
RX LS ack      4                 264
RX Total       33                1812
TX Failed      0                 0
TX Hello       19                724
TX DB des      12                456
TX LS req      2                 104
TX LS upd      8                 628
TX LS ack      6                 296
TX Total       47                2208
OSPFv3 header errors
Length 0, Checksum 0, Version 0, No Virtual Link 0,
Area Mismatch 0, Self Originated 0, Duplicate ID 0,
Instance ID 0, Hello 0, MTU Mismatch 0,
Nbr Ignored 0, Authentication 0,

```

```
OSPFv3 LSA errors
  Type 0, Length 0, Data 0, Checksum 0,
```

The network administrator wants to start collecting new statistics, resetting the counters and clearing the traffic statistics by entering the **clear ipv6 ospf traffic** command as follows:

```
Device# clear ipv6 ospf traffic
```

The table below describes the significant fields shown in the display.

**Table 61: show ipv6 ospf traffic Field Descriptions**

Field	Description
OSPFv3 statistics	Traffic statistics accumulated for all OSPF processes running on the router. To ensure compatibility with the <b>showiptraffic</b> command, only checksum errors are displayed. Identifies the route map name.
OSPFv3 queues statistic for process ID	Queue statistics specific to Cisco IOS software.
Hello queue	Statistics for the internal Cisco IOS queue between the packet switching code (process IP Input) and the OSPF hello process for all received OSPF packets.
Router queue	Statistics for the internal Cisco IOS queue between the OSPF hello process and the OSPF router for all received OSPF packets except OSPF hellos.
queue size	Actual size of the queue.
queue limit	Maximum allowed size of the queue.
queue max size	Maximum recorded size of the queue.
Interface statistics	Per-interface traffic statistics for all interfaces that belong to the specific OSPFv3 process ID.
OSPFv3 packets received/sent	Number of OSPFv3 packets received and sent on the interface, sorted by packet types.
OSPFv3 header errors	Packet appears in this section if it was discarded because of an error in the header of an OSPFv3 packet. The discarded packet is counted under the appropriate discard reason.
OSPFv3 LSA errors	Packet appears in this section if it was discarded because of an error in the header of an OSPF link-state advertisement (LSA). The discarded packet is counted under the appropriate discard reason.
Summary traffic statistics for process ID	Summary traffic statistics accumulated for an OSPFv3 process.  <b>Note</b> The OSPF process ID is a unique value assigned to the OSPFv3 process in the configuration.  The value for the received errors is the sum of the OSPFv3 header errors that are detected by the OSPFv3 process, unlike the sum of the checksum errors that are listed in the global OSPF statistics.

---

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>clear ip ospf traffic</b>	Clears OSPFv2 traffic statistics.
<b>clear ipv6 ospf traffic</b>	Clears OSPFv3 traffic statistics.
<b>show ip ospf traffic</b>	Displays OSPFv2 traffic statistics.



# show ipv6 ospf virtual-links

To display parameters and the current state of Open Shortest Path First (OSPF) virtual links, use the **show ipv6 ospf virtual-links** command in user EXEC or privileged EXEC mode.

**show ipv6 ospf virtual-links**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The information displayed by the **show ipv6 ospf virtual-links** command is useful in debugging OSPF routing operations.

## Examples

The following is sample output from the **show ipv6 ospf virtual-links** command:

```
Device# show ipv6 ospf virtual-links
Virtual Link OSPF_VL0 to router 172.16.6.6 is up
  Interface ID 27, IPv6 address FEC0:6666:6666::
  Run as demand circuit
  DoNotAge LSA allowed.
  Transit area 2, via interface ATM3/0, Cost of using 1
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Hello due in 00:00:06
```

The table below describes the significant fields shown in the display.

**Table 62: show ipv6 ospf virtual-links Field Descriptions**

Field	Description
Virtual Link OSPF_VL0 to router 172.16.6.6 is up	Specifies the OSPF neighbor, and if the link to that neighbor is up or down.
Interface ID	Interface ID and IPv6 address of the router.
Transit area 2	The transit area through which the virtual link is formed.
via interface ATM3/0	The interface through which the virtual link is formed.
Cost of using 1	The cost of reaching the OSPF neighbor through the virtual link.
Transmit Delay is 1 sec	The transmit delay (in seconds) on the virtual link.
State POINT_TO_POINT	The state of the OSPF neighbor.

Field	Description
Timer intervals...	The various timer intervals configured for the link.
Hello due in 0:00:06	When the next hello is expected from the neighbor.

The following sample output from the **show ipv6 ospf virtual-links** command has two virtual links. One is protected by authentication, and the other is protected by encryption.

```

Device# show ipv6 ospf virtual-links
Virtual Link OSPFv3_VL1 to router 10.2.0.1 is up
  Interface ID 69, IPv6 address 2001:0DB8:11:0:A8BB:CCFF:FE00:6A00
  Run as demand circuit
  DoNotAge LSA allowed.
  Transit area 1, via interface Serial12/0, Cost of using 64
  NULL encryption SHA-1 auth SPI 3944, secure socket UP (errors: 0)
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 2, Dead 10, Wait 40, Retransmit 5
  Adjacency State FULL (Hello suppressed)
  Index 1/2/4, retransmission queue length 0, number of retransmission 1
  First 0x0(0)/0x0(0)/0x0(0) Next 0x0(0)/0x0(0)/0x0(0)
  Last retransmission scan length is 1, maximum is 1
  Last retransmission scan time is 0 msec, maximum is 0 msec
Virtual Link OSPFv3_VL0 to router 10.1.0.1 is up
  Interface ID 67, IPv6 address 2001:0DB8:13:0:A8BB:CCFF:FE00:6700
  Run as demand circuit
  DoNotAge LSA allowed.
  Transit area 1, via interface Serial11/0, Cost of using 128
  MD5 authentication SPI 940, secure socket UP (errors: 0)
  Transmit Delay is 1 sec, State POINT_TO_POINT,
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  Adjacency State FULL (Hello suppressed)
  Index 1/1/3, retransmission queue length 0, number of retransmission 1
  First 0x0(0)/0x0(0)/0x0(0) Next 0x0(0)/0x0(0)/0x0(0)
  Last retransmission scan length is 1, maximum is 1
  Last retransmission scan time is 0 msec, maximum is 0 msec

```

## show ipv6 pim anycast-RP

To verify IPv6 PIM anycast RP operation, use the **show ipv6 pim anycast-RP** command in user EXEC or privileged EXEC mode.

**show ipv6 pim anycast-RP** *rp-address*

### Syntax Description

<i>rp-address</i>	RP address to be verified.
-------------------	----------------------------

### Command Modes

User EXEC (>)  
Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

#### Examples

```
Device# show ipv6 pim anycast-rp 110::1:1:1
```

```
Anycast RP Peers For 110::1:1:1   Last Register/Register-Stop received
 20::1:1:1 00:00:00/00:00:00
```

### Related Commands

Command	Description
ipv6 pim anycast-RP	Configures the address of the PIM RP for an anycast group range.

# show ipv6 pim bsr

To display information related to Protocol Independent Multicast (PIM) bootstrap router (BSR) protocol processing, use the **show ipv6 pim bsr** command in user EXEC or privileged EXEC mode.

**show ipv6 pim** [*vrf vrf-name*] **bsr election** | **rp-cache** | **candidate-rp**

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<b>election</b>	Displays BSR state, BSR election, and bootstrap message (BSM)-related timers.
<b>rp-cache</b>	Displays candidate rendezvous point (C-RP) cache learned from unicast C-RP announcements on the elected BSR.
<b>candidate-rp</b>	Displays C-RP state on devices that are configured as C-RPs.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **show ipv6 pim bsr** command to display details of the BSR election-state machine, C-RP advertisement state machine, and the C-RP cache. Information on the C-RP cache is displayed only on the elected BSR device, and information on the C-RP state machine is displayed only on a device configured as a C-RP.

## Examples

The following example displays BSM election information:

```
Device# show ipv6 pim bsr election
PIMv2 BSR information
BSR Election Information
Scope Range List: ff00::/8
This system is the Bootstrap Router (BSR)
BSR Address: 60::1:1:4
Uptime: 00:11:55, BSR Priority: 0, Hash mask length: 126
RPF: FE80::A8BB:CCFF:FE03:C400,Ethernet0/0
BS Timer: 00:00:07
This system is candidate BSR
Candidate BSR address: 60::1:1:4, priority: 0, hash mask length: 126
```

The table below describes the significant fields shown in the display.

**Table 63: show ipv6 pim bsr election Field Descriptions**

Field	Description
Scope Range List	Scope to which this BSR information applies.

Field	Description
This system is the Bootstrap Router (BSR)	Indicates this device is the BSR and provides information on the parameters associated with it.
BS Timer	On the elected BSR, the BS timer shows the time in which the next BSM will be originated.  On all other devices in the domain, the BS timer shows the time at which the elected BSR expires.
This system is candidate BSR	Indicates this device is the candidate BSR and provides information on the parameters associated with it.

The following example displays information that has been learned from various C-RPs at the BSR. In this example, two candidate RPs have sent advertisements for the FF00::/8 or the default IPv6 multicast range:

```
Device# show ipv6 pim bsr rp-cache
PIMv2 BSR C-RP Cache
BSR Candidate RP Cache
Group(s) FF00::/8, RP count 2
  RP 10::1:1:3
    Priority 192, Holdtime 150
    Uptime: 00:12:36, expires: 00:01:55
  RP 20::1:1:1
    Priority 192, Holdtime 150
    Uptime: 00:12:36, expires: 00:01:5
```

The following example displays information about the C-RP. This RP has been configured without a specific scope value, so the RP will send C-RP advertisements to all BSRs about which it has learned through BSMs it has received.

```
Device# show ipv6 pim bsr candidate-rp
PIMv2 C-RP information
Candidate RP: 10::1:1:3
All Learnt Scoped Zones, Priority 192, Holdtime 150
Advertisement interval 60 seconds
Next advertisement in 00:00:33
```

The following example confirms that the IPv6 C-BSR is PIM-enabled. If PIM is disabled on an IPv6 C-BSR interface, or if a C-BSR or C-RP is configured with the address of an interface that does not have PIM enabled, the **show ipv6 pim bsr** command used with the **election** keyword would display that information instead.

```
Device# show ipv6 pim bsr election

PIMv2 BSR information

BSR Election Information
Scope Range List: ff00::/8
BSR Address: 2001:DB8:1:1:2
Uptime: 00:02:42, BSR Priority: 34, Hash mask length: 28
RPF: FE80::20:1:2,Ethernet1/0
BS Timer: 00:01:27
```

# show ipv6 pim df

To display the designated forwarder (DF)-election state of each interface for each rendezvous point (RP), use the **show ipv6 pim df** command in user EXEC or privileged EXEC mode.

**show ipv6 pim** [**vrf** *vrf-name*] **df** [*interface-type interface-number*] [*rp-address*]

Syntax Description		
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.	
<i>interface-type interface-number</i>	(Optional) Interface type and number. For more information, use the question mark (?) online help function.	
<i>rp-address</i>	(Optional) RP IPv6 address.	

**Command Default** If no interface or RP address is specified, all DFs are displayed.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **show ipv6 pim df** command to display the state of the DF election for each RP on each Protocol Independent Multicast (PIM)-enabled interface if the bidirectional multicast traffic is not flowing as expected.

## Examples

The following example displays the DF-election states:

```
Device# show ipv6 pim df
Interface      DF State      Timer          Metrics
Ethernet0/0    Winner        4s 8ms        [120/2]
  RP :200::1
Ethernet1/0    Lose          0s 0ms        [inf/inf]
  RP :200::1
```

The following example shows information on the RP:

```
Device# show ipv6 pim df
Interface      DF State      Timer          Metrics
Ethernet0/0    None:RP LAN  0s 0ms        [inf/inf]
  RP :200::1
Ethernet1/0    Winner        7s 600ms      [0/0]
  RP :200::1
Ethernet2/0    Winner        9s 8ms        [0/0]
  RP :200::1
```

The table below describes the significant fields shown in the display.

Table 64: show ipv6 pim df Field Descriptions

Field	Description
Interface	Interface type and number that is configured to run PIM.
DF State	<p>The state of the DF election on the interface. The state can be:</p> <ul style="list-style-type: none"> <li>• Offer</li> <li>• Winner</li> <li>• Backoff</li> <li>• Lose</li> <li>• None:RP LAN</li> </ul> <p>The None:RP LAN state indicates that no DF election is taking place on this LAN because the RP is directly connected to this LAN.</p>
Timer	DF election timer.
Metrics	Routing metrics to the RP announced by the DF.
RP	The IPv6 address of the RP.

**Related Commands**

Command	Description
<b>debug ipv6 pim df-election</b>	Displays debug messages for PIM bidirectional DF-election message processing.
<b>ipv6 pim rp-address</b>	Configures the address of a PIM RP for a particular group range.
<b>show ipv6 pim df winner</b>	Displays the DF-election winner on each interface for each RP.

# show ipv6 pim group-map

To display an IPv6 Protocol Independent Multicast (PIM) group mapping table, use the **show ipv6 pim group-map** command in user EXEC or privileged EXEC mode.

**show ipv6 pim** [*vrf vrf-name*] **group-map** [*group-namegroup-address*] | [*group-rangegroup-mask*] [**info-source** *bsr* | **default** | **embedded-rp** | **static**]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<i>group-name</i>   <i>group-address</i>	(Optional) IPv6 address or name of the multicast group.
<i>group-range</i>   <i>group-mask</i>	(Optional) Group range list. Includes group ranges with the same prefix or mask length.
<b>info-source</b>	(Optional) Displays all mappings learned from a specific source, such as the bootstrap router (BSR) or static configuration.
<b>bsr</b>	Displays ranges learned through the BSR.
<b>default</b>	Displays ranges enabled by default.
<b>embedded-rp</b>	Displays group ranges learned through the embedded rendezvous point (RP).
<b>static</b>	Displays ranges enabled by static configuration.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **show ipv6 pim group-map** command to find all group mappings installed by a given source of information, such as BSR or static configuration.

You can also use this command to find which group mapping a router at a specified IPv6 group address is using by specifying a group address, or to find an exact group mapping entry by specifying a group range and mask length.

## Examples

The following is sample output from the **show ipv6 pim group-map** command:

```
Device# show ipv6 pim group-map
FF33::/32*
  SSM
  Info source:Static
  Uptime:00:08:32, Groups:0
FF34::/32*
  SSM
```



```
Info source:Static
Uptime:00:09:42, Groups:0
```

The table below describes the significant fields shown in the display.

**Table 65: show ipv6 pim group-map Field Descriptions**

Field	Description
RP	Address of the RP router if the protocol is sparse mode or bidir.
Protocol	Protocol used: sparse mode (SM), Source Specific Multicast (SSM), link-local (LL), or NOROUTE (NO).  LL is used for the link-local scoped IPv6 address range (ff[0-f]2::/16). LL is treated as a separate protocol type, because packets received with these destination addresses are not forwarded, but the router might need to receive and process them.  NOROUTE or NO is used for the reserved and node-local scoped IPv6 address range (ff[0-f][0-1]::/16). These addresses are nonroutable, and the router does not need to process them.
Groups	How many groups are present in the topology table from this range.
Info source	Mappings learned from a specific source; in this case, static configuration.
Uptime	The uptime for the group mapping displayed.

The following example displays the group mappings learned from BSRs that exist in the PIM group-to-RP or mode-mapping cache. The example shows the address of the BSR from which the group mappings have been learned and the associated timeout.

```
Router# show ipv6 pim group-map info-source bsr
FF00::/8*
  SM, RP: 20::1:1:1
  RPF: Et1/0,FE80::A8BB:CCFF:FE03:C202
  Info source: BSR From: 60::1:1:4(00:01:42), Priority: 192
  Uptime: 00:19:51, Groups: 0
FF00::/8*
  SM, RP: 10::1:1:3
  RPF: Et0/0,FE80::A8BB:CCFF:FE03:C102
  Info source: BSR From: 60::1:1:4(00:01:42), Priority: 192
  Uptime: 00:19:51, Groups: 0
```

# show ipv6 pim interface

To display information about interfaces configured for Protocol Independent Multicast (PIM), use the **show ipv6 pim interface** command in privileged EXEC mode.

**show ipv6 pim** [*vrf vrf-name*] **interface** [*state-on*] [*state-off*] [*type number*]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<b>state-on</b>	(Optional) Displays interfaces with PIM enabled.
<b>state-off</b>	(Optional) Displays interfaces with PIM disabled.
<i>type number</i>	(Optional) Interface type and number.

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **show ipv6 pim interface** command is used to check if PIM is enabled on an interface, the number of neighbors, and the designated router (DR) on the interface.

## Examples

The following is sample output from the **show ipv6 pim interface** command using the **state-on** keyword:

```
Device# show ipv6 pim interface state-on
Interface          PIM  Nbr  Hello  DR
                   Count Intvl Prior
Ethernet0         on   0    30    1
  Address:FE80::208:20FF:FE08:D7FF
  DR      :this system
POS1/0            on   0    30    1
  Address:FE80::208:20FF:FE08:D554
  DR      :this system
POS4/0           on   1    30    1
  Address:FE80::208:20FF:FE08:D554
  DR      :FE80::250:E2FF:FE8B:4C80
POS4/1           on   0    30    1
  Address:FE80::208:20FF:FE08:D554
  DR      :this system
Loopback0        on   0    30    1
  Address:FE80::208:20FF:FE08:D554
  DR      :this system
```

The table below describes the significant fields shown in the display.

**Table 66: show ipv6 pim interface Field Descriptions**

Field	Description
Interface	Interface type and number that is configured to run PIM.
PIM	Whether PIM is enabled on an interface.
Nbr Count	Number of PIM neighbors that have been discovered through this interface.
Hello Intvl	Frequency, in seconds, of PIM hello messages.
DR	IP address of the designated router (DR) on a network.
Address	Interface IP address of the next-hop router.

The following is sample output from the **show ipv6 pim interface** command, modified to display passive interface information:

```
Device(config)# show ipv6 pim interface gigabitethernet0/0/0

Interface                PIM  Nbr  Hello  DR  BFD
                        Count Intvl Prior

GigabitEthernet0/0/0  on/P  0    30    1   On
  Address: FE80::A8BB:CCFF:FE00:9100
  DR      : this system
```

The table below describes the significant change shown in the display.

**Table 67: show ipv6 pim interface Field Description**

Field	Description
PIM	Whether PIM is enabled on an interface. When PIM passive mode is used, a "P" is displayed in the output.

**Related Commands**

Command	Description
<b>show ipv6 pim neighbor</b>	Displays the PIM neighbors discovered by the Cisco IOS software.

# show ipv6 pim join-prune statistic

To display the average join-prune aggregation for the most recently aggregated 1000, 10,000, and 50,000 packets for each interface, use the **show ipv6 pim join-prune statistic** command in user EXEC or privileged EXEC mode.

**show ipv6 pim** [*vrf vrf-name*] **join-prune statistic** [*interface-type*]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<i>interface-type</i>	(Optional) Interface type. For more information, use the question mark (?) online help function.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

When Protocol Independent Multicast (PIM) sends multiple joins and prunes simultaneously, it aggregates them into a single packet. The **show ipv6 pim join-prune statistic** command displays the average number of joins and prunes that were aggregated into a single packet over the last 1000 PIM join-prune packets, over the last 10,000 PIM join-prune packets, and over the last 50,000 PIM join-prune packets.

## Examples

The following example provides the join/prune aggregation on Ethernet interface 0/0/0:

```
Device# show ipv6 pim join-prune statistic Ethernet0/0/0
PIM Average Join/Prune Aggregation for last (1K/10K/50K) packets
Interface          Transmitted          Received
Ethernet0/0/0      0 / 0 / 0           1 / 0 / 0
```

The table below describes the significant fields shown in the display.

**Table 68: show ipv6 pim join-prune statistics Field Descriptions**

Field	Description
Interface	The interface from which the specified packets were transmitted or on which they were received.
Transmitted	The number of packets transmitted on the interface.
Received	The number of packets received on the interface.

# show ipv6 pim limit

To display Protocol Independent Multicast (PIM) interface limit, use the **show ipv6 pim limit** command in privileged EXEC mode.

```
show ipv6 pim [vrf vrf-name] limit [interface]
```

Syntax Description	Parameter	Description
	<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
	<i>interface</i>	(Optional) Specific interface for which limit information is provided.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ipv6 pim limit** command checks interface statistics for limits. If the optional *interface* argument is enabled, only information for the specified interface is shown.

**Examples** The following example displays s PIM interface limit information:

```
Device# show ipv6 pim limit
```

Related Commands	Command	Description
	<b>ipv6 multicast limit</b>	Configures per-interface mroute state limiters in IPv6.
	<b>ipv6 multicast limit cost</b>	Applies a cost to mroutes that match per interface mroute state limiters in IPv6.

# show ipv6 pim neighbor

To display the Protocol Independent Multicast (PIM) neighbors discovered by the Cisco software, use the **show ipv6 pim neighbor** command in privileged EXEC mode.

**show ipv6 pim** [**vrf** *vrf-name*] **neighbor** [**detail**] [*interface-type interface-number* | **count**]

Syntax Description		
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.	
<b>detail</b>	(Optional) Displays the additional addresses of the neighbors learned, if any, through the routable address hello option.	
<i>interface-type interface-number</i>	(Optional) Interface type and number.	
<b>count</b>	(Optional) Displays neighbor counts on each interface.	

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ipv6 pim neighbor** command displays which routers on the LAN are configured for PIM.

## Examples

The following is sample output from the **show ipv6 pim neighbor** command using the detail keyword to identify the additional addresses of the neighbors learned through the routable address hello option:

```
Device# show ipv6 pim neighbor detail

Neighbor Address(es)      Interface      Uptime      Expires DR pri Bidir
-----
FE80::A8BB:CCFF:FE00:401  Ethernet0/0   01:34:16   00:01:16  1      B
60::1:1:3
FE80::A8BB:CCFF:FE00:501  Ethernet0/0   01:34:15   00:01:18  1      B
60::1:1:4
```

The table below describes the significant fields shown in the display.

**Table 69: show ipv6 pim neighbor Field Descriptions**

Field	Description
Neighbor addresses	IPv6 address of the PIM neighbor.
Interface	Interface type and number on which the neighbor is reachable.
Uptime	How long (in hours, minutes, and seconds) the entry has been in the PIM neighbor table.

Field	Description
Expires	How long (in hours, minutes, and seconds) until the entry will be removed from the IPv6 multicast routing table.
DR	Indicates that this neighbor is a designated router (DR) on the LAN.
pri	DR priority used by this neighbor.
Bidir	The neighbor is capable of PIM in bidirectional mode.

**Related Commands**

Command	Description
<b>show ipv6 pim interfaces</b>	Displays information about interfaces configured for PIM.

# show ipv6 pim range-list

To display information about IPv6 multicast range lists, use the **show ipv6 pim range-list** command in privileged EXEC mode.

**show ipv6 pim** [**vrf** *vrf-name*] **range-list** [**config**] [*rp-addressrp-name*]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<b>config</b>	(Optional) The client. Displays the range lists configured on the router.
<i>rp-address</i>   <i>rp-name</i>	(Optional) The address of a Protocol Independent Multicast (PIM) rendezvous point (RP).

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **show ipv6 pim range-list** command displays IPv6 multicast range lists on a per-client and per-mode basis. A client is the entity from which the specified range list was learned. The clients can be config, and the modes can be Source Specific Multicast (SSM) or sparse mode (SM).

## Examples

The following is sample output from the **show ipv6 pim range-list** command:

```
Device# show ipv6 pim range-list
config SSM Exp:never Learnt from :::
FF33::/32 Up:00:26:33
FF34::/32 Up:00:26:33
FF35::/32 Up:00:26:33
FF36::/32 Up:00:26:33
FF37::/32 Up:00:26:33
FF38::/32 Up:00:26:33
FF39::/32 Up:00:26:33
FF3A::/32 Up:00:26:33
FF3B::/32 Up:00:26:33
FF3C::/32 Up:00:26:33
FF3D::/32 Up:00:26:33
FF3E::/32 Up:00:26:33
FF3F::/32 Up:00:26:33
config SM RP:40::1:1:1 Exp:never Learnt from :::
FF13::/64 Up:00:03:50
config SM RP:40::1:1:3 Exp:never Learnt from :::
FF09::/64 Up:00:03:50
```

The table below describes the significant fields shown in the display.



*Table 70: show ipv6 pim range-list Field Descriptions*

<b>Field</b>	<b>Description</b>
config	Config is the client.
SSM	Protocol being used.
FF33::/32	Group range.
Up:	Uptime.

# show ipv6 pim topology

To display Protocol Independent Multicast (PIM) topology table information for a specific group or all groups, use the **show ipv6 pim topology** command in user EXEC or privileged EXEC mode.

**show ipv6 pim** [**vrf** *vrf-name*] **topology** [*group-name* | *group-address* [*source-address* *source-name*] | **link-local**]**route-count** [**detail**]

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<i>group-name</i>   <i>group-address</i>	(Optional) IPv6 address or name of the multicast group.
<i>source-address</i>   <i>source-name</i>	(Optional) IPv6 address or name of the source.
<b>link-local</b>	(Optional) Displays the link-local groups.
<b>route-count</b>	(Optional) Displays the number of routes in PIM topology table.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

This command shows the PIM topology table for a given group--(\*, G), (S, G), and (S, G) Rendezvous Point Tree (RPT)-- as internally stored in a PIM topology table. The PIM topology table may have various entries for a given group, each with its own interface list. The resulting forwarding state is maintained in the Multicast Routing Information Base (MRIB) table, which shows which interface the data packet should be accepted on and which interfaces the data packet should be forwarded to for a given (S, G) entry. Additionally, the Multicast Forwarding Information Base (MFIB) table is used during forwarding to decide on per-packet forwarding actions.

The **route-count** keyword shows the count of all entries, including link-local entries.

PIM communicates the contents of these entries through the MRIB, which is an intermediary for communication between multicast routing protocols (such as PIM), local membership protocols (such as Multicast Listener Discovery [MLD]), and the multicast forwarding engine of the system.

For example, an interface is added to the (\*, G) entry in PIM topology table upon receipt of an MLD report or PIM (\*, G) join message. Similarly, an interface is added to the (S, G) entry upon receipt of the MLD INCLUDE report for the S and G or PIM (S, G) join message. Then PIM installs an (S, G) entry in the MRIB with the immediate olist (from (S, G)) and the inherited olist (from (\*, G)). Therefore, the proper forwarding state for a given entry (S, G) can be seen only in the MRIB or the MFIB, not in the PIM topology table.

## Examples

The following is sample output from the **show ipv6 pim topology** command:

```
Device# show ipv6 pim topology
```

```

IP PIM Multicast Topology Table
Entry state:(*/S,G)[RPT/SPT] Protocol Uptime Info
Entry flags:KAT - Keep Alive Timer, AA - Assume Alive, PA - Probe Alive,
  RA - Really Alive, LH - Last Hop, DSS - Don't Signal Sources,
  RR - Register Received, SR - Sending Registers, E - MSDP External,
  DCC - Don't Check Connected
Interface state:Name, Uptime, Fwd, Info
Interface flags:LI - Local Interest, LD - Local Dissinterest,
  II - Internal Interest, ID - Internal Dissinterest,
  LH - Last Hop, AS - Assert, AB - Admin Boundary
(*,FF05::1)
SM UP:02:26:56 JP:Join(now) Flags:LH
RP:40::1:1:2
RPF:Ethernet1/1,FE81::1
  Ethernet0/1          02:26:56  fwd LI LH
(50::1:1:200,FF05::1)
SM UP:00:00:07 JP:Null(never) Flags:
RPF:Ethernet1/1,FE80::30:1:4
  Ethernet1/1          00:00:07  off LI

```

The table below describes the significant fields shown in the display.

**Table 71: show ipv6 pim topology Field Descriptions**

Field	Description
Entry flags: KAT	The keepalive timer (KAT) associated with a source is used to keep track of two intervals while the source is alive. When a source first becomes active, the first-hop router sets the keepalive timer to 3 minutes and 30 seconds, during which time it does not probe to see if the source is alive. Once this timer expires, the router enters the probe interval and resets the timer to 65 seconds, during which time the router assumes the source is alive and starts probing to determine if it actually is. If the router determines that the source is alive, the router exits the probe interval and resets the keepalive timer to 3 minutes and 30 seconds. If the source is not alive, the entry is deleted at the end of the probe interval.
AA, PA	The assume alive (AA) and probe alive (PA) flags are set when the router is in the probe interval for a particular source.
RR	The register received (RR) flag is set on the (S, G) entries on the Route Processor (RP) as long as the RP receives registers from the source Designated Router (DR), which keeps the source state alive on the RP.
SR	The sending registers (SR) flag is set on the (S, G) entries on the DR as long as it sends registers to the RP.

#### Related Commands

Command	Description
<b>show ipv6 mrrib client</b>	Displays information about the clients of the MRIB.
<b>show ipv6 mrrib route</b>	Displays MRIB route information.

# show ipv6 pim traffic

To display the Protocol Independent Multicast (PIM) traffic counters, use the **show ipv6 pim traffic** command in user EXEC or privileged EXEC mode.

**show ipv6 pim [vrf vrf-name] traffic**

## Syntax Description

<b>vrf vrf-name</b>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
---------------------	--

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **show ipv6 pim traffic** command to check if the expected number of PIM protocol messages have been received and sent.

## Examples

The following example shows the number of PIM protocol messages received and sent.

```
Device# show ipv6 pim traffic

PIM Traffic Counters
Elapsed time since counters cleared:00:05:29

          Received      Sent
Valid PIM Packets         22      22
Hello                     22      22
Join-Prune                 0        0
Register                   0        0
Register Stop              0        0
Assert                     0        0
Bidir DF Election         0        0
Errors:
Malformed Packets                0
Bad Checksums                    0
Send Errors                      0
Packet Sent on Loopback Errors    0
Packets Received on PIM-disabled Interface 0
Packets Received with Unknown PIM Version 0
```

The table below describes the significant fields shown in the display.

**Table 72: show ipv6 pim traffic Field Descriptions**

Field	Description
Elapsed time since counters cleared	Indicates the amount of time (in hours, minutes, and seconds) since the counters cleared.
Valid PIM Packets	Number of valid PIM packets received and sent.

Field	Description
Hello	Number of valid hello messages received and sent.
Join-Prune	Number of join and prune announcements received and sent.
Register	Number of PIM register messages received and sent.
Register Stop	Number of PIM register stop messages received and sent.
Assert	Number of asserts received and sent.

# show ipv6 pim tunnel

To display information about the Protocol Independent Multicast (PIM) register encapsulation and de-encapsulation tunnels on an interface, use the **show ipv6 pim tunnel** command in privileged EXEC mode.

**show ipv6 pim** [**vrf vrf-name**] **tunnel** [*interface-type interface-number*]

Syntax Description		
<b>vrf vrf-name</b>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.	
<b>interface-type interface-number</b>	(Optional) Tunnel interface type and number.	

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

If you use the **show ipv6 pim tunnel** command without the optional *interface* keyword, information about the PIM register encapsulation and de-encapsulation tunnel interfaces is displayed.

The PIM encapsulation tunnel is the register tunnel. An encapsulation tunnel is created for every known rendezvous point (RP) on each router. The PIM decapsulation tunnel is the register decapsulation tunnel. A decapsulation tunnel is created on the RP for the address that is configured to be the RP address.

## Examples

The following is sample output from the **show ipv6 pim tunnel** command on the RP:

```
Device# show ipv6 pim tunnel
Tunnel0*
  Type   :PIM Encap
  RP     :100::1
  Source:100::1
Tunnel0*
  Type   :PIM Decap
  RP     :100::1
  Source: -
```

The following is sample output from the **show ipv6 pim tunnel** command on a non-RP:

```
Device# show ipv6 pim tunnel
Tunnel0*
  Type   :PIM Encap
  RP     :100::1
  Source:2001::1:1:1
```

The table below describes the significant fields shown in the display.

**Table 73: show ipv6 pim tunnel Field Descriptions**

Field	Description
Tunnel0*	Name of the tunnel.

Field	Description
Type	Type of tunnel. Can be PIM encapsulation or PIM de-encapsulation.
source	Source address of the router that is sending encapsulating registers to the RP.

# show ipv6 policy

To display the IPv6 policy-based routing (PBR) configuration, use the **show ipv6 policy** command in user EXEC or privileged EXEC mode.

**show ipv6 policy**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

IPv6 policy matches will be counted on route maps, as is done in IPv4. Therefore, IPv6 policy matches can also be displayed on the **show route-map** command.

## Examples

The following example displays the PBR configuration:

```
Device# show ipv6 policy
```

```
Interface          Routemap
Ethernet0/0        src-1
```

The table below describes the significant fields shown in the display.

Field	Description
Interface	Interface type and number that is configured to run Protocol-Independent Multicast (PIM).
Routemap	The name of the route map on which IPv6 policy matches were counted.

## Related Commands

Command	Description
<b>show route-map</b>	Displays all route maps configured or only the one specified.



# show ipv6 prefix-list

To display information about an IPv6 prefix list or IPv6 prefix list entries, use the **show ipv6 prefix-list** command in user EXEC or privileged EXEC mode.

```
show ipv6 prefix-list [detail | summary] [list-name]
show ipv6 prefix-list list-name ipv6-prefix/prefix-length [longer | first-match]
show ipv6 prefix-list list-name seq seq-num
```

Syntax Description	detail   summary	(Optional) Displays detailed or summarized information about all IPv6 prefix lists.
	<i>list-name</i>	(Optional) The name of a specific IPv6 prefix list.
	<i>ipv6-prefix</i>	All prefix list entries for the specified IPv6 network. This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
	<i>/ prefix-length</i>	The length of the IPv6 prefix. A decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash mark must precede the decimal value.
	<b>longer</b>	(Optional) Displays all entries of an IPv6 prefix list that are more specific than the given <i>ipv6-prefix / prefix-length</i> values.
	<b>first-match</b>	(Optional) Displays the entry of an IPv6 prefix list that matches the given <i>ipv6-prefix / prefix-length</i> values.
	<b>seq seq-num</b>	The sequence number of the IPv6 prefix list entry.

**Command Default** Displays information about all IPv6 prefix lists.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ipv6 prefix-list** command provides output similar to the **show ip prefix-list** command, except that it is IPv6-specific.

**Examples** The following example shows the output of the **show ipv6 prefix-list** command with the **detail** keyword:

```
Device# show ipv6 prefix-list detail
Prefix-list with the last deletion/insertion: bgp-in
ipv6 prefix-list 6to4:
```

```

count: 1, range entries: 0, sequences: 5 - 5, refcount: 2
seq 5 permit 2002::/16 (hit count: 313, refcount: 1)
ipv6 prefix-list aggregate:
count: 2, range entries: 2, sequences: 5 - 10, refcount: 30
seq 5 deny 3FFE:C00::/24 ge 25 (hit count: 568, refcount: 1)
seq 10 permit ::/0 le 48 (hit count: 31310, refcount: 1)
ipv6 prefix-list bgp-in:
count: 6, range entries: 3, sequences: 5 - 30, refcount: 31
seq 5 deny 5F00::/8 le 128 (hit count: 0, refcount: 1)
seq 10 deny ::/0 (hit count: 0, refcount: 1)
seq 15 deny ::/1 (hit count: 0, refcount: 1)
seq 20 deny ::/2 (hit count: 0, refcount: 1)
seq 25 deny ::/3 ge 4 (hit count: 0, refcount: 1)
seq 30 permit ::/0 le 128 (hit count: 240664, refcount: 0)

```

The table below describes the significant fields shown in the display.

**Table 74: show ipv6 prefix-list Field Descriptions**

Field	Description
Prefix list with the latest deletion/insertion:	Prefix list that was last modified.
count	Number of entries in the list.
range entries	Number of entries with matching range.
sequences	Sequence number for the prefix entry.
refcount	Number of objects currently using this prefix list.
seq	Entry number in the list.
permit, deny	Granting status.
hit count	Number of matches for the prefix entry.

The following example shows the output of the **show ipv6 prefix-list** command with the **summary** keyword:

```

Device# show ipv6 prefix-list summary
Prefix-list with the last deletion/insertion: bgp-in
ipv6 prefix-list 6to4:
count: 1, range entries: 0, sequences: 5 - 5, refcount: 2
ipv6 prefix-list aggregate:
count: 2, range entries: 2, sequences: 5 - 10, refcount: 30
ipv6 prefix-list bgp-in:
count: 6, range entries: 3, sequences: 5 - 30, refcount: 31

```

## Related Commands

Command	Description
<b>clear ipv6 prefix-list</b>	Resets the hit count of the prefix list entries.
<b>distribute-list in</b>	Filters networks received in updates.
<b>distribute-list out</b>	Suppresses networks from being advertised in updates.
<b>ipv6 prefix-list</b>	Creates an entry in an IPv6 prefix list.

<b>Command</b>	<b>Description</b>
<b>ipv6 prefix-list description</b>	Adds a text description of an IPv6 prefix list.
<b>match ipv6 address</b>	Distributes IPv6 routes that have a prefix permitted by a prefix list.
<b>neighbor prefix-list</b>	Distributes BGP neighbor information as specified in a prefix list.
<b>remark (prefix-list)</b>	Adds a comment for an entry in a prefix list.

# show ipv6 protocols

To display the parameters and the current state of the active IPv6 routing protocol processes, use the **show ipv6 protocols** command in user EXEC or privileged EXEC mode.

**show ipv6 protocols** [**summary**]

## Syntax Description

<b>summary</b>	(Optional) Displays the configured routing protocol process names.
----------------	--

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The information displayed by the **show ipv6 protocols** command is useful in debugging routing operations.

## Examples

The following sample output from the **show ipv6 protocols** command displays Intermediate System-to-Intermediate System (IS-IS) routing protocol information:

```
Device# show ipv6 protocols

IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "static"
IPv6 Routing Protocol is "isis"
  Interfaces:
    Ethernet0/0/3
    Ethernet0/0/1
    Serial1/0/1
    Loopback1 (Passive)
    Loopback2 (Passive)
    Loopback3 (Passive)
    Loopback4 (Passive)
    Loopback5 (Passive)
  Redistribution:
    Redistributing protocol static at level 1
  Inter-area redistribution
    Redistributing L1 into L2 using prefix-list word
  Address Summarization:
    L2: 33::/16 advertised with metric 0
    L2: 44::/16 advertised with metric 20
    L2: 66::/16 advertised with metric 10
    L2: 77::/16 advertised with metric 10
```

The table below describes the significant fields shown in the display.

**Table 75: show ipv6 protocols Field Descriptions for IS-IS Processes**

Field	Description
IPv6 Routing Protocol is	Specifies the IPv6 routing protocol used.
Interfaces	Specifies the interfaces on which the IPv6 IS-IS protocol is configured.
Redistribution	Lists the protocol that is being redistributed.
Inter-area redistribution	Lists the IS-IS levels that are being redistributed into other levels.
using prefix-list	Names the prefix list used in the interarea redistribution.
Address Summarization	Lists all the summary prefixes. If the summary prefix is being advertised, "advertised with metric x" will be displayed after the prefix.

The following sample output from the **show ipv6 protocols** command displays the Border Gateway Protocol (BGP) information for autonomous system 30:

```
Device# show ipv6 protocols

IPv6 Routing Protocol is "bgp 30"
  IGP synchronization is disabled
  Redistribution:
    Redistributing protocol connected
  Neighbor(s):
    Address          FiltIn FiltOut Weight  RoutemapIn RoutemapOut
    2001:DB8:0:ABCD::1      5      7      200
    2001:DB8:0:ABCD::2                      rmap-in   rmap-out
    2001:DB8:0:ABCD::3                      rmap-in   rmap-out
```

The table below describes the significant fields shown in the display.

**Table 76: show ipv6 protocols Field Descriptions for BGP Process**

Field	Description
IPv6 Routing Protocol is	Specifies the IPv6 routing protocol used.
Redistribution	Lists the protocol that is being redistributed.
Address	Neighbor IPv6 address.
FiltIn	AS-path filter list applied to input.
FiltOut	AS-path filter list applied to output.
Weight	Neighbor weight value used in BGP best path selection.
RoutemapIn	Neighbor route map applied to input.
RoutemapOut	Neighbor route map applied to output.

The following is sample output from the **show ipv6 protocols summary** command:

```
Device# show ipv6 protocols summary
```

```

Index Process Name
0      connected
1      static
2      rip myrip
3      bgp 30

```

The following sample output from the **show ipv6 protocols** command displays the EIGRP information including the vector metric and EIGRP IPv6 NSF:

```

Device# show ipv6 protocols

IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "bgp 1"
  IGP synchronization is disabled
  Redistribution:
    None
IPv6 Routing Protocol is "bgp multicast"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "eigrp 1"
EIGRP-IPv6 VR(name) Address-Family Protocol for AS(1)
  Metric weight K1=1, K2=0, K3=1, K4=0, K5=0 K6=0
  Metric rib-scale 128
  Metric version 64bit
  NSF-aware route hold timer is 260
  EIGRP NSF enabled
    NSF signal timer is 15s
    NSF converge timer is 65s
  Router-ID: 10.1.2.2
  Topology : 0 (base)
    Active Timer: 3 min
    Distance: internal 90 external 170
    Maximum path: 16
    Maximum hopcount 100
    Maximum metric variance 1
    Total Prefix Count: 0
    Total Redist Count: 0

Interfaces:
Redistribution:
  None

```

The following example displays IPv6 protocol information after configuring redistribution in an Open Shortest Path First (OSPF) domain:

```

Device# redistribute ospf 1 match internal
Device(config-rtr)# end
Device# show ipv6 protocols

IPv6 Routing Protocol is "connected"
IPv6 Routing Protocol is "ND"
IPv6 Routing Protocol is "rip 1"
  Interfaces:
    Ethernet0/1
    Loopback9
  Redistribution:
    Redistributing protocol ospf 1 (internal)
IPv6 Routing Protocol is "ospf 1"
  Interfaces (Area 0):
    Ethernet0/0
  Redistribution:
    None

```

# show ipv6 rip

To display information about current IPv6 Routing Information Protocol (RIP) processes, use the **show ipv6 rip** command in user EXEC or privileged EXEC mode.

```
show ipv6 rip [name] [vrf vrf-name][database | next-hops]
```

```
show ipv6 rip [name] [database | next-hops]
```

Syntax Description	
<i>name</i>	(Optional) Name of the RIP process. If the name is not entered, details of all configured RIP processes are displayed.
<b>vrf</b> <i>vrf-name</i>	(Optional) Displays information about the specified Virtual Routing and Forwarding (VRF) instance.
<b>database</b>	(Optional) Displays information about entries in the specified RIP IPv6 routing table.
<b>next-hops</b>	(Optional) Displays information about the next hop addresses for the specified RIP IPv6 process. If no RIP process name is specified, the next-hop addresses for all RIP IPv6 processes are displayed.

**Command Default** Information about all current IPv6 RIP processes is displayed.

**Command Modes** User EXEC (>)

Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following is sample output from the **show ipv6 rip** command:

```
Device# show ipv6 rip

RIP process "one", port 521, multicast-group FF02::9, pid 55
  Administrative distance is 25. Maximum paths is 4
  Updates every 30 seconds, expire after 180
  Holddown lasts 0 seconds, garbage collect after 120
  Split horizon is on; poison reverse is off
  Default routes are not generated
  Periodic updates 8883, trigger updates 2
  Interfaces:
    Ethernet2
  Redistribution:
RIP process "two", port 521, multicast-group FF02::9, pid 61
  Administrative distance is 120. Maximum paths is 4
  Updates every 30 seconds, expire after 180
  Holddown lasts 0 seconds, garbage collect after 120
  Split horizon is on; poison reverse is off
  Default routes are not generated
```

```

    Periodic updates 8883, trigger updates 0
  Interfaces:
    None
  Redistribution:

```

The table below describes the significant fields shown in the display.

**Table 77: show ipv6 rip Field Descriptions**

Field	Description
RIP process	The name of the RIP process.
port	The port that the RIP process is using.
multicast-group	The IPv6 multicast group of which the RIP process is a member.
pid	The process identification number (pid) assigned to the RIP process.
Administrative distance	Used to rank the preference of sources of routing information. Connected routes have an administrative distance of 1 and are preferred over the same route learned by a protocol with a larger administrative distance value.
Updates	The value (in seconds) of the update timer.
expire	The interval (in seconds) in which updates expire.
Holddown	The value (in seconds) of the hold-down timer.
garbage collect	The value (in seconds) of the garbage-collect timer.
Split horizon	The split horizon state is either on or off.
poison reverse	The poison reverse state is either on or off.
Default routes	The origination of a default route into RIP. Default routes are either generated or not generated.
Periodic updates	The number of RIP update packets sent on an update timer.
trigger updates	The number of RIP update packets sent as triggered updates.

The following is sample output from the **show ipv6 rip database** command.

```

Device# show ipv6 rip one database

RIP process "one", local RIB
 2001:72D:1000::/64, metric 2
   Ethernet2/2001:DB8:0:ABCD::1, expires in 168 secs
 2001:72D:2000::/64, metric 2, installed
   Ethernet2/2001:DB8:0:ABCD::1, expires in 168 secs
 2001:72D:3000::/64, metric 2, installed
   Ethernet2/2001:DB8:0:ABCD::1, expires in 168 secs
   Ethernet1/2001:DB8::1, expires in 120 secs
 2001:72D:4000::/64, metric 16, expired, [advertise 119/hold 0]
   Ethernet2/2001:DB8:0:ABCD::1
 3004::/64, metric 2 tag 2A, installed
   Ethernet2/2001:DB8:0:ABCD::1, expires in 168 secs

```



The table below describes the significant fields shown in the display.

**Table 78: show ipv6 rip database Field Descriptions**

Field	Description
RIP process	The name of the RIP process.
2001:72D:1000::/64	The IPv6 route prefix.
metric	Metric for the route.
installed	Route is installed in the IPv6 routing table.
Ethernet2/2001:DB8:0:ABCD::1	Interface and LL next hop through which the IPv6 route was learned.
expires in	The interval (in seconds) before the route expires.
advertise	For an expired route, the value (in seconds) during which the route will be advertised as expired.
hold	The value (in seconds) of the hold-down timer.
tag	Route tag.

The following is sample output from the **show ipv6 rip next-hops** command.

```
Device# show ipv6 rip one next-hops

RIP process "one", Next Hops
  FE80::210:7BFF:FEC2:ACCF/Ethernet4/2 [1 routes]
  FE80::210:7BFF:FEC2:B286/Ethernet4/2 [2 routes]
```

The table below describes the significant fields shown in the display.

**Table 79: show ipv6 rip next-hops Field Descriptions**

Field	Description
RIP process	The name of the RIP process.
2001:DB8:0:1::1/Ethernet4/2	The next-hop address and interface through which it was learned. Next hops are either the addresses of IPv6 RIP neighbors from which we have learned routes or explicit next hops received in IPv6 RIP advertisements.  <b>Note</b> An IPv6 RIP neighbor may choose to advertise all its routes with an explicit next hop. In this case the address of the neighbor would not appear in the next hop display.
[1 routes]	The number of routes in the IPv6 RIP routing table using the specified next hop.

The following is sample output from the **show ipv6 rip vrf** command:

```
Device# show ipv6 rip vrf red
```

```

RIP VRF "red", port 521, multicast-group 2001:DB8::/32, pid 295
Administrative distance is 120. Maximum paths is 16
Updates every 30 seconds, expire after 180
Holddown lasts 0 seconds, garbage collect after 120
Split horizon is on; poison reverse is off
Default routes are not generated
Periodic updates 99, trigger updates 3
Full Advertisement 0, Delayed Events 0
Interfaces:
  Ethernet0/1
  Loopback2
Redistribution:
  None

```

The table below describes the significant fields shown in the display.

**Table 80: show ipv6 rip vrf Field Descriptions**

Field	Description
RIP VRF	The name of the RIP VRF.
port	The port that the RIP process is using.
multicast-group	The IPv6 multicast group of which the RIP process is a member.
Administrative distance	Used to rank the preference of sources of routing information. Connected routes have an administrative distance of 1 and are preferred over the same route learned by a protocol with a larger administrative distance value.
Updates	The value (in seconds) of the update timer.
expires after	The interval (in seconds) in which updates expire.
Holddown	The value (in seconds) of the hold-down timer.
garbage collect	The value (in seconds) of the garbage-collect timer.
Split horizon	The split horizon state is either on or off.
poison reverse	The poison reverse state is either on or off.
Default routes	The origination of a default route into RIP. Default routes are either generated or not generated.
Periodic updates	The number of RIP update packets sent on an update timer.
trigger updates	The number of RIP update packets sent as triggered updates.

The following is sample output from **show ipv6 rip vrf next-hops** command:

```
Device# show ipv6 rip vrf blue next-hops
```

```

RIP VRF "blue", local RIB
  AAAA::/64, metric 2, installed
  Ethernet0/0/FE80::A8BB:CCFF:FE00:7C00, expires in 177 secs

```

**Table 81: show ipv6 rip vrf next-hops Field Descriptions**

Field	Description
RIP VRF	The name of the RIP VRF.
metric	Metric for the route.
installed	Route is installed in the IPv6 routing table.
Ethernet0/0/FE80::A8BB:CCFF:FE00:7C00	The next hop address and interface through which it was learned. Next hops are either the addresses of IPv6 RIP neighbors from which we have learned routes, or explicit next hops received in IPv6 RIP advertisements.  <b>Note</b> An IPv6 RIP neighbor may choose to advertise all its routes with an explicit next hop. In this case the address of the neighbor would not appear in the next hop display.
expires in	The interval (in seconds) before the route expires.

The following is sample output from **show ipv6 rip vrf database** command:

```
Device# show ipv6 rip vrf blue database
      RIP VRF "blue", Next Hops
      FE80::A8BB:CCFF:FE00:7C00/Ethernet0/0 [1 paths]
```

**Table 82: show ipv6 rip vrf database Field Descriptions**

Field	Description
RIP VRF	The name of the RIP VRF.
FE80::A8BB:CCFF:FE00:7C00/Ethernet0/0	Interface and LL next hop through which the IPv6 route was learned.
1 paths	Indicates the number of unique paths to this router that exist in the routing table.

**Related Commands**

Command	Description
<b>clear ipv6 rip</b>	Deletes routes from the IPv6 RIP routing table.
<b>debug ipv6 rip</b>	Displays the current contents of the IPv6 RIP routing table.
<b>ipv6 rip vrf-mode enable</b>	Enables VRF-aware support for IPv6 RIP.

## show ipv6 route

To display contents of the IPv6 routing table, use the **show ipv6 route** command in user EXEC or privileged EXEC mode.

**show ipv6 route** [*ipv6-address* | *ipv6-prefix/prefix-length* [**longer-prefixes**] | [*protocol*] | [**repair**] | [**updated** [**boot-up**] [*day month*] [*time*]] | **interface** *type number* | **nd** | **nsf** | **table** *table-id* | **watch**]

### Syntax Description

<i>ipv6-address</i>	(Optional) Displays routing information for a specific IPv6 address.
<i>ipv6-prefix</i>	(Optional) Displays routing information for a specific IPv6 network.
<i>lprefix-length</i>	(Optional) The length of the IPv6 prefix. A decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash mark must precede the decimal value.
<b>longer-prefixes</b>	(Optional) Displays output for longer prefix entries.
<i>protocol</i>	(Optional) The name of a routing protocol or the keyword <b>connected</b> , <b>local</b> , <b>mobile</b> , or <b>static</b> . If you specify a routing protocol, use one of the following keywords: <b>bgp</b> , <b>isis</b> , <b>eigrp</b> , <b>ospf</b> , or <b>rip</b> .
<b>repair</b>	(Optional) Displays routes with repair paths.
<b>updated</b>	(Optional) Displays routes with time stamps.
<b>boot-up</b>	(Optional) Displays routing information since bootup.
<i>day month</i>	(Optional) Displays routes since the specified day and month.
<i>time</i>	(Optional) Displays routes since the specified time, in <i>hh:mm</i> format.
<b>interface</b>	(Optional) Displays information about the interface.
<i>type</i>	(Optional) Interface type.
<i>number</i>	(Optional) Interface number.
<b>nd</b>	(Optional) Displays only routes from the IPv6 Routing Information Base (RIB) that are owned by Neighbor Discovery (ND).
<b>nsf</b>	(Optional) Displays routes in the nonstop forwarding (NSF) state.
<b>repair</b>	(Optional)
<b>table</b> <i>table-id</i>	(Optional) Displays IPv6 RIB table information for the specified table ID. The table ID must be in hexadecimal format. The range is from 0 to 0-0xFFFFFFFF.
<b>watch</b>	(Optional) Displays information about route watchers.

### Command Default

If none of the optional syntax elements is chosen, all IPv6 routing information for all active routing tables is displayed.

**Command Modes**

User EXEC (&gt;)

Privileged EXEC (#)

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

The **show ipv6 route** command provides output similar to the **show ip route** command, except that the information is IPv6-specific.

When the *ipv6-address* or *ipv6-prefix/prefix-length* argument is specified, the longest match lookup is performed from the routing table, and only route information for that address or network is displayed. When a routing protocol is specified, only routes for that protocol are displayed. When the **connected**, **local**, **mobile**, or **static** keyword is specified, only the specified type of route is displayed. When the **interface** keyword and *type* and *number* arguments are specified, only routes for the specified interface are displayed.

**Examples**

The following is sample output from the **show ipv6 route** command when no keywords or arguments are specified:

```
Device# show ipv6 route

IPv6 Routing Table - 9 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       I1 - ISIS L1, I2 - ISIS L2, IA - IIS interarea
B   2001:DB8:4::2/48 [20/0]
    via FE80::A8BB:CCFF:FE02:8B00, Serial6/0
L   2001:DB8:4::3/48 [0/0]
    via ::, Ethernet1/0
C   2001:DB8:4::4/48 [0/0]
    via ::, Ethernet1/0
LC  2001:DB8:4::5/48 [0/0]
    via ::, Loopback0
L   2001:DB8:4::6/48 [0/0]
    via ::, Serial6/0
C   2001:DB8:4::7/48 [0/0]
    via ::, Serial6/0
S   2001:DB8:4::8/48 [1/0]
    via 2001:DB8:1::1, Null
L   FE80::/10 [0/0]
    via ::, Null0
L   FF00::/8 [0/0]
    via ::, Null0
```

The table below describes the significant fields shown in the display.

Table 83: show ipv6 route Field Descriptions

Field	Description
Codes:	Indicates the protocol that derived the route. Values are as follows: <ul style="list-style-type: none"> <li>• B—BGP derived</li> <li>• C—Connected</li> <li>• I1—ISIS L1—Integrated IS-IS Level 1 derived</li> <li>• I2—ISIS L2—Integrated IS-IS Level 2 derived</li> <li>• IA—ISIS interarea—Integrated IS-IS interarea derived</li> <li>• L—Local</li> <li>• R—RIP derived</li> <li>• S—Static</li> </ul>
2001:DB8:4::2/48	Indicates the IPv6 prefix of the remote network.
[20/0]	The first number in brackets is the administrative distance of the information source; the second number is the metric for the route.
via FE80::A8BB:CCFF:FE02:8B00	Specifies the address of the next device to the remote network.

When the *ipv6-address* or *ipv6-prefix/prefix-length* argument is specified, only route information for that address or network is displayed. The following is sample output from the **show ipv6 route** command when IPv6 prefix 2001:DB8::/35 is specified. The fields in the display are self-explanatory.

```
Device# show ipv6 route 2001:DB8::/35

IPv6 Routing Table - 261 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea
B 2001:DB8::/35 [20/3]
  via FE80::60:5C59:9E00:16, Tunnel1
```

When you specify a protocol, only routes for that particular routing protocol are shown. The following is sample output from the **show ipv6 route bgp** command. The fields in the display are self-explanatory.

```
Device# show ipv6 route bgp

IPv6 Routing Table - 9 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
      I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea
B   2001:DB8:4::4/64 [20/0]
    via FE80::A8BB:CCFF:FE02:8B00, Serial16/0
```

The following is sample output from the **show ipv6 route local** command. The fields in the display are self-explanatory.

```
Device# show ipv6 route local
```

```
IPv6 Routing Table - 9 entries
Codes: C - Connected, L - Local, S - Static, R - RIP, B - BGP
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea
L   2001:DB8:4::2/128 [0/0]
    via ::, Ethernet1/0
LC  2001:DB8:4::1/128 [0/0]
    via ::, Loopback0
L   2001:DB8:4::3/128 [0/0]
    via ::, Serial6/0
L   FE80::/10 [0/0]
    via ::, Null0
L   FF00::/8 [0/0]
    via ::, Null0
```

The following is sample output from the **show ipv6 route** command when the 6PE multipath feature is enabled. The fields in the display are self-explanatory.

```
Device# show ipv6 route
```

```
IPv6 Routing Table - default - 19 entries
Codes:C - Connected, L - Local, S - Static, R - RIP, B - BGP
       U - Per-user Static route
       I1 - ISIS L1, I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary
       O - OSPF intra, OI - OSPF inter, OE1 - OSPF ext 1, OE2 - OSPF ext 2
.
.
.
B   2001:DB8::/64 [200/0]
    via ::FFFF:172.16.0.1
    via ::FFFF:172.30.30.1
```

#### Related Commands

Command	Description
<b>ipv6 route</b>	Establishes a static IPv6 route.
<b>show ipv6 interface</b>	Displays IPv6 interface information.
<b>show ipv6 route summary</b>	Displays the current contents of the IPv6 routing table in summary format.
<b>show ipv6 tunnel</b>	Displays IPv6 tunnel information.

# show ipv6 routers

To display IPv6 router advertisement (RA) information received from on-link devices, use the **show ipv6 routers** command in user EXEC or privileged EXEC mode.

**show ipv6 routers** [*interface-type interface-number*][**conflicts**][**vrf vrf-name**][**detail**]

## Syntax Description

<i>interface -type</i>	(Optional) Specifies the Interface type.
<i>interface -number</i>	(Optional) Specifies the Interface number.
<b>conflicts</b>	(Optional) Displays RAs that differ from the RAs configured for a specified interface.
<b>vrf vrf-name</b>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
<b>detail</b>	(Optional) Provides detail about the eligibility of the neighbor for election as the default device.

## Command Default

When an interface is not specified, on-link RA information is displayed for all interface types. (The term *on-link* refers to a locally reachable address on the link.)

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Devices that advertise parameters that differ from the RA parameters configured for the interface on which the RAs are received are marked as conflicting.

## Examples

The following is sample output from the **show ipv6 routers** command when entered without an IPv6 interface type and number:

```
Device# show ipv6 routers

Device FE80::83B3:60A4 on Tunnel15, last update 3 min
  Hops 0, Lifetime 6000 sec, AddrFlag=0, OtherFlag=0
  Reachable time 0 msec, Retransmit time 0 msec
  Prefix 3FFE:C00:8007::800:207C:4E37/96 autoconfig
  Valid lifetime -1, preferred lifetime -1
Device FE80::290:27FF:FE8C:B709 on Tunnel157, last update 0 min
  Hops 64, Lifetime 1800 sec, AddrFlag=0, OtherFlag=0
  Reachable time 0 msec, Retransmit time 0 msec
```

The following sample output shows a single neighboring device that is advertising a high default device preference and is indicating that it is functioning as a Mobile IPv6 home agent on this link.

```
Device# show ipv6 routers
```



```

IPV6 ND Routers (table: default)
  Device FE80::100 on Ethernet0/0, last update 0 min
  Hops 64, Lifetime 50 sec, AddrFlag=0, OtherFlag=0, MTU=1500
  HomeAgentFlag=1, Preference=High
  Reachable time 0 msec, Retransmit time 0 msec
  Prefix 2001::100/64 onlink autoconfig
  Valid lifetime 2592000, preferred lifetime 604800

```

The following table describes the significant fields shown in the displays.

**Table 84: show ipv6 routers Field Descriptions**

Field	Description
Hops	The configured hop limit value for the RA.
Lifetime	The configured lifetime value for the RA. A value of 0 indicates that the device is not a default device. A value other than 0 indicates that the device is a default device.
AddrFlag	If the value is 0, the RA received from the device indicates that addresses are not configured using the stateful autoconfiguration mechanism. If the value is 1, the addresses are configured using this mechanism.
OtherFlag	If the value is 0, the RA received from the device indicates that information other than addresses is not obtained using the stateful autoconfiguration mechanism. If the value is 1, other information is obtained using this mechanism. (The value of OtherFlag can be 1 only if the value of AddrFlag is 1.)
MTU	The maximum transmission unit (MTU).
HomeAgentFlag=1	The value can be either 0 or 1. A value of 1 indicates that the device from which the RA was received is functioning as a mobile IPv6 home agent on this link, and a value of 0 indicates it is not functioning as a mobile IPv6 home agent on this link.
Preference=High	The DRP value, which can be high, medium, or low.
Retransmit time	The configured RetransTimer value. The time value to be used on this link for neighbor solicitation transmissions, which are used in address resolution and neighbor unreachability detection. A value of 0 means the time value is not specified by the advertising device.
Prefix	A prefix advertised by the device. Also indicates if on-link or autoconfig bits were set in the RA message.
Valid lifetime	The length of time (in seconds) relative to the time the advertisement is sent that the prefix is valid for the purpose of on-link determination. A value of -1 (all ones, 0xffffffff) represents infinity.
preferred lifetime	The length of time (in seconds) relative to the time the advertisements is sent that addresses generated from the prefix via address autoconfiguration remain valid. A value of -1 (all ones, 0xffffffff) represents infinity.

When the *interface-type* and *interface-number* arguments are specified, RA details about that specific interface are displayed. The following is sample output from the **show ipv6 routers** command when entered with an interface type and number:

```
Device# show ipv6 routers tunnel 5
```

```
Device FE80::83B3:60A4 on Tunnel15, last update 5 min
  Hops 0, Lifetime 6000 sec, AddrFlag=0, OtherFlag=0
  Reachable time 0 msec, Retransmit time 0 msec
  Prefix 3FFE:C00:8007::800:207C:4E37/96 autoconfig
  Valid lifetime -1, preferred lifetime -1
```

Entering the **conflicts** keyword with the **show ipv6 routers** command displays information for devices that are advertising parameters different from the parameters configured for the interface on which the advertisements are being received, as the following sample output shows:

```
Device# show ipv6 routers conflicts
```

```
Device FE80::203:FDFE:FE34:7039 on Ethernet1, last update 1 min, CONFLICT
  Hops 64, Lifetime 1800 sec, AddrFlag=0, OtherFlag=0
  Reachable time 0 msec, Retransmit time 0 msec
  Prefix 2003::/64 onlink autoconfig
  Valid lifetime -1, preferred lifetime -1
Device FE80::201:42FF:FECA:A5C on Ethernet1, last update 0 min, CONFLICT
  Hops 64, Lifetime 1800 sec, AddrFlag=0, OtherFlag=0
  Reachable time 0 msec, Retransmit time 0 msec
  Prefix 2001::/64 onlink autoconfig
  Valid lifetime -1, preferred lifetime -1
```

Use of the **detail** keyword provides information about the preference rank of the device, its eligibility for election as default device, and whether the device has been elected:

```
Device# show ipv6 routers detail
```

```
Device FE80::A8BB:CCFF:FE00:5B00 on Ethernet0/0, last update 0 min
  Rank 0x811 (elegant), Default Router
  Hops 64, Lifetime 1800 sec, AddrFlag=0, OtherFlag=0, MTU=1500
  HomeAgentFlag=0, Preference=Medium, trustlevel = 0
  Reachable time 0 (unspecified), Retransmit time 0 (unspecified)
  Prefix 2001::/64 onlink autoconfig
  Valid lifetime 2592000, preferred lifetime 604800
```

# show ipv6 rpf

To check Reverse Path Forwarding (RPF) information for a given unicast host address and prefix, use the **show ipv6 rpf** command in user EXEC or privileged EXEC mode.

**show ipv6 rpf** *source-vrf* [*access-list*] | **vrf** *receiver-vrf* *source-vrf* [*access-list*] | **select**

Syntax Description	
<i>source-vrf</i>	Name or address of the virtual routing and forwarding (VRF) on which lookups are to be performed.
<i>receiver-vrf</i>	Name or address of the VRF in which the lookups originate.
<i>access-list</i>	Name or address of access control list (ACL) to be applied to the group-based VRF selection policy.
<b>vrf</b>	Displays information about the VRF instance.
<b>select</b>	Displays group-to-VRF mapping information.

Command Modes	
	User EXEC (>)
	Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ipv6 rpf** command displays information about how IPv6 multicast routing performs Reverse Path Forwarding (RPF). Because the router can find RPF information from multiple routing tables (for example, unicast Routing Information Base [RIB], multiprotocol Border Gateway Protocol [BGP] routing table, or static mroutes), the **show ipv6 rpf** command to display the source from which the information is retrieved.

**Examples** The following example displays RPF information for the unicast host with the IPv6 address of 2001::1:1:2:

```
Device# show ipv6 rpf 2001::1:1:2
RPF information for 2001::1:1:2
  RPF interface:Ethernet3/2
  RPF neighbor:FE80::40:1:3
  RPF route/mask:20::/64
  RPF type:Unicast
  RPF recursion count:0
  Metric preference:110
  Metric:30
```

The table below describes the significant fields shown in the display.

**Table 85: show ipv6 rpf Field Descriptions**

<b>Field</b>	<b>Description</b>
RPF information for 2001::1:1:2	Source address that this information concerns.
RPF interface:Ethernet3/2	For the given source, the interface from which the router expects to get packets.
RPF neighbor:FE80::40:1:3	For the given source, the neighbor from which the router expects to get packets.
RPF route/mask:20::/64	Route number and mask that matched against this source.
RPF type:Unicast	Routing table from which this route was obtained, either unicast, multiprotocol BGP, or static mroutes.
RPF recursion count	Indicates the number of times the route is recursively resolved.
Metric preference:110	The preference value used for selecting the unicast routing metric to the Route Processor (RP) announced by the designated forwarder (DF).
Metric:30	Unicast routing metric to the RP announced by the DF.

# show ipv6 source-guard policy

To display the IPv6 source-guard policy configuration, use the **show ipv6 source-guard policy** command in user EXEC or privileged EXEC mode.

```
show ipv6 source-guard policy[source-guard-policy]
```

Syntax Description	<i>source-guard-policy</i>	User-defined name of the snooping policy. The policy name can be a symbolic string (such as Engineering) or an integer (such as 0).
--------------------	----------------------------	---

Command Modes	User EXEC (>) Privileged EXEC (#)
---------------	--------------------------------------

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ipv6 source-guard policy** command displays the IPv6 source-guard policy configuration, as well as all the interfaces on which the policy is applied. The command also displays IPv6 prefix guard information if the IPv6 prefix guard feature is enabled on the device.

## Examples

```
Device# show ipv6 source-guard policy policy1
```

```
Policy policy1 configuration:
data-glean
prefix-guard
address-guard
```

```
Policy policy1 is applied on the following targets:
```

Target	Type	Policy	Feature	Target range
Et0/0	PORT	policy1	source-guard	vlan all
vlan 100	VLAN	policy1	source-guard	vlan all

Related Commands	Command	Description
	<b>ipv6 source-guard attach-policy</b>	Applies IPv6 source guard on an interface.
	<b>ipv6 source-guard policy</b>	Defines an IPv6 source-guard policy name and enters source-guard policy configuration mode.

# show ipv6 spd

To display the IPv6 Selective Packet Discard (SPD) configuration, use the **show ipv6 spd** command in privileged EXEC mode.

**show ipv6 spd**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **show ipv6 spd** command to display the SPD configuration, which may provide useful troubleshooting information.

## Examples

The following is sample output from the **show ipv6 spd** command:

```
Device# show ipv6 spd
Current mode: normal
Queue max threshold: 74, Headroom: 100, Extended Headroom: 10
IPv6 packet queue: 0
```

The table below describes the significant fields shown in the display.

**Table 86: show ipv6 spd Field Description**

Field	Description
Current mode: normal	The current SPD state or mode.
Queue max threshold: 74	The process input queue maximum.

## Related Commands

Command	Description
<b>ipv6 spd queue max-threshold</b>	Configures the maximum number of packets in the SPD process input queue.

# show ipv6 static

To display the current contents of the IPv6 routing table, use the **show ipv6 static** command in user EXEC or privileged EXEC mode.

**show ipv6 static** [*ipv6-address* | *ipv6-prefix/prefix-length*] [**interface** *type number* | **recursive**] [**detail**]

Syntax Description	
<i>ipv6-address</i>	(Optional) Provides routing information for a specific IPv6 address. This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
<i>ipv6-prefix</i>	(Optional) Provides routing information for a specific IPv6 network. This argument must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons.
<i>lprefix-length</i>	(Optional) The length of the IPv6 prefix. A decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). A slash mark must precede the decimal value.
<b>interface</b>	(Optional) Name of an interface.
<i>type</i>	(Optional, but required if the <b>interface</b> keyword is used) Interface type. For a list of supported interface types, use the question mark (?) online help function.
<i>number</i>	(Optional, but required if the <b>interface</b> keyword is used) Interface number. For specific numbering syntax for supported interface types, use the question mark (?) online help function.
<b>recursive</b>	(Optional) Allows the display of recursive static routes only.
<b>detail</b>	(Optional) Specifies the following additional information: <ul style="list-style-type: none"> <li>• For valid recursive routes, the output path set and maximum resolution depth.</li> <li>• For invalid recursive routes, the reason why the route is not valid.</li> <li>• For invalid direct or fully specified routes, the reason why the route is not valid.</li> </ul>

**Command Default** All IPv6 routing information for all active routing tables is displayed.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ipv6 static** command provides output similar to the **show ip route** command, except that it is IPv6-specific.

When the *ipv6-address* or *ipv6-prefix/prefix-length* argument is specified, a longest match lookup is performed from the routing table and only route information for that address or network is displayed. Only the information matching the criteria specified in the command syntax is displayed. For example, when the *type number* arguments are specified, only the specified interface-specific routes are displayed.

## Examples

### show ipv6 static Command with No Options Specified in the Command Syntax: Example

When no options specified in the command, those routes installed in the IPv6 Routing Information Base (RIB) are marked with an asterisk, as shown in the following example:

```
Device# show ipv6 static

IPv6 Static routes
Code: * - installed in RIB
* 3000::/16, interface Ethernet1/0, distance 1
* 4000::/16, via nexthop 2001:1::1, distance 1
  5000::/16, interface Ethernet3/0, distance 1
* 5555::/16, via nexthop 4000::1, distance 1
  5555::/16, via nexthop 9999::1, distance 1
* 5555::/16, interface Ethernet2/0, distance 1
* 6000::/16, via nexthop 2007::1, interface Ethernet1/0, distance 1
```

The table below describes the significant fields shown in the display.

**Table 87: show ipv6 static Field Descriptions**

Field	Description
via nexthop	Specifies the address of the next Device in the path to the remote network.
distance 1	Indicates the administrative distance to the specified route.

### show ipv6 static Command with the IPv6 Address and Prefix: Example

When the *ipv6-address* or *ipv6-prefix/prefix-length* argument is specified, only information about static routes for that address or network is displayed. The following is sample output from the **show ipv6 route** command when entered with the IPv6 prefix 2001:200::/35:

```
Device# show ipv6 static 2001:200::/35

IPv6 Static routes
Code: * - installed in RIB
* 2001:200::/35, via nexthop 4000::1, distance 1
  2001:200::/35, via nexthop 9999::1, distance 1
* 2001:200::/35, interface Ethernet2/0, distance 1
```

### show ipv6 static interface Command: Example

When an interface is supplied, only those static routes with the specified interface as the outgoing interface are displayed. The **interface** keyword may be used with or without the IPv6 address and prefix specified in the command statement.



```
Device# show ipv6 static interface ethernet 3/0
```

IPv6 Static routes Code: \* - installed in RIB 5000::/16, interface Ethernet3/0, distance 1

### show ipv6 static recursive Command: Example

When the **recursive** keyword is specified, only recursive static routes are displayed:

```
Device# show ipv6 static recursive
```

IPv6 Static routes Code: \* - installed in RIB \* 4000::/16, via nexthop 2001:1::1, distance 1 \* 5555::/16, via nexthop 4000::1, distance 1 5555::/16, via nexthop 9999::1, distance 1

### show ipv6 static detail Command: Example

When the **detail** keyword is specified, the following additional information is displayed:

- For valid recursive routes, the output path set and maximum resolution depth.
- For invalid recursive routes, the reason why the route is not valid.
- For invalid direct or fully specified routes, the reason why the route is not valid.

```
Device# show ipv6 static detail
```

```
IPv6 Static routes
Code: * - installed in RIB
* 3000::/16, interface Ethernet1/0, distance 1
* 4000::/16, via nexthop 2001:1::1, distance 1
  Resolves to 1 paths (max depth 1)
  via Ethernet1/0
5000::/16, interface Ethernet3/0, distance 1
  Interface is down
* 5555::/16, via nexthop 4000::1, distance 1
  Resolves to 1 paths (max depth 2)
  via Ethernet1/0
5555::/16, via nexthop 9999::1, distance 1
  Route does not fully resolve
* 5555::/16, interface Ethernet2/0, distance 1
* 6000::/16, via nexthop 2007::1, interface Ethernet1/0, distance 1
```

#### Related Commands

Command	Description
<b>ipv6 route</b>	Establishes a static IPv6 route.
<b>show ip route</b>	Displays the current state of the routing table.
<b>show ipv6 interface</b>	Displays IPv6 interface information.
<b>show ipv6 route summary</b>	Displays the current contents of the IPv6 routing table in summary format.
<b>show ipv6 tunnel</b>	Displays IPv6 tunnel information.

# show ipv6 traffic

To display statistics about IPv6 traffic, use the **show ipv6 traffic** command in user EXEC or privileged EXEC mode.

**show ipv6 traffic** [**interface**[*interface type number*]]

## Syntax Description

<b>interface</b>	(Optional) All interfaces. IPv6 forwarding statistics for all interfaces on which IPv6 forwarding statistics are being kept will be displayed.
<i>interface type number</i>	(Optional) Specified interface. Interface statistics that have occurred since the statistics were last cleared on the specific interface are displayed.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **show ipv6 traffic** command provides output similar to the **show ip traffic** command, except that it is IPv6-specific.

## Examples

The following is sample output from the **show ipv6 traffic** command:

```
Device# show ipv6 traffic
IPv6 statistics:
  Rcvd: 0 total, 0 local destination
        0 source-routed, 0 truncated
        0 format errors, 0 hop count exceeded
        0 bad header, 0 unknown option, 0 bad source
        0 unknown protocol, 0 not a device
        0 fragments, 0 total reassembled
        0 reassembly timeouts, 0 reassembly failures
        0 unicast RPF drop, 0 suppressed RPF drop
  Sent: 0 generated, 0 forwarded
        0 fragmented into 0 fragments, 0 failed
        0 encapsulation failed, 0 no route, 0 too big
  Mcast: 0 received, 0 sent
ICMP statistics:
  Rcvd: 0 input, 0 checksum errors, 0 too short
        0 unknown info type, 0 unknown error type
  unreachable: 0 routing, 0 admin, 0 neighbor, 0 address, 0 port
  parameter: 0 error, 0 header, 0 option
        0 hopcount expired, 0 reassembly timeout, 0 too big
        0 echo request, 0 echo reply
        0 group query, 0 group report, 0 group reduce
        0 device solicit, 0 device advert, 0 redirects
```

The following is sample output for the **show ipv6 interface** command without IPv6 CEF running:

```

Device# show ipv6 interface ethernet 0/1/1
Ethernet0/1/1 is up, line protocol is up
IPv6 is enabled, link-local address is FE80::203:FDFE:FE49:9
Description: sat-2900a f0/12
Global unicast address(es):
 7::7, subnet is 7::/32
Joined group address(es):
 FF02::1
 FF02::2
 FF02::1:FF00:7
 FF02::1:FF49:9
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
Input features: RPF
Unicast RPF access-list MINI
  Process Switching:
    0 verification drops
    0 suppressed verification drops
ND DAD is enabled, number of DAD attempts: 1
ND reachable time is 30000 milliseconds

```

The following is sample output for the **show ipv6 interface** command with IPv6 CEF running:

```

Device# show ipv6 interface ethernet 0/1/1
Ethernet0/1/1 is up, line protocol is up
IPv6 is enabled, link-local address is FE80::203:FDFE:FE49:9
Description: sat-2900a f0/12
Global unicast address(es):
 7::7, subnet is 7::/32
Joined group address(es):
 FF02::1
 FF02::2
 FF02::1:FF00:7
 FF02::1:FF49:9
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
Input features: RPF
Unicast RPF access-list MINI
  Process Switching:
    0 verification drops
    0 suppressed verification drops
  CEF Switching:
    0 verification drops
    0 suppressed verification drops
ND DAD is enabled, number of DAD attempts: 1
ND reachable time is 30000 milliseconds
ND advertised reachable time is 0 milliseconds
ND advertised retransmit interval is 0 milliseconds
ND router advertisements are sent every 200 seconds
ND router advertisements live for 1800 seconds
Hosts use stateless autoconfig for addresses.

```

The table below describes the significant fields shown in the display.

**Table 88: show ipv6 traffic Field Descriptions**

Field	Description
source-routed	Number of source-routed packets.

Field	Description
truncated	Number of truncated packets.
format errors	Errors that can result from checks performed on header fields, the version number, and packet length.
not a device	Message sent when IPv6 unicast routing is not enabled.
0 unicast RPF drop, 0 suppressed RPF drop	Number of unicast and suppressed reverse path forwarding (RPF) drops.
failed	Number of failed fragment transmissions.
encapsulation failed	Failure that can result from an unresolved address or try-and-queue packet.
no route	Counted when the software discards a datagram it did not know how to route.
unreach	Unreachable messages received are as follows: <ul style="list-style-type: none"> <li>• routing--Indicates no route to the destination.</li> <li>• admin--Indicates that communication with the destination is administratively prohibited.</li> <li>• neighbor--Indicates that the destination is beyond the scope of the source address. For example, the source may be a local site or the destination may not have a route back to the source.</li> <li>• address--Indicates that the address is unreachable.</li> <li>• port--Indicates that the port is unreachable.</li> </ul>
Unicast RPF access-list MINI	Unicast RPF access-list in use.
Process Switching	Displays process RPF counts, such as verification and suppressed verification drops.
CEF Switching	Displays CEF switching counts, such as verification drops and suppressed verification drops.

# show ipv6 pim tunnel

To display information about the Protocol Independent Multicast (PIM) register encapsulation and de-encapsulation tunnels on an interface, use the **show ipv6 pim tunnel** command in privileged EXEC mode.

**show ipv6 pim** [*vrf vrf-name*] **tunnel** [*interface-type interface-number*]

Syntax Description	Field	Description
	<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies a virtual routing and forwarding (VRF) configuration.
	<i>interface-type interface-number</i>	(Optional) Tunnel interface type and number.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** If you use the **show ipv6 pim tunnel** command without the optional *interface* keyword, information about the PIM register encapsulation and de-encapsulation tunnel interfaces is displayed.

The PIM encapsulation tunnel is the register tunnel. An encapsulation tunnel is created for every known rendezvous point (RP) on each router. The PIM decapsulation tunnel is the register decapsulation tunnel. A decapsulation tunnel is created on the RP for the address that is configured to be the RP address.

## Examples

The following is sample output from the **show ipv6 pim tunnel** command on the RP:

```
Device# show ipv6 pim tunnel
Tunnel0*
  Type  :PIM Encap
  RP    :100::1
  Source:100::1
Tunnel0*
  Type  :PIM Decap
  RP    :100::1
  Source: -
```

The following is sample output from the **show ipv6 pim tunnel** command on a non-RP:

```
Device# show ipv6 pim tunnel
Tunnel0*
  Type  :PIM Encap
  RP    :100::1
  Source:2001::1:1:1
```

The table below describes the significant fields shown in the display.

**Table 89: show ipv6 pim tunnel Field Descriptions**

Field	Description
Tunnel0*	Name of the tunnel.

Field	Description
Type	Type of tunnel. Can be PIM encapsulation or PIM de-encapsulation.
source	Source address of the router that is sending encapsulating registers to the RP.



# PART VI

## Layer 2/3

- [Layer 2/3 Commands, on page 537](#)







## Layer 2/3 Commands

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- [clear lacp](#), on page 543
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# channel-group

To assign an Ethernet port to an EtherChannel group, or to enable an EtherChannel mode, or both, use the **channel-group** command in interface configuration mode. To remove an Ethernet port from an EtherChannel group, use the **no** form of this command.

**channel-group** | *channel-group-number* **mode** **active** | **auto** [**non-silent**] | **desirable** [**non-silent**] | **on** | **passive**  
**no channel-group**

## Syntax Description

*channel-group-number*

<b>mode</b>	Specifies the EtherChannel mode.
<b>active</b>	Unconditionally enables Link Aggregation Control Protocol (LACP).
<b>auto</b>	Enables the Port Aggregation Protocol (PAgP) only if a PAgP device is detected.
<b>non-silent</b>	(Optional) Configures the interface for nonsilent operation when connected to a partner that is PAgP-capable. Use in PAgP mode with the <b>auto</b> or <b>desirable</b> keyword when traffic is expected from the other device.
<b>desirable</b>	Unconditionally enables PAgP.
<b>on</b>	Enables the on mode.
<b>passive</b>	Enables LACP only if a LACP device is detected.

## Command Default

No channel groups are assigned.  
 No mode is configured.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

For Layer 2 EtherChannels, the **channel-group** command automatically creates the port-channel interface when the channel group gets its first physical port. You do not have to use the **interface port-channel** command in global configuration mode to manually create a port-channel interface. If you create the port-channel

interface first, the *channel-group-number* can be the same as the *port-channel-number*, or you can use a new number. If you use a new number, the **channel-group** command dynamically creates a new port channel.

Although it is not necessary to disable the IP address that is assigned to a physical port that is part of a channel group, we strongly recommend that you do so.

You create Layer 3 port channels by using the **interface port-channel** command followed by the **no switchport** interface configuration command. Manually configure the port-channel logical interface before putting the interface into the channel group.

After you configure an EtherChannel, configuration changes that you make on the port-channel interface apply to all the physical ports assigned to the port-channel interface. Configuration changes applied to the physical port affect only the port where you apply the configuration. To change the parameters of all ports in an EtherChannel, apply configuration commands to the port-channel interface, for example, spanning-tree commands or commands to configure a Layer 2 EtherChannel as a trunk.

Active mode places a port into a negotiating state in which the port initiates negotiations with other ports by sending LACP packets. A channel is formed with another port group in either the active or passive mode.

Auto mode places a port into a passive negotiating state in which the port responds to PAgP packets it receives but does not start PAgP packet negotiation. A channel is formed only with another port group in desirable mode. When auto is enabled, silent operation is the default.

Desirable mode places a port into an active negotiating state in which the port starts negotiations with other ports by sending PAgP packets. An EtherChannel is formed with another port group that is in the desirable or auto mode. When desirable is enabled, silent operation is the default.

If you do not specify non-silent with the auto or desirable mode, silent is assumed. The silent mode is used when the is connected to a device that is not PAgP-capable and rarely, if ever, sends packets. An example of a silent partner is a file server or a packet analyzer that is not generating traffic. In this case, running PAgP on a physical port prevents that port from ever becoming operational. However, it allows PAgP to operate, to attach the port to a channel group, and to use the port for transmission. Both ends of the link cannot be set to silent.

In on mode, a usable EtherChannel exists only when both connected port groups are in the on mode.




---

**Caution**

Use care when using the on mode. This is a manual configuration, and ports on both ends of the EtherChannel must have the same configuration. If the group is misconfigured, packet loss or spanning-tree loops can occur.

---

Passive mode places a port into a negotiating state in which the port responds to received LACP packets but does not initiate LACP packet negotiation. A channel is formed only with another port group in active mode.

Do not configure an EtherChannel in both the PAgP and LACP modes. EtherChannel groups running PAgP and LACP can coexist on the same or on different in the stack (but not in a cross-stack configuration). Individual EtherChannel groups can run either PAgP or LACP, but they cannot interoperate.

If you set the protocol by using the **channel-protocol** interface configuration command, the setting is not overridden by the **channel-group** interface configuration command.

Do not configure a port that is an active or a not-yet-active member of an EtherChannel as an IEEE 802.1x port. If you try to enable IEEE 802.1x authentication on an EtherChannel port, an error message appears, and IEEE 802.1x authentication is not enabled.

Do not configure a secure port as part of an EtherChannel or configure an EtherChannel port as a secure port.

For a complete list of configuration guidelines, see the “Configuring EtherChannels” chapter in the software configuration guide for this release.



**Caution** Do not enable Layer 3 addresses on the physical EtherChannel ports. Do not assign bridge groups on the physical EtherChannel ports because it creates loops.

This example shows how to configure an EtherChannel on a single in the stack. It assigns two static-access ports in VLAN 10 to channel 5 with the PAgP mode desirable:

```
Device# configure terminal
Device(config)# interface range GigabitEthernet 2/0/1 - 2
Device(config-if-range)# switchport mode access
Device(config-if-range)# switchport access vlan 10
Device(config-if-range)# channel-group 5 mode desirable
Device(config-if-range)# end
```

This example shows how to configure an EtherChannel on a single in the stack. It assigns two static-access ports in VLAN 10 to channel 5 with the LACP mode active:

```
Device# configure terminal
Device(config)# interface range GigabitEthernet 2/0/1 - 2
Device(config-if-range)# switchport mode access
Device(config-if-range)# switchport access vlan 10
Device(config-if-range)# channel-group 5 mode active
Device(config-if-range)# end
```

This example shows how to configure a cross-stack EtherChannel in a stack. It uses LACP passive mode and assigns two ports on stack member 2 and one port on stack member 3 as static-access ports in VLAN 10 to channel 5:

```
Device# configure terminal
Device(config)# interface range GigabitEthernet 2/0/4 - 5
Device(config-if-range)# switchport mode access
Device(config-if-range)# switchport access vlan 10
Device(config-if-range)# channel-group 5 mode passive
Device(config-if-range)# exit
Device(config)# interface GigabitEthernet 3/0/3
Device(config-if)# switchport mode access
Device(config-if)# switchport access vlan 10
Device(config-if)# channel-group 5 mode passive
Device(config-if)# exit
```

You can verify your settings by entering the **show running-config** privileged EXEC command.

# channel-protocol

To restrict the protocol used on a port to manage channeling, use the **channel-protocol** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

**channel-protocol lACP | pAgP**  
**no channel-protocol**

## Syntax Description

**lACP** Configures an EtherChannel with the Link Aggregation Control Protocol (LACP).

**pAgP** Configures an EtherChannel with the Port Aggregation Protocol (PAgP).

## Command Default

No protocol is assigned to the EtherChannel.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **channel-protocol** command only to restrict a channel to LACP or PAgP. If you set the protocol by using the **channel-protocol** command, the setting is not overridden by the **channel-group** interface configuration command.

You must use the **channel-group** interface configuration command to configure the EtherChannel parameters. The **channel-group** command also can set the mode for the EtherChannel.

You cannot enable both the PAgP and LACP modes on an EtherChannel group.

PAgP and LACP are not compatible; both ends of a channel must use the same protocol.

You cannot configure PAgP on cross-stack configurations.

This example shows how to specify LACP as the protocol that manages the EtherChannel:

```
Device(config-if)# channel-protocol lACP
```

You can verify your settings by entering the **show etherchannel** [*channel-group-number*] **protocol** privileged EXEC command.

# clear lacp

To clear Link Aggregation Control Protocol (LACP) channel-group counters, use the **clear lacp** command in privileged EXEC mode.

**clear lacp** [*channel-group-number*] **counters**

## Syntax Description

*channel-group-number*

**counters** Clears traffic counters.

## Command Default

None

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

You can clear all counters by using the **clear lacp counters** command, or you can clear only the counters for the specified channel group by using the **clear lacp** *channel-group-number* **counters** command.

This example shows how to clear all channel-group information:

```
Device# clear lacp counters
```

This example shows how to clear LACP traffic counters for group 4:

```
Device# clear lacp 4 counters
```

You can verify that the information was deleted by entering the **show lacp counters** or the **show lacp** *channel-group-number* **counters** privileged EXEC command.

# clear pagp

To clear the Port Aggregation Protocol (PAgP) channel-group information, use the **clear pagp** command in privileged EXEC mode.

**clear pagp** [*channel-group-number*] **counters**

## Syntax Description

*channel-group-number*

**counters** Clears traffic counters.

## Command Default

None

## Command Modes

Privileged EXEC

## Command History

### Release

Cisco IOS XE Everest 16.5.1a

### Modification

This command was introduced.

## Usage Guidelines

You can clear all counters by using the **clear pagp counters** command, or you can clear only the counters for the specified channel group by using the **clear pagp *channel-group-number* counters** command.

This example shows how to clear all channel-group information:

```
Device# clear pagp counters
```

This example shows how to clear PAgP traffic counters for group 10:

```
Device# clear pagp 10 counters
```

You can verify that the information was deleted by entering the **show pagp** privileged EXEC command.



## clear spanning-tree counters

To clear the spanning-tree counters, use the **clear spanning-tree counters** command in privileged EXEC mode.

**clear spanning-tree counters** [**interface** *interface-id*]

<b>Syntax Description</b>	<b>interface</b> <i>interface-id</i>	(Optional) Clears all spanning-tree counters on the specified interface. Valid interfaces include physical ports, VLANs, and port channels.  The VLAN range is 1 to 4094.  The port-channel range is 1 to 128.
<b>Command Default</b>	None	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	<p>If the <i>interface-id</i> value is not specified, spanning-tree counters are cleared for all interfaces.</p> <p>This example shows how to clear spanning-tree counters for all interfaces:</p> <pre>Device# clear spanning-tree counters</pre>	

## clear spanning-tree detected-protocols

To restart the protocol migration process and force renegotiation with neighboring on the interface, use the **clear spanning-tree detected-protocols** command in privileged EXEC mode.

```
clear spanning-tree detected-protocols [interface interface-id]
```

<b>Syntax Description</b>	<b>interface</b> <i>interface-id</i>	(Optional) Restarts the protocol migration process on the specified interface. Valid interfaces include physical ports, VLANs, and port channels.  The VLAN range is 1 to 4094.
<b>Command Default</b>	None	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

A running the rapid per-VLAN spanning-tree plus (rapid-PVST+) protocol or the Multiple Spanning Tree Protocol (MSTP) supports a built-in protocol migration method that enables it to interoperate with legacy IEEE 802.1D . If a rapid-PVST+ or an MSTP receives a legacy IEEE 802.1D configuration bridge protocol data unit (BPDU) with the protocol version set to 0, the sends only IEEE 802.1D BPDUs on that port. A multiple spanning-tree (MST) can also detect that a port is at the boundary of a region when it receives a legacy BPDU, an MST BPDU (Version 3) associated with a different region, or a rapid spanning-tree (RST) BPDU (Version 2).

The does not automatically revert to the rapid-PVST+ or the MSTP mode if it no longer receives IEEE 802.1D BPDUs because it cannot learn whether the legacy switch has been removed from the link unless the legacy switch is the designated switch. Use the **clear spanning-tree detected-protocols** command in this situation.

This example shows how to restart the protocol migration process on a port:

```
Device# clear spanning-tree detected-protocols interface gigabitethernet2/0/1
```

# debug etherchannel

To enable debugging of EtherChannels, use the **debug etherchannel** command in privileged EXEC mode. To disable debugging, use the **no** form of the command.

```
debug etherchannel [all | detail | error | event | idb ]
no debug etherchannel [all | detail | error | event | idb ]
```

## Syntax Description

<b>all</b>	(Optional) Displays all EtherChannel debug messages.
<b>detail</b>	(Optional) Displays detailed EtherChannel debug messages.
<b>error</b>	(Optional) Displays EtherChannel error debug messages.
<b>event</b>	(Optional) Displays EtherChannel event messages.
<b>idb</b>	(Optional) Displays PAgP interface descriptor block debug messages.

## Command Default

Debugging is disabled.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **undebug etherchannel** command is the same as the **no debug etherchannel** command.



**Note** Although the **linecard** keyword is displayed in the command-line help, it is not supported.

When you enable debugging on a stack, it is enabled only on the active switch. To enable debugging on the standby switch, start a session from the active switch by using the **session switch-number** command in privileged EXEC mode. Enter the **debug** command at the command-line prompt of the standby switch.

To enable debugging on the standby switch without first starting a session on the active switch, use the **remote command switch-number LINE** command in privileged EXEC mode.

This example shows how to display all EtherChannel debug messages:

```
Device# debug etherchannel all
```

This example shows how to display debug messages related to EtherChannel events:

```
Device# debug etherchannel event
```

# debug lacp

To enable debugging of Link Aggregation Control Protocol (LACP) activity, use the **debug lacp** command in privileged EXEC mode. To disable LACP debugging, use the **no** form of this command.

```
debug lacp [all | event | fsm | misc | packet]
no debug lacp [all | event | fsm | misc | packet]
```

## Syntax Description

<b>all</b>	(Optional) Displays all LACP debug messages.
<b>event</b>	(Optional) Displays LACP event debug messages.
<b>fsm</b>	(Optional) Displays messages about changes within the LACP finite state machine.
<b>misc</b>	(Optional) Displays miscellaneous LACP debug messages.
<b>packet</b>	(Optional) Displays the receiving and transmitting LACP control packets.

## Command Default

Debugging is disabled.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **undebug etherchannel** command is the same as the **no debug etherchannel** command.

When you enable debugging on a stack, it is enabled only on the active switch. To enable debugging on the standby switch, start a session from the active switch by using the **session switch-number** command in privileged EXEC mode. Enter the **debug** command at the command-line prompt of the standby switch.

To enable debugging on the standby switch without first starting a session on the active switch, use the **remote command switch-number LINE** command in privileged EXEC mode.

This example shows how to display all LACP debug messages:

```
Device# debug LACP all
```

This example shows how to display debug messages related to LACP events:

```
Device# debug LACP event
```

# debug pagp

To enable debugging of Port Aggregation Protocol (PAgP) activity, use the **debug pagp** command in privileged EXEC mode. To disable PAgP debugging, use the **no** form of this command.

**debug pagp** [**all** | **dual-active** | **event** | **fsm** | **misc** | **packet**]  
**no debug pagp** [**all** | **dual-active** | **event** | **fsm** | **misc** | **packet**]

Syntax Description	
<b>all</b>	(Optional) Displays all PAgP debug messages.
<b>dual-active</b>	(Optional) Displays dual-active detection messages.
<b>event</b>	(Optional) Displays PAgP event debug messages.
<b>fsm</b>	(Optional) Displays messages about changes within the PAgP finite state machine.
<b>misc</b>	(Optional) Displays miscellaneous PAgP debug messages.
<b>packet</b>	(Optional) Displays the receiving and transmitting PAgP control packets.

**Command Default** Debugging is disabled.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **undebbug pagp** command is the same as the **no debug pagp** command.

When you enable debugging on a stack, it is enabled only on the active switch. To enable debugging on the standby switch, start a session from the active switch by using the **session switch-number** command in privileged EXEC mode. Enter the **debug** command at the command-line prompt of the standby switch.

To enable debugging on the standby switch without first starting a session on the active switch, use the **remote command switch-number LINE** command in privileged EXEC mode.

This example shows how to display all PAgP debug messages:

```
Device# debug pagp all
```

This example shows how to display debug messages related to PAgP events:

```
Device# debug pagp event
```

## debug platform pm

To enable debugging of the platform-dependent port manager software module, use the **debug platform pm** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

Syntax Description		
	<b>all</b>	Displays all port manager debug messages.
	<b>counters</b>	Displays counters for remote procedure call (RPC) debug messages.
	<b>errdisable</b>	Displays error-disabled-related events debug messages.
	<b>if-numbers</b>	Displays interface-number translation event debug messages.
	<b>link-status</b>	Displays interface link-detection event debug messages.
	<b>platform</b>	Displays port manager function event debug messages.
	<b>pm-vectors</b>	Displays port manager vector-related event debug messages.
	<b>detail</b>	(Optional) Displays vector-function details.
	<b>vlan</b>	Displays VLAN creation and deletion event debug messages.

**Command Default** Debugging is disabled.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **undebg platform pm** command is the same as the **no debug platform pm** command.

When you enable debugging on a stack, it is enabled only on the active switch. To enable debugging on the standby switch, start a session from the active switch by using the **session *switch-number*** command in privileged EXEC mode. Enter the **debug** command at the command-line prompt of the standby switch.

To enable debugging on the standby switch without first starting a session on the active switch, use the **remote command *switch-number* *LINE*** command in privileged EXEC mode.

This example shows how to display debug messages related to the creation and deletion of VLANs:

```
Device# debug platform pm vlans
```

## debug platform udd

To enable debugging of the platform-dependent UniDirectional Link Detection (UDLD) software, use the **debug platform udd** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

---

**Syntax Description**

**error** (Optional) Displays error condition debug messages.

---

---

**Command Default**

Debugging is disabled.

---

---

**Command Modes**

Privileged EXEC

---

---

**Command History**

---

**Release**

Cisco IOS XE Everest 16.5.1a

---

---

**Modification**

This command was introduced.

---

---

**Usage Guidelines**

The **undebg platform udd** command is the same as the **no debug platform udd** command.

## debug spanning-tree

To enable debugging of spanning-tree activities, use the **debug spanning-tree** command in EXEC mode. To disable debugging, use the **no** form of this command.

**debug spanning-tree** all | backbonefast | bpdu | bpdu-opt | config | etherchannel | events | exceptions | general | ha | mstp | pvst+ | root | snmp | synchronization | switch | uplinkfast  
**no debug spanning-tree** all | backbonefast | bpdu | bpdu-opt | config | etherchannel | events | exceptions | general | mstp | pvst+ | root | snmp | synchronization | switch | uplinkfast

### Syntax Description

<b>all</b>	Displays all spanning-tree debug messages.
<b>backbonefast</b>	Displays BackboneFast-event debug messages.
<b>bpdu</b>	Displays spanning-tree bridge protocol data unit (BPDU) debug messages.
<b>bpdu-opt</b>	Displays optimized BPDU handling debug messages.
<b>config</b>	Displays spanning-tree configuration change debug messages.
<b>etherchannel</b>	Displays EtherChannel-support debug messages.
<b>events</b>	Displays spanning-tree topology event debug messages.
<b>exceptions</b>	Displays spanning-tree exception debug messages.
<b>general</b>	Displays general spanning-tree activity debug messages.
<b>ha</b>	Displays high-availability spanning-tree debug messages.
<b>mstp</b>	Debugs Multiple Spanning Tree Protocol (MSTP) events.
<b>pvst+</b>	Displays per-VLAN spanning-tree plus (PVST+) event debug messages.
<b>root</b>	Displays spanning-tree root-event debug messages.
<b>snmp</b>	Displays spanning-tree Simple Network Management Protocol (SNMP) handling debug messages.
<b>switch</b>	Displays shim command debug messages. This shim is the software module that is the interface between the generic Spanning Tree Protocol (STP) code and the platform-specific code of various platforms.
<b>synchronization</b>	Displays the spanning-tree synchronization event debug messages.
<b>uplinkfast</b>	Displays UplinkFast-event debug messages.



**Command Default** Debugging is disabled.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **undebbug spanning-tree** command is the same as the **no debug spanning-tree** command.

When you enable debugging on a stack, it is enabled only on the active switch. To enable debugging on the standby switch, start a session from the active switch by using the **session** *switch-number* command in privileged EXEC mode. Enter the **debug** command at the command-line prompt of the standby switch.

To enable debugging on the standby switch without first starting a session on the active switch, use the **remote command** *switch-number LINE* command in privileged EXEC mode.

This example shows how to display all spanning-tree debug messages:

```
Device# debug spanning-tree all
```

# interface port-channel

To access or create a port channel, use the **interface port-channel** command in global configuration mode. Use the **no** form of this command to remove the port channel.

```
interface port-channel port-channel-number
no interface port-channel
```

---

## Syntax Description

*port-channel-number*

---

## Command Default

No port channel logical interfaces are defined.

## Command Modes

Global configuration

---

## Command History

### Release

### Modification

Cisco IOS XE Everest 16.5.1a

This command was introduced.

---



---

## Usage Guidelines

For Layer 2 EtherChannels, you do not have to create a port-channel interface before assigning physical ports to a channel group. Instead, you can use the **channel-group** interface configuration command, which automatically creates the port-channel interface when the channel group obtains its first physical port. If you create the port-channel interface first, the *channel-group-number* can be the same as the *port-channel-number*, or you can use a new number. If you use a new number, the **channel-group** command dynamically creates a new port channel.

You create Layer 3 port channels by using the **interface port-channel** command followed by the **no switchport** interface configuration command. You should manually configure the port-channel logical interface before putting the interface into the channel group.

Only one port channel in a channel group is allowed.



### Caution

When using a port-channel interface as a routed port, do not assign Layer 3 addresses on the physical ports that are assigned to the channel group.

---



### Caution

Do not assign bridge groups on the physical ports in a channel group used as a Layer 3 port channel interface because it creates loops. You must also disable spanning tree.

---

Follow these guidelines when you use the **interface port-channel** command:

- If you want to use the Cisco Discovery Protocol (CDP), you must configure it on the physical port and not on the port channel interface.
- Do not configure a port that is an active member of an EtherChannel as an IEEE 802.1x port. If IEEE 802.1x is enabled on a not-yet active port of an EtherChannel, the port does not join the EtherChannel.

For a complete list of configuration guidelines, see the “Configuring EtherChannels” chapter in the software configuration guide for this release.

This example shows how to create a port channel interface with a port channel number of 5:

```
Device(config)# interface port-channel 5
```

You can verify your setting by entering the **show running-config** privileged EXEC or **show etherchannel channel-group-number detail** privileged EXEC command.

# lacp max-bundle

To define the maximum number of active LACP ports allowed in a port channel, use the **lacp max-bundle** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

```
lacp max-bundle max_bundle_number
no lacp max-bundle
```

<b>Syntax Description</b>	<i>max_bundle_number</i>	The maximum number of active LACP ports in the port channel. The range is 1 to 8. The default is 8.
<b>Command Default</b>	None	
<b>Command Modes</b>	Interface configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.

## Usage Guidelines

An LACP channel group can have up to 16 Ethernet ports of the same type. Up to eight ports can be active, and up to eight ports can be in hot-standby mode. When there are more than eight ports in an LACP channel group, the on the controlling end of the link uses port priorities to determine which ports are bundled into the channel and which ports are put in hot-standby mode. Port priorities on the other (the noncontrolling end of the link) are ignored.

The **lacp max-bundle** command must specify a number greater than the number specified by the **port-channel min-links** command.

Use the **show etherchannel summary** privileged EXEC command to see which ports are in the hot-standby mode (denoted with an H port-state flag in the output display).

This example shows how to specify a maximum of five active LACP ports in port channel 2:

```
Device(config)# interface port-channel 2
Device(config-if)# lacp max-bundle 5
```

# lACP port-priority

To configure the port priority for the Link Aggregation Control Protocol (LACP), use the **lACP port-priority** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

**lACP port-priority** *priority*  
**no lACP port-priority**

<b>Syntax Description</b>	<i>priority</i> Port priority for LACP. The range is 1 to 65535.
---------------------------	--

<b>Command Default</b>	The default is 32768.
------------------------	-----------------------

<b>Command Modes</b>	Interface configuration
----------------------	-------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **lACP port-priority** interface configuration command determines which ports are bundled and which ports are put in hot-standby mode when there are more than eight ports in an LACP channel group.

An LACP channel group can have up to 16 Ethernet ports of the same type. Up to eight ports can be active, and up to eight ports can be in standby mode.

In port-priority comparisons, a numerically lower value has a higher priority: When there are more than eight ports in an LACP channel group, the eight ports with the numerically lowest values (highest priority values) for LACP port priority are bundled into the channel group, and the lower-priority ports are put in hot-standby mode. If two or more ports have the same LACP port priority (for example, they are configured with the default setting of 65535), then an internal value for the port number determines the priority.



**Note** The LACP port priorities are only effective if the ports are on the that controls the LACP link. See the **lACP system-priority** global configuration command for determining which controls the link.

Use the **show lACP internal** privileged EXEC command to display LACP port priorities and internal port number values.

For information about configuring LACP on physical ports, see the configuration guide for this release.

This example shows how to configure the LACP port priority on a port:

```
Device# interface gigabitethernet2/0/1
Device(config-if)# lACP port-priority 1000
```

You can verify your settings by entering the **show lACP** [*channel-group-number*] **internal** privileged EXEC command.

# lacp rate

To set the rate at which Link Aggregation Control Protocol (LACP) control packets are ingressed to an LACP-supported interface, use the **lacp rate** command in interface configuration mode. To return to the default settings, use the **no** form of this command

**lacp rate normal | fast**  
**no lacp rate**

<b>Syntax Description</b>	<b>normal</b> Specifies that LACP control packets are ingressed at the normal rate, every 30 seconds after the link is bundled.				
	<b>fast</b> Specifies that LACP control packets are ingressed at the fast rate, once every 1 second.				
<b>Command Default</b>	The default ingress rate for control packets is 30 seconds after the link is bundled.				
<b>Command Modes</b>	Interface configuration (config-if)				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td></td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification		This command was introduced.
Release	Modification				
	This command was introduced.				
<b>Usage Guidelines</b>	<p>Use this command to modify the duration of LACP timeout. The LACP timeout value on Cisco switch is three times the LACP rate configured on the interface. Using the <b>lacp rate</b> command, you can select the LACP timeout value for a switch to be either 90 seconds or 3 seconds.</p> <p>This command is supported only on LACP-enabled interfaces.</p> <p>This example shows how to specify the fast (1 second) ingress rate on interface GigabitEthernet 0/0:</p> <pre>Device(config)# interface gigabitEthernet 0/0 Device(config-if)# lacp rate fast</pre>				

# lACP system-priority

To configure the system priority for the Link Aggregation Control Protocol (LACP), use the **lACP system-priority** command in global configuration mode on the . To return to the default setting, use the **no** form of this command.

```
lACP system-priority priority
no lACP system-priority
```

<b>Syntax Description</b>	<i>priority</i> System priority for LACP. The range is 1 to 65535.				
<b>Command Default</b>	The default is 32768.				
<b>Command Modes</b>	Global configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

## Usage Guidelines

The **lACP system-priority** command determines which in an LACP link controls port priorities.

An LACP channel group can have up to 16 Ethernet ports of the same type. Up to eight ports can be active, and up to eight ports can be in standby mode. When there are more than eight ports in an LACP channel group, the on the controlling end of the link uses port priorities to determine which ports are bundled into the channel and which ports are put in hot-standby mode. Port priorities on the other (the noncontrolling end of the link) are ignored.

In priority comparisons, numerically lower values have a higher priority. Therefore, the system with the numerically lower value (higher priority value) for LACP system priority becomes the controlling system. If both have the same LACP system priority (for example, they are both configured with the default setting of 32768), the LACP system ID (the MAC address) determines which is in control.

The **lACP system-priority** command applies to all LACP EtherChannels on the .

Use the **show etherchannel summary** privileged EXEC command to see which ports are in the hot-standby mode (denoted with an H port-state flag in the output display).

This example shows how to set the LACP system priority:

```
Device(config)# lACP system-priority 20000
```

You can verify your settings by entering the **show lACP sys-id** privileged EXEC command.

# pagp learn-method

To learn the source address of incoming packets received from an EtherChannel port, use the **pagp learn-method** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

**pagp learn-method aggregation-port | physical-port**  
**no pagp learn-method**

<b>Syntax Description</b>	<p><b>aggregation-port</b> Specifies address learning on the logical port channel. The sends packets to the source using any port in the EtherChannel. This setting is the default. With aggregation-port learning, it is not important on which physical port the packet arrives.</p> <p><b>physical-port</b> Specifies address learning on the physical port within the EtherChannel. The sends packets to the source using the same port in the EtherChannel from which it learned the source address. The other end of the channel uses the same port in the channel for a particular destination MAC or IP address.</p>				
<b>Command Default</b>	The default is aggregation-port (logical port channel).				
<b>Command Modes</b>	Interface configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines**

The learn method must be configured the same at both ends of the link.

The supports address learning only on aggregate ports even though the **physical-port** keyword is provided in the command-line interface (CLI). The **pagp learn-method** and the **pagp port-priority** interface configuration commands have no effect on the hardware, but they are required for PAgP interoperability with devices that only support address learning by physical ports.

When the link partner to the is a physical learner, we recommend that you configure the as a physical-port learner by using the **pagp learn-method physical-port** interface configuration command. We also recommend that you set the load-distribution method based on the source MAC address by using the **port-channel load-balance src-mac** global configuration command. Use the **pagp learn-method** interface configuration command only in this situation.

This example shows how to set the learning method to learn the address on the physical port within the EtherChannel:

```
Device(config-if)# pagp learn-method physical-port
```

This example shows how to set the learning method to learn the address on the port channel within the EtherChannel:

```
Device(config-if)# pagp learn-method aggregation-port
```



You can verify your settings by entering the **show running-config** privileged EXEC command or the **show pagp *channel-group-number* internal** privileged EXEC command.

## pagp port-priority

To select a port over which all Port Aggregation Protocol (PAgP) traffic through the EtherChannel is sent, use the **pagp port-priority** command in interface configuration mode. If all unused ports in the EtherChannel are in hot-standby mode, they can be placed into operation if the currently selected port and link fails. To return to the default setting, use the **no** form of this command.

**pagp port-priority** *priority*  
**no pagp port-priority**

<b>Syntax Description</b>	<i>priority</i> Priority number. The range is from 0 to 255.
---------------------------	--

<b>Command Default</b>	The default is 128.
------------------------	---------------------

<b>Command Modes</b>	Interface configuration
----------------------	-------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	The physical port with the highest priority that is operational and has membership in the same EtherChannel is the one selected for PAgP transmission.
-------------------------	--

The `pagp` supports address learning only on aggregate ports even though the **physical-port** keyword is provided in the command-line interface (CLI). The **pagp learn-method** and the **pagp port-priority** interface configuration commands have no effect on the hardware, but they are required for PAgP interoperability with devices that only support address learning by physical ports, such as the Catalyst 1900 switch.

When the link partner to the `pagp` is a physical learner, we recommend that you configure the `pagp` as a physical-port learner by using the **pagp learn-method physical-port** interface configuration command. We also recommend that you set the load-distribution method based on the source MAC address by using the **port-channel load-balance src-mac** global configuration command. Use the **pagp learn-method** interface configuration command only in this situation.

This example shows how to set the port priority to 200:

```
Device(config-if)# pagp port-priority 200
```

You can verify your setting by entering the **show running-config** privileged EXEC command or the **show pagp channel-group-number internal** privileged EXEC command.

# port-channel

To convert the auto created EtherChannel into a manual channel and adding configuration on the EtherChannel, use the **port-channel** command in privileged EXEC mode.

```
port-channel {channel-group-number persistent | persistent }
```

<b>Syntax Description</b>	<i>channel-group-number</i>	Channel group number. The range is 1 to 128.
	<b>persistent</b>	Converts the auto created EtherChannel into a manual channel and allows you to add configuration on the EtherChannel.
<b>Command Default</b>	None	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	You can use the <b>show etherchannel summary</b> privileged EXEC command to display the EtherChannel information.	

## Examples

This example shows how to convert the auto created EtherChannel into a manual channel:

```
Device# port-channel 1 persistent
```

# port-channel auto

To enable the auto-LAG feature on a switch globally, use the **port-channel auto** command in global configuration mode. To disable the auto-LAG feature on the switch globally, use **no** form of this command.

**port-channel auto**  
**no port-channel auto**

---

## Syntax Description

This command has no arguments or keywords.

---

## Command Default

By default, the auto-LAG feature is disabled globally and is enabled on all port interfaces.

---

## Command Modes

Global configuration

---

## Command History

Release	Modification
Cisco IOS XE 3.7.2E	This command was introduced.

---

## Usage Guidelines

You can use the **show etherchannel auto** privileged EXEC command to verify if the EtherChannel was created automatically.

---

## Examples

This example shows how to enable the auto-LAG feature on the switch:

```
Device(config)# port-channel auto
```

## port-channel load-balance

To set the load-distribution method among the ports in the EtherChannel, use the **port-channel load-balance** command in global configuration mode. To reset the load-balancing mechanism to the default setting, use the **no** form of this command.

```
port-channel load-balance dst-ip | dst-mac | dst-mixed-ip-port | dst-port | extended | src-dst-ip |
src-dst-mac | src-dst-mixed-ip-port | src-dst-port | src-ip | src-mac | src-mixed-ip-port | src-port
no port-channel load-balance
```

Syntax Description		
<b>dst-ip</b>	Specifies load distribution based on the destination host IP address.	
<b>dst-mac</b>	Specifies load distribution based on the destination host MAC address. Packets to the same destination are sent on the same port, but packets to different destinations are sent on different ports in the channel.	
<b>dst-mixed-ip-port</b>	Specifies load distribution based on the destination IPv4 or IPv6 address and the TCP/UDP (Layer 4) port number.	
<b>dst-port</b>	Specifies load distribution based on the destination TCP/UDP (Layer 4) port number for both IPv4 and IPv6.	
<b>extended</b>	Sets extended load balance methods among the ports in the EtherChannel. See the <b>port-channel load-balance extended</b> command.	
<b>src-dst-ip</b>	Specifies load distribution based on the source and destination host IP address.	
<b>src-dst-mac</b>	Specifies load distribution based on the source and destination host MAC address.	
<b>src-dst-mixed-ip-port</b>	Specifies load distribution based on the source and destination host IP address and TCP/UDP (layer 4) port number.	
<b>src-dst-port</b>	Specifies load distribution based on the source and destination TCP/UDP (Layer 4) port number.	
<b>src-ip</b>	Specifies load distribution based on the source host IP address.	
<b>src-mac</b>	Specifies load distribution based on the source MAC address. Packets from different hosts use different ports in the channel, but packets from the same host use the same port.	
<b>src-mixed-ip-port</b>	Specifies load distribution based on the source host IP address and TCP/UDP (Layer 4) port number.	
<b>src-port</b>	Specifies load distribution based on the TCP/UDP (Layer 4) port number.	

**Command Default** The default is **src-mac**.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You can verify your setting by entering the **show running-config** privileged EXEC command or the **show etherchannel load-balance** privileged EXEC command.

**Examples**

This example shows how to set the load-distribution method to dst-mac:

```
Device(config)# port-channel load-balance dst-mac
```

# port-channel load-balance extended

To set combinations of load-distribution methods among the ports in the EtherChannel, use the **port-channel load-balance extended** command in global configuration mode. To reset the extended load-balancing mechanism to the default setting, use the **no** form of this command.

```
port-channel load-balance extended[dst-ip | dst-mac | dst-port | ipv6-label | l3-proto | src-ip | src-mac | src-port]
no port-channel load-balance extended
```

## Syntax Description

<b>dst-ip</b>	(Optional) Specifies load distribution based on the destination host IP address.
<b>dst-mac</b>	(Optional) Specifies load distribution based on the destination host MAC address. Packets to the same destination are sent on the same port, but packets to different destinations are sent on different ports in the channel.
<b>dst-port</b>	(Optional) Specifies load distribution based on the destination TCP/UDP (Layer 4) port number for both IPv4 and IPv6.
<b>ipv6-label</b>	(Optional) Specifies load distribution based on the source MAC address and IPv6 flow label.
<b>l3-proto</b>	(Optional) Specifies load distribution based on the source MAC address and Layer 3 protocols.
<b>src-ip</b>	(Optional) Specifies load distribution based on the source host IP address.
<b>src-mac</b>	(Optional) Specifies load distribution based on the source MAC address. Packets from different hosts use different ports in the channel, but packets from the same host use the same port.
<b>src-port</b>	(Optional) Specifies load distribution based on the TCP/UDP (Layer 4) port number.

## Command Default

The default is **src-mac**.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

For information about when to use these forwarding methods, see the [for this release](#).

You can verify your setting by entering the **show running-config** privileged EXEC command or the **show etherchannel load-balance** privileged EXEC command.

## Examples

This example shows how to set the extended load-distribution method:

```
Device(config)# port-channel load-balance extended dst-ip dst-mac src-ip
```

# port-channel min-links

To define the minimum number of LACP ports that must be bundled in the link-up state and bundled in the EtherChannel in order that a port channel becomes active, use the **port-channel min-links** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

```
port-channel min-links min_links_number
no port-channel min-links
```

<b>Syntax Description</b>	<i>min_links_number</i>	The minimum number of active LACP ports in the port channel. The range is 2 to 8. The default is 1.
<b>Command Default</b>	None	
<b>Command Modes</b>	Interface configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.

**Usage Guidelines**

An LACP channel group can have up to 16 Ethernet ports of the same type. Up to eight ports can be active, and up to eight ports can be in hot-standby mode. When there are more than eight ports in an LACP channel group, the on the controlling end of the link uses port priorities to determine which ports are bundled into the channel and which ports are put in hot-standby mode. Port priorities on the other (the noncontrolling end of the link) are ignored.

The **port-channel min-links** command must specify a number a less than the number specified by the **lacp max-bundle** command.

Use the **show etherchannel summary** privileged EXEC command to see which ports are in the hot-standby mode (denoted with an H port-state flag in the output display).

This example shows how to specify a minimum of three active LACP ports before port channel 2 becomes active:

```
Device(config)# interface port-channel 2
Device(config-if)# port-channel min-links 3
```



## rep admin vlan

To configure a Resilient Ethernet Protocol (REP) administrative VLAN for the REP to transmit hardware flood layer (HFL) messages, use the **rep admin vlan** command in global configuration mode. To return to the default configuration with VLAN 1 as the administrative VLAN, use the **no** form of this command.

```
rep admin vlan vlan-id
no rep admin vlan
```

<b>Syntax Description</b>	<i>vlan-id</i> 48-bit static MAC address.				
<b>Command Default</b>	None.				
<b>Command Modes</b>	Global configuration (config)				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td></td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification		This command was introduced.
Release	Modification				
	This command was introduced.				

**Usage Guidelines**

The range of the REP administrative VLAN is from 1 to 4094.

There can be only one administrative VLAN on a device and on a segment.

Verify your settings by entering the **show interfaces rep detail** command in privileged EXEC mode.

### Examples

The following example shows how to configure VLAN 100 as the REP administrative VLAN:

```
Device(config)# rep admin vlan 100
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>show interfaces rep detail</b>	Displays detailed REP configuration and status for all the interfaces or the specified interface, including the administrative VLAN.

# rep block port

To configure Resilient Ethernet Protocol (REP) VLAN load balancing on a REP primary edge port, use the **rep block port** command in interface configuration mode. To return to the default configuration with VLAN 1 as the administrative VLAN, use the **no** form of this command.

```
rep block port {id port-id | neighbor-offset | preferred} vlan {vlan-list | all}
no rep block port {id port-id | neighbor-offset | preferred}
```

Syntax Description	
<b>id</b> <i>port-id</i>	Specifies the VLAN blocking alternate port by entering the unique port ID, which is automatically generated when REP is enabled. The REP port ID is a 16-character hexadecimal value.
<i>neighbor-offset</i>	VLAN blocking alternate port by entering the offset number of a neighbor. The range is from -256 to +256. A value of 0 is invalid.
<b>preferred</b>	Selects the regular segment port previously identified as the preferred alternate port for VLAN load balancing.
<b>vlan</b>	Identifies the VLANs to be blocked.
<i>vlan-list</i>	VLAN ID or range of VLAN IDs to be displayed. Enter a VLAN ID from 1 to 4094, or a range or sequence of VLANs (such as 1-3, 22, and 41-44) to be blocked.
<b>all</b>	Blocks all the VLANs.

**Command Default** The default behavior after you enter the **rep preempt segment** command in privileged EXEC (for manual preemption) is to block all the VLANs at the primary edge port. This behavior remains until you configure the **rep block port** command.

If the primary edge port cannot determine which port is to be the alternate port, the default action is no preemption and no VLAN load balancing.

**Command Modes** Interface configuration (config-if)

Command History	Release	Modification
		This command was introduced.

**Usage Guidelines** When you select an alternate port by entering an offset number, this number identifies the downstream neighbor port of an edge port. The primary edge port has an offset number of 1; positive numbers above 1 identify downstream neighbors of the primary edge port. Negative numbers identify the secondary edge port (offset number -1) and its downstream neighbors.



**Note** Do not enter an offset value of 1 because that is the offset number of the primary edge port itself.

If you have configured a preempt delay time by entering the **rep preempt delay seconds** command in interface configuration mode and a link failure and recovery occurs, VLAN load balancing begins after the configured

preemption time period elapses without another link failure. The alternate port specified in the load-balancing configuration blocks the configured VLANs and unblocks all the other segment ports. If the primary edge port cannot determine the alternate port for VLAN balancing, the default action is no preemption.

Each port in a segment has a unique port ID. To determine the port ID of a port, enter the **show interfaces interface-id rep detail** command in privileged EXEC mode.

### Examples

The following example shows how to configure REP VLAN load balancing:

```
Device(config)# interface TenGigabitEthernet 4/1
Device(config-if)# rep block port id 0009001818D68700 vlan 1-100
```

### Related Commands

Command	Description
<b>show interfaces rep detail</b>	Displays detailed REP configuration and status for all the interfaces or the specified interface, including the administrative VLAN.

## rep lsl-age-timer

To configure the Resilient Ethernet Protocol (REP) link status layer (LSL) age-out timer value, use the **rep lsl-age-timer** command in interface configuration mode. To restore the default age-out timer value, use the **no** form of this command.

```
rep lsl-age-timer milliseconds
no rep lsl-age-timer milliseconds
```

<b>Syntax Description</b>	<i>milliseconds</i> REP LSL age-out timer value, in milliseconds (ms). The range is from 120 to 10000 in multiples of 40.				
<b>Command Default</b>	The default LSL age-out timer value is 5 ms.				
<b>Command Modes</b>	Interface configuration (config-if)				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td></td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification		This command was introduced.
Release	Modification				
	This command was introduced.				

**Usage Guidelines** While configuring REP configurable timers, we recommend that you configure the REP LSL number of retries first and then configure the REP LSL age-out timer value.

### Examples

The following example shows how to configure a REP LSL age-out timer value:

```
Device(config)# interface TenGigabitEthernet 4/1
Device(config-if)# rep segment 1 edge primary
Device(config-if)# rep lsl-age-timer 2000
```

### Related Commands

Command	Description
<b>interface interface-type interface-name</b>	Specifies a physical interface or port channel to receive STCNs.
<b>rep segment</b>	Enables REP on an interface and assigns a segment ID.

## rep lsl-retries

To configure the REP link status layer (LSL) number of retries, use the **rep lsl-retries** command in interface configuration mode. To restore the default number of retries, use the **no** form of this command.

**rep lsl-retries** *number-of-retries*  
**no rep lsl-retries** *number-of-retries*

### Syntax Description

*number-of-retries* Number of LSL retries. The range of retries is from 3 to 10.

### Command Default

The default number of LSL retries is 5.

### Command Modes

Interface configuration (config-if)

### Command History

Release	Modification
	This command was introduced

### Usage Guidelines

The **rep lsl-retries** command is used to configure the number of retries before the REP link is disabled. While configuring REP configurable timers, we recommend that you configure the REP LSL number of retries first and then configure the REP LSL age-out timer value.

The following example shows how to configure REP LSL retries.

```
Device(config)# interface TenGigabitEthernet 4/1
Device(config-if)# rep segment 2 edge primary
```

## rep preempt delay

To configure a waiting period after a segment port failure and recovery before Resilient Ethernet Protocol (REP) VLAN load balancing is triggered, use the **rep preempt delay** command in interface configuration mode. To remove the configured delay, use the **no** form of this command.

**rep preempt delay** *seconds*  
**no rep preempt delay**

<b>Syntax Description</b>	<i>seconds</i> Number of seconds to delay REP preemption. The range is from 15 to 300 seconds. The default is manual preemption without delay.
---------------------------	--

<b>Command Default</b>	REP preemption delay is not set. The default is manual preemption without delay.
------------------------	--

<b>Command Modes</b>	Interface configuration (config-if)
----------------------	-------------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.

<b>Usage Guidelines</b>	Enter this command on the REP primary edge port.
	Enter this command and configure a preempt time delay for VLAN load balancing to be automatically triggered after a link failure and recovery.

If VLAN load balancing is configured after a segment port failure and recovery, the REP primary edge port starts a delay timer before VLAN load balancing occurs. Note that the timer restarts after each link failure. When the timer expires, the REP primary edge port alerts the alternate port to perform VLAN load balancing (configured by using the **rep block port** interface configuration command) and prepares the segment for the new topology. The configured VLAN list is blocked at the alternate port, and all other VLANs are blocked at the primary edge port.

You can verify your settings by entering the **show interfaces rep** command.

<b>Examples</b>	The following example shows how to configure a REP preemption time delay of 100 seconds on the primary edge port:
-----------------	---

```
Device(config)# interface TenGigabitEthernet 4/1
Device(config-if)# rep preempt delay 100
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>rep block port</b>	Configures VLAN load balancing.
	<b>show interfaces rep detail</b>	Displays detailed REP configuration and status for all the interfaces or the specified interface, including the administrative VLAN.

## rep preempt segment

To manually start Resilient Ethernet Protocol (REP) VLAN load balancing on a segment, use the **rep preempt segment** command in privileged EXEC mode.

```
rep preempt segment segment-id
```

### Syntax Description

*segment-id* ID of the REP segment. The range is from 1 to 1024.

### Command Default

Manual preemption is the default behavior.

### Command Modes

Privileged EXEC (#)

### Command History

Release	Modification
	This command was introduced.

### Usage Guidelines

Enter this command on the segment, which has the primary edge port on the device.

Ensure that all the other segment configurations are completed before setting preemption for VLAN load balancing. When you enter the **rep preempt segment** *segment-id* command, a confirmation message appears before the command is executed because preemption for VLAN load balancing can disrupt the network.

If you do not enter the **rep preempt delay** *seconds* command in interface configuration mode on the primary edge port to configure a preemption time delay, the default configuration is to manually trigger VLAN load balancing on the segment.

Enter the **show rep topology** command in privileged EXEC mode to see which port in the segment is the primary edge port.

If you do not configure VLAN load balancing, entering the **rep preempt segment** *segment-id* command results in the default behavior, that is, the primary edge port blocks all the VLANs.

You can configure VLAN load balancing by entering the **rep block port** command in interface configuration mode on the REP primary edge port before you manually start preemption.

### Examples

The following example shows how to manually trigger REP preemption on segment 100:

```
Device# rep preempt segment 100
```


### Related Commands

Command	Description
<b>rep block port</b>	Configures VLAN load balancing.
<b>rep preempt delay</b>	Configures a waiting period after a segment port failure and recovery before REP VLAN load balancing is triggered.
<b>show rep topology</b>	Displays REP topology information for a segment or for all the segments.

## rep segment

To enable Resilient Ethernet Protocol (REP) on an interface and to assign a segment ID to the interface, use the **rep segment** command in interface configuration mode. To disable REP on the interface, use the **no** form of this command.

**rep segment** *segment-id* [**edge** [**no-neighbor**] [**primary**] ] [**preferred**]  
**no rep segment**

<b>Syntax Description</b>	<i>segment-id</i> Segment for which REP is enabled. Assign a segment ID to the interface. The range is from 1 to 1024.				
<b>edge</b>	(Optional) Configures the port as an edge port. Each segment has only two edge ports.				
<b>no-neighbor</b>	(Optional) Specifies the segment edge as one with no external REP neighbor.				
<b>primary</b>	(Optional) Specifies that the port is the primary edge port where you can configure VLAN load balancing. A segment has only one primary edge port.				
<b>preferred</b>	(Optional) Specifies that the port is the preferred alternate port or the preferred port for VLAN load balancing.				
	<b>Note</b> Configuring a port as a preferred port does not guarantee that it becomes the alternate port; it merely gives it a slight edge among equal contenders. The alternate port is usually a previously failed port.				
<b>Command Default</b>	REP is disabled on the interface.				
<b>Command Modes</b>	Interface configuration (config-if)				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td></td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification		This command was introduced.
Release	Modification				
	This command was introduced.				
<b>Usage Guidelines</b>	<p>REP ports must be a Layer 2 IEEE 802.1Q port or a 802.1AD port. You must configure two edge ports on each REP segment, a primary edge port and a secondary edge port.</p> <p>If REP is enabled on two ports on a device, both the ports must be either regular segment ports or edge ports. REP ports follow these rules:</p> <ul style="list-style-type: none"> <li>• If only one port on a device is configured in a segment, that port should be an edge port.</li> <li>• If two ports on a device belong to the same segment, both the ports must be regular segment ports.</li> <li>• If two ports on a device belong to the same segment, and one is configured as an edge port and one as a regular segment port (a misconfiguration), the edge port is treated as a regular segment port.</li> </ul>				
					
<b>Caution</b>	REP interfaces come up in a blocked state and remain in a blocked state until notified that it is safe to unblock. Be aware of this to avoid sudden connection losses.				



When REP is enabled on an interface, the default is for that port to be a regular segment port.

## Examples

The following example shows how to enable REP on a regular (nonedge) segment port:

```
Device(config)# interface TenGigabitEthernet 4/1
Device(config-if)# rep segment 100
```

The following example shows how to enable REP on a port and identify the port as the REP primary edge port:

```
Device(config)# interface TenGigabitEthernet 4/1
Device(config-if)# rep segment 100 edge primary
```

The following example shows how to enable REP on a port and identify the port as the REP secondary edge port:

```
Device(config)# interface TenGigabitEthernet 4/1
Device(config-if)# rep segment 100 edge
```

The following example shows how to enable REP as an edge no-neighbor port:

```
Device(config)# interface TenGigabitEthernet 4/1
Device(config-if)# rep segment 1 edge no-neighbor primary
```

## rep stcn

To configure a Resilient Ethernet Protocol (REP) edge port to send segment topology change notifications (STCNs) to another interface or to other segments, use the **rep stcn** command in interface configuration mode. To disable the task of sending STCNs to the interface or to the segment, use the **no** form of this command.

```
rep stcn {interface interface-id | segment segment-id-list}
no rep stcn {interface | segment}
```

<b>Syntax Description</b>	<b>interface</b> <i>interface-id</i> Specifies a physical interface or port channel to receive STCNs.
	<b>segment</b> <i>segment-id-list</i> Specifies one REP segment or a list of REP segments to receive STCNs. The segment range is from 1 to 1024. You can also configure a sequence of segments, for example, 3 to 5, 77, 100.
<b>Command Default</b>	Transmission of STCNs to other interfaces or segments is disabled.
<b>Command Modes</b>	Interface configuration (config-if)
<b>Command History</b>	<b>Release</b>
	<b>Modification</b>
	This command was introduced.

**Usage Guidelines** You can verify your settings by entering the **show interfaces rep detail** command in privileged EXEC mode.

### Examples

The following example shows how to configure a REP edge port to send STCNs to segments 25 to 50:

```
Device(config)# interface TenGigabitEthernet 4/1
Device(config-if)# rep stcn segment 25-50
```

# show etherchannel

To display EtherChannel information for a channel, use the **show etherchannel** command in user EXEC mode.

**show etherchannel** [*channel-group-number* | **detail** | **port** | **port-channel** | **protocol** | **summary**] | [**detail** | **load-balance** | **port** | **port-channel** | **protocol** | **summary**]

Syntax Description		
<i>channel-group-number</i>		
<b>detail</b>	(Optional) Displays detailed EtherChannel information.	
<b>load-balance</b>	(Optional) Displays the load-balance or frame-distribution scheme among ports in the port channel.	
<b>port</b>	(Optional) Displays EtherChannel port information.	
<b>port-channel</b>	(Optional) Displays port-channel information.	
<b>protocol</b>	(Optional) Displays the protocol that is being used in the channel.	
<b>summary</b>	(Optional) Displays a one-line summary per channel group.	
Command Default	None	
Command Modes	User EXEC	
Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

If you do not specify a channel group number, all channel groups are displayed.

In the output, the passive port list field is displayed only for Layer 3 port channels. This field means that the physical port, which is still not up, is configured to be in the channel group (and indirectly is in the only port channel in the channel group).

This is an example of output from the **show etherchannel** *channel-group-number* **detail** command:

```
Device> show etherchannel 1 detail
Group state = L2
Ports: 2   Maxports = 16
Port-channels: 1 Max Port-channels = 16
Protocol:   LACP
           Ports in the group:
           -----
Port: Gi1/0/1
-----
Port state   = Up Mstr In-Bndl
Channel group = 1           Mode = Active           Gchange = -
Port-channel =              PoIGC = -             Pseudo port-channel = Po1
Port index   =              0Load = 0x00           Protocol = LACP
```

Flags: S - Device is sending Slow LACPDU      F - Device is sending fast LACPDU  
 A - Device is in active mode.                  P - Device is in passive mode.

Local information:

Port	Flags	State	LACP port Priority	Admin Key	Oper Key	Port Number	Port State
Gil/0/1	SA	bndl	32768	0x1	0x1	0x101	0x3D
Gil/0/2	A	bndl	32768	0x0	0x1	0x0	0x3D

Age of the port in the current state: 01d:20h:06m:04s

Port-channels in the group:

Port-channel: Po1 (Primary Aggregator)

Age of the Port-channel = 01d:20h:20m:26s  
 Logical slot/port = 10/1                  Number of ports = 2  
 HotStandBy port = null  
 Port state = Port-channel Ag-Inuse  
 Protocol = LACP

Ports in the Port-channel:

Index	Load	Port	EC state	No of bits
0	00	Gil/0/1	Active	0
0	00	Gil/0/2	Active	0

Time since last port bundled: 01d:20h:24m:44s Gil/0/2

This is an example of output from the **show etherchannel channel-group-number summary** command:

```
Device> show etherchannel 1 summary
Flags: D - down P - in port-channel
       I - stand-alone s - suspended
       H - Hot-standby (LACP only)
       R - Layer3 S - Layer2
       u - unsuitable for bundling
       U - in use f - failed to allocate aggregator
       d - default port
```

Number of channel-groups in use: 1  
 Number of aggregators: 1

Group	Port-channel	Protocol	Ports
1	Po1(SU)	LACP	Gil/0/1(P) Gil/0/2(P)

This is an example of output from the **show etherchannel channel-group-number port-channel** command:

```
Device> show etherchannel 1 port-channel
Port-channels in the group:
-----
Port-channel: Po1 (Primary Aggregator)
-----
Age of the Port-channel = 01d:20h:24m:50s
Logical slot/port = 10/1 Number of ports = 2
Logical slot/port = 10/1 Number of ports = 2
Port state = Port-channel Ag-Inuse
```

```
Protocol = LACP
```

```
Ports in the Port-channel:
```

Index	Load	Port	EC state	No of bits
0	00	Gi1/0/1	Active	0
0	00	Gi1/0/2	Active	0

```
Time since last port bundled: 01d:20h:24m:44s Gi1/0/2
```

This is an example of output from **show etherchannel protocol** command:

```
Device# show etherchannel protocol
Channel-group listing:
-----
Group: 1
-----
Protocol: LACP
Group: 2
-----
Protocol: PAgP
```

## show interfaces rep detail

To display detailed Resilient Ethernet Protocol (REP) configuration and status for all interfaces or a specified interface, including the administrative VLAN, use the **show interfaces rep detail** command in privileged EXEC mode.

**show interfaces** [*interface-id*] **rep detail**

### Syntax Description

*interface-id* (Optional) Physical interface used to display the port ID.

### Command Default

None.

### Command Modes

Privileged EXEC (#)

### Command History

Release	Modification
	This command was introduced.

### Usage Guidelines

Enter this command on a segment edge port to send STCNs to one or more segments or to an interface. You can verify your settings by entering the **show interfaces rep detail** command in privileged EXEC mode.

### Examples

The following example shows how to display the REP configuration and status for a specified interface;

```
Device# show interfaces TenGigabitEthernet4/1 rep detail

TenGigabitEthernet4/1 REP enabled
Segment-id: 3 (Primary Edge)
PortID: 03010015FA66FF80
Preferred flag: No
Operational Link Status: TWO_WAY
Current Key: 02040015FA66FF804050
Port Role: Open
Blocked VLAN: <empty>
Admin-vlan: 1
Preempt Delay Timer: disabled
Configured Load-balancing Block Port: none
Configured Load-balancing Block VLAN: none
STCN Propagate to: none
LSL PDU rx: 999, tx: 652
HFL PDU rx: 0, tx: 0
BPA TLV rx: 500, tx: 4
BPA (STCN, LSL) TLV rx: 0, tx: 0
BPA (STCN, HFL) TLV rx: 0, tx: 0
EPA-ELECTION TLV rx: 6, tx: 5
EPA-COMMAND TLV rx: 0, tx: 0
EPA-INFO TLV rx: 135, tx: 136
```

### Related Commands

Command	Description
<b>rep admin vlan</b>	Configures a REP administrative VLAN for the REP to transmit HFL messages.

# show lacp

To display Link Aggregation Control Protocol (LACP) channel-group information, use the **show lacp** command in user EXEC mode.

**show lacp** [*channel-group-number*] **counters** | **internal** | **neighbor** | **sys-id**

Syntax Description	
	<i>channel-group-number</i>
<b>counters</b>	Displays traffic information.
<b>internal</b>	Displays internal information.
<b>neighbor</b>	Displays neighbor information.
<b>sys-id</b>	Displays the system identifier that is being used by LACP. The system identifier consists of the LACP system priority and the MAC address.

**Command Default** None

**Command Modes** User EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You can enter any **show lacp** command to display the active channel-group information. To display specific channel information, enter the **show lacp** command with a channel-group number.

If you do not specify a channel group, information for all channel groups appears.

You can enter the *channel-group-number* to specify a channel group for all keywords except **sys-id**.

This is an example of output from the **show lacp counters** user EXEC command. The table that follows describes the fields in the display.

```
Device> show lacp counters
          LACPDUs      Marker      Marker Response      LACPDUs
Port      Sent  Recv      Sent  Recv      Sent  Recv      Pkts  Err
-----
Channel group:1
Gi2/0/1      19   10           0    0           0    0           0
Gi2/0/2      14    6           0    0           0    0           0
```

**Table 90: show lacp counters Field Descriptions**

Field	Description
LACPDUs Sent and Recv	The number of LACP packets sent and received by a port.

Field	Description
Marker Sent and Recv	The number of LACP marker packets sent and received by a port.
Marker Response Sent and Recv	The number of LACP marker response packets sent and received by a port.
LACPDUs Pkts and Err	The number of unknown and illegal packets received by LACP for a port.

This is an example of output from the **show lacp internal** command:

```
Device> show lacp 1 internal
Flags: S - Device is requesting Slow LACPDUs
       F - Device is requesting Fast LACPDUs
       A - Device is in Active mode           P - Device is in Passive mode

Channel group 1

Port      Flags  State  LACP port  Admin  Oper  Port  Port
Port      Flags  State  Priority   Key    Key   Number State
Gi2/0/1   SA     bndl   32768     0x3    0x3   0x4   0x3D
Gi2/0/2   SA     bndl   32768     0x3    0x3   0x5   0x3D
```

The following table describes the fields in the display:

**Table 91: show lacp internal Field Descriptions**

Field	Description
State	State of the specific port. These are the allowed values: <ul style="list-style-type: none"> <li>• <b>—</b>—Port is in an unknown state.</li> <li>• <b>bndl</b>—Port is attached to an aggregator and bundled with other ports.</li> <li>• <b>susp</b>—Port is in a suspended state; it is not attached to any aggregator.</li> <li>• <b>hot-sby</b>—Port is in a hot-standby state.</li> <li>• <b>indiv</b>—Port is incapable of bundling with any other port.</li> <li>• <b>indep</b>—Port is in an independent state (not bundled but able to handle data traffic. In this case, LACP is not running on the partner port).</li> <li>• <b>down</b>—Port is down.</li> </ul>
LACP Port Priority	Port priority setting. LACP uses the port priority to put ports in standby mode when there is a hardware limitation that prevents all compatible ports from aggregating.



Field	Description
Admin Key	Administrative key assigned to this port. LACP automatically generates an administrative key value as a hexadecimal number. The administrative key defines the ability of a port to aggregate with other ports. A port's ability to aggregate with other ports is determined by the port physical characteristics (for example, data rate and duplex capability) and configuration restrictions that you establish.
Oper Key	Runtime operational key that is being used by this port. LACP automatically generates this value as a hexadecimal number.
Port Number	Port number.
Port State	<p>State variables for the port, encoded as individual bits within a single octet with these meanings:</p> <ul style="list-style-type: none"> <li>• bit0: LACP_Activity</li> <li>• bit1: LACP_Timeout</li> <li>• bit2: Aggregation</li> <li>• bit3: Synchronization</li> <li>• bit4: Collecting</li> <li>• bit5: Distributing</li> <li>• bit6: Defaulted</li> <li>• bit7: Expired</li> </ul> <p><b>Note</b> In the list above, bit7 is the MSB and bit0 is the LSB.</p>

This is an example of output from the **show lacp neighbor** command:

```

Device> show lacp neighbor
Flags: S - Device is sending Slow LACPDUs   F - Device is sending Fast LACPDUs
       A - Device is in Active mode          P - Device is in Passive mode

Channel group 3 neighbors

Partner's information:

Port          Partner                               Partner   Partner
Gi2/0/1      System ID                             Port Number Age      Flags
32768,0007.eb49.5e80  0xC                               19s     SP

              LACP Partner               Partner   Partner
              Port Priority                Oper Key  Port State
              32768                        0x3      0x3C

Partner's information:

```

Port	Partner System ID	Partner Port Number	Age	Partner Flags
Gi2/0/2	32768,0007.eb49.5e80	0xD	15s	SP
	LACP Partner Port Priority	Partner Oper Key	Partner Port State	
	32768	0x3	0x3C	

This is an example of output from the **show lacp sys-id** command:

```
Device> show lacp sys-id
32765,0002.4b29.3a00
```

The system identification is made up of the system priority and the system MAC address. The first two bytes are the system priority, and the last six bytes are the globally administered individual MAC address associated to the system.

# show pagp

To display Port Aggregation Protocol (PAgP) channel-group information, use the **show pagp** command in EXEC mode.

**show pagp** [*channel-group-number*] **counters** | **dual-active** | **internal** | **neighbor**

Syntax Description	
	<i>channel-group-number</i>
<b>counters</b>	Displays traffic information.
<b>dual-active</b>	Displays the dual-active status.
<b>internal</b>	Displays internal information.
<b>neighbor</b>	Displays neighbor information.

**Command Default** None

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You can enter any **show pagp** command to display the active channel-group information. To display the nonactive information, enter the **show pagp** command with a channel-group number.

## Examples

This is an example of output from the **show pagp 1 counters** command:

```
Device> show pagp 1 counters
          Information      Flush
Port      Sent   Recv   Sent   Recv
-----
Channel group: 1
  Gi1/0/1   45    42     0     0
  Gi1/0/2   45    41     0     0
```

This is an example of output from the **show pagp dual-active** command:

```
Device> show pagp dual-active
PAgP dual-active detection enabled: Yes
PAgP dual-active version: 1.1

Channel group 1
Port      Dual-Active   Partner      Partner   Partner
          Detect Capable Name          Port     Version
Gi1/0/1   No            Gi1/0/1     Gi3/0/3   N/A
Gi1/0/2   No            Gi1/0/2     Gi3/0/4   N/A
```

<output truncated>

This is an example of output from the **show pagp 1 internal** command:

```
Device> show pagp 1 internal
Flags: S - Device is sending Slow hello. C - Device is in Consistent state.
      A - Device is in Auto mode.
Timers: H - Hello timer is running.      Q - Quit timer is running.
      S - Switching timer is running.    I - Interface timer is running.

Channel group 1
```

Port	Flags	State	Timers	Hello Interval	Partner Count	PAGP Priority	Learning Method	Group Ifindex
Gi1/0/1	SC	U6/S7	H	30s	1	128	Any	16
Gi1/0/2	SC	U6/S7	H	30s	1	128	Any	16

This is an example of output from the **show pagp 1 neighbor** command:

```
Device> show pagp 1 neighbor

Flags: S - Device is sending Slow hello. C - Device is in Consistent state.
      A - Device is in Auto mode.      P - Device learns on physical port.

Channel group 1 neighbors
```

Port	Partner Name	Partner Device ID	Partner Port	Age	Partner Flags	Partner Group Cap.
Gi1/0/1	-p2	0002.4b29.4600	Gi01//1	9s	SC	10001
Gi1/0/2	-p2	0002.4b29.4600	Gi1/0/2	24s	SC	10001

# show platform etherchannel

To display platform-dependent EtherChannel information, use the **show platform etherchannel** command in privileged EXEC mode.

**show platform etherchannel** *channel-group-number* **group-mask** | **load-balance mac** *src-mac dst-mac* [**ip** *src-ip dst-ip* [**port** *src-port dst-port*]] [**switch** *switch-number*]

Syntax Description	
<i>channel-group-number</i>	Channel group number. The range is 1 to 128.
<b>group-mask</b>	Displays EtherChannel group mask.
<b>load-balance</b>	Tests EtherChannel load-balance hash algorithm.
<b>mac</b> <i>src-mac</i> <i>dst-mac</i>	Specifies the source and destination MAC addresses.
<b>ip</b> <i>src-ip dst-ip</i>	(Optional) Specifies the source and destination IP addresses.
<b>port</b> <i>src-port</i> <i>dst-port</i>	(Optional) Specifies the source and destination layer port numbers.
<b>switch</b> <i>switch-number</i>	(Optional) Specifies the stack member.

**Command Default** None

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use this command only when you are working directly with a technical support representative while troubleshooting a problem.

Do not use this command unless a technical support representative asks you to do so.

# show platform pm

To display platform-dependent port manager information, use the **show platform pm** command in privileged EXEC mode.

---

**Command Default** None

---

**Command Modes** Privileged EXEC

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

**Usage Guidelines** Use this command only when you are working directly with your technical support representative while troubleshooting a problem.

Do not use this command unless your technical support representative asks you to do so.

# show rep topology

To display Resilient Ethernet Protocol (REP) topology information for a segment or for all the segments, including the primary and secondary edge ports in the segment, use the **show rep topology** command in privileged EXEC mode.

**show rep topology** [**segment** *segment-id*] [**archive**] [**detail**]

Syntax Description	segment <i>segment-id</i>	(Optional) Specifies the segment for which to display the REP topology information. The <i>segment-id</i> range is from 1 to 1024.
	<b>archive</b>	(Optional) Displays the previous topology of the segment. This keyword is useful for troubleshooting a link failure.
	<b>detail</b>	(Optional) Displays detailed REP topology information.
Command Modes	Privileged EXEC (#)	
Command History	Release	Modification
		This command was introduced.

## Examples

The following is a sample output from the **show rep topology** command:

```
Device# show rep topology

REP Segment 1
BridgeName      PortName      Edge Role
-----
10.64.106.63    Te5/4         Pri  Open
10.64.106.228  Te3/4         Open
10.64.106.228  Te3/3         Open
10.64.106.67   Te4/3         Open
10.64.106.67   Te4/4         Alt
10.64.106.63   Te4/4         Sec  Open

REP Segment 3
BridgeName      PortName      Edge Role
-----
10.64.106.63    Gi50/1        Pri  Open
SVT_3400_2      Gi0/3         Open
SVT_3400_2      Gi0/4         Open
10.64.106.68    Gi40/2        Open
10.64.106.68    Gi40/1        Open
10.64.106.63    Gi50/2        Sec  Alt
```

The following is a sample output from the **show rep topology detail** command:

```
Device# show rep topology detail

REP Segment 1
10.64.106.63, Te5/4 (Primary Edge)
  Open Port, all vlans forwarding
  Bridge MAC: 0005.9b2e.1700
```

```
Port Number: 010
Port Priority: 000
Neighbor Number: 1 / [-6]
10.64.106.228, Te3/4 (Intermediate)
Open Port, all vlans forwarding
Bridge MAC: 0005.9b1b.1f20
Port Number: 010
Port Priority: 000
Neighbor Number: 2 / [-5]
10.64.106.228, Te3/3 (Intermediate)
Open Port, all vlans forwarding
Bridge MAC: 0005.9b1b.1f20
Port Number: 00E
Port Priority: 000
Neighbor Number: 3 / [-4]
10.64.106.67, Te4/3 (Intermediate)
Open Port, all vlans forwarding
Bridge MAC: 0005.9b2e.1800
Port Number: 008
Port Priority: 000
Neighbor Number: 4 / [-3]
10.64.106.67, Te4/4 (Intermediate)
Alternate Port, some vlans blocked
Bridge MAC: 0005.9b2e.1800
Port Number: 00A
Port Priority: 000
Neighbor Number: 5 / [-2]
10.64.106.63, Te4/4 (Secondary Edge)
Open Port, all vlans forwarding
Bridge MAC: 0005.9b2e.1700
Port Number: 00A
Port Priority: 000
Neighbor Number: 6 / [-1]
```



# show uddl

To display UniDirectional Link Detection (UDLD) administrative and operational status for all ports or the specified port, use the **show uddl** command in user EXEC mode.

```
show uddl [Auto-Template | Capwap | GigabitEthernet | GroupVI | InternalInterface |
Loopback | Null | Port-channel | TenGigabitEthernet | Tunnel | Vlan] interface_number
show uddl neighbors
```

Syntax Description		
<b>Auto-Template</b>	(Optional) Displays UDLD operational status of the auto-template interface. The range is from 1 to 999.	
<b>Capwap</b>	(Optional) Displays UDLD operational status of the CAPWAP interface. The range is from 0 to 2147483647.	
<b>GigabitEthernet</b>	(Optional) Displays UDLD operational status of the GigabitEthernet interface. The range is from 0 to 9.	
<b>GroupVI</b>	(Optional) Displays UDLD operational status of the group virtual interface. The range is from 1 to 255.	
<b>InternalInterface</b>	(Optional) Displays UDLD operational status of the internal interface. The range is from 0 to 9.	
<b>Loopback</b>	(Optional) Displays UDLD operational status of the loopback interface. The range is from 0 to 2147483647.	
<b>Null</b>	(Optional) Displays UDLD operational status of the null interface.	
<b>Port-channel</b>	(Optional) Displays UDLD operational status of the Ethernet channel interfaces. The range is from 1 to 128.	
<b>TenGigabitEthernet</b>	(Optional) Displays UDLD operational status of the Ten Gigabit Ethernet interface. The range is from 0 to 9.	
<b>Tunnel</b>	(Optional) Displays UDLD operational status of the tunnel interface. The range is from 0 to 2147483647.	
<b>Vlan</b>	(Optional) Displays UDLD operational status of the VLAN interface. The range is from 1 to 4095.	
<i>interface-id</i>	(Optional) ID of the interface and port number. Valid interfaces include physical ports, VLANs, and port channels.	
<b>neighbors</b>	(Optional) Displays neighbor information only.	
<b>Command Default</b>	None	
<b>Command Modes</b>	User EXEC	

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

If you do not enter an interface ID, administrative and operational UDLD status for all interfaces appear.

This is an example of output from the **show udld interface-id** command. For this display, UDLD is enabled on both ends of the link, and UDLD detects that the link is bidirectional. The table that follows describes the fields in this display.

```
Device> show udld gigabitethernet2/0/1
Interface gi2/0/1
---
Port enable administrative configuration setting: Follows device default
Port enable operational state: Enabled
Current bidirectional state: Bidirectional
Current operational state: Advertisement - Single Neighbor detected
Message interval: 60
Time out interval: 5
Entry 1
Expiration time: 146
Device ID: 1
Current neighbor state: Bidirectional
Device name: Switch-A
Port ID: Gi2/0/1
Neighbor echo 1 device: Switch-B
Neighbor echo 1 port: Gi2/0/2
Message interval: 5
CDP Device name: Switch-A
```

**Table 92: show udld Field Descriptions**

Field	Description
Interface	The interface on the local device configured for UDLD.
Port enable administrative configuration setting	How UDLD is configured on the port. If UDLD is enabled or disabled, the port enable configuration setting is the same as the operational enable state. Otherwise, the enable operational setting depends on the global enable setting.
Port enable operational state	Operational state that shows whether UDLD is actually running on this port.
Current bidirectional state	The bidirectional state of the link. An unknown state appears if the link is down or if it is connected to an UDLD-incapable device. A bidirectional state appears if the link is a normal two-way connection to a UDLD-capable device. All other values mean miswiring.

Field	Description
Current operational state	The current phase of the UDLD state machine. For a normal bidirectional link, the state machine is most often in the Advertisement phase.
Message interval	How often advertisement messages are sent from the local device. Measured in seconds.
Time out interval	The time period, in seconds, that UDLD waits for echoes from a neighbor device during the detection window.
Entry 1	Information from the first cache entry, which contains a copy of echo information received from the neighbor.
Expiration time	The amount of time in seconds remaining before this cache entry is aged out.
Device ID	The neighbor device identification.
Current neighbor state	The neighbor's current state. If both the local and neighbor devices are running UDLD normally, the neighbor state and local state should be bidirectional. If the link is down or the neighbor is not UDLD-capable, no cache entries appear.
Device name	The device name or the system serial number of the neighbor. The system serial number appears if the device name is not set or is set to the default (Switch).
Port ID	The neighbor port ID enabled for UDLD.
Neighbor echo 1 device	The device name of the neighbors' neighbor from which the echo originated.
Neighbor echo 1 port	The port number ID of the neighbor from which the echo originated.
Message interval	The rate, in seconds, at which the neighbor is sending advertisement messages.
CDP device name	The CDP device name or the system serial number. The system serial number appears if the device name is not set or is set to the default (Switch).

This is an example of output from the **show udld neighbors** command:

```
Device# show udld neighbors
Port      Device Name      Device ID  Port-ID  OperState
-----
Gi2/0/1   Switch-A         1         Gi2/0/1  Bidirectional
Gi3/0/1   Switch-A         2         Gi3/0/1  Bidirectional
```

# switchport

To put an interface that is in Layer 3 mode into Layer 2 mode for Layer 2 configuration, use the **switchport** command in interface configuration mode. To put an interface in Layer 3 mode, use the **no** form of this command.

**switchport**  
**no switchport**

**Syntax Description** This command has no arguments or keywords.

**Command Default** By default, all interfaces are in Layer 2 mode.

**Command Modes** Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **no switchport** command (without parameters) to set the interface to the routed-interface status and to erase all Layer 2 configurations. You must use this command before assigning an IP address to a routed port.



**Note** This command is not supported on running the LAN Base feature set.

Entering the **no switchport** command shuts the port down and then reenables it, which might generate messages on the device to which the port is connected.

When you put an interface that is in Layer 2 mode into Layer 3 mode (or the reverse), the previous configuration information related to the affected interface might be lost, and the interface is returned to its default configuration.



**Note** If an interface is configured as a Layer 3 interface, you must first enter the **switchport** command to configure the interface as a Layer 2 port. Then you can enter the **switchport access vlan** and **switchport mode** commands.

The **switchport** command is not used on platforms that do not support Cisco-routed ports. All physical ports on such platforms are assumed to be Layer 2-switched interfaces.

You can verify the port status of an interface by entering the **show running-config** privileged EXEC command.

## Examples

This example shows how to cause an interface to cease operating as a Layer 2 port and become a Cisco-routed port:

```
Device(config-if)# no switchport
```

This example shows how to cause the port interface to cease operating as a Cisco-routed port and convert to a Layer 2 switched interface:

```
Device(config-if)# switchport
```

# switchport access vlan

To configure a port as a static-access port, use the **switchport access vlan** command in interface configuration mode. To reset the access mode to the default VLAN mode for the , use the **no** form of this command.

**switchport access vlan** *vlan-id*  
**no switchport access vlan**

## Syntax Description

*vlan-id* VLAN ID of the access mode VLAN; the range is 1 to 4094.

## Command Default

The default access VLAN and trunk interface native VLAN is a default VLAN corresponding to the platform or interface hardware.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The port must be in access mode before the **switchport access vlan** command can take effect.

If the switchport mode is set to **access vlan** *vlan-id*, the port operates as a member of the specified VLAN. An access port can be assigned to only one VLAN.

The **no switchport access** command resets the access mode VLAN to the appropriate default VLAN for the device.

## Examples

This example shows how to change a switched port interface that is operating in access mode to operate in VLAN 2 instead of the default VLAN:

```
Device(config-if)# switchport access vlan 2
```

# switchport mode

To configure the VLAN membership mode of a port, use the **switchport mode** command in interface configuration mode. To reset the mode to the appropriate default for the device, use the **no** form of this command.

**switchport mode access | dynamic | auto | desirable | trunk**  
**noswitchport mode access | dynamic | auto | desirable | trunk**

<b>Syntax Description</b>	<table border="1"> <tbody> <tr> <td><b>access</b></td> <td>Sets the port to access mode (either static-access or dynamic-access depending on the setting of the <b>switchport access vlan</b> interface configuration command). The port is set to access unconditionally and operates as a nontrunking, single VLAN interface that sends and receives nonencapsulated (non-tagged) frames. An access port can be assigned to only one VLAN.</td> </tr> <tr> <td><b>dynamic auto</b></td> <td>Sets the port trunking mode dynamic parameter to auto to specify that the interface convert the link to a trunk link. This is the default switchport mode.</td> </tr> <tr> <td><b>dynamic desirable</b></td> <td>Sets the port trunking mode dynamic parameter to desirable to specify that the interface actively attempt to convert the link to a trunk link.</td> </tr> <tr> <td><b>trunk</b></td> <td>Sets the port to trunk unconditionally. The port is a trunking VLAN Layer 2 interface. The port sends and receives encapsulated (tagged) frames that identify the VLAN of origination. A trunk is a point-to-point link between two or between a and a router.</td> </tr> </tbody> </table>	<b>access</b>	Sets the port to access mode (either static-access or dynamic-access depending on the setting of the <b>switchport access vlan</b> interface configuration command). The port is set to access unconditionally and operates as a nontrunking, single VLAN interface that sends and receives nonencapsulated (non-tagged) frames. An access port can be assigned to only one VLAN.	<b>dynamic auto</b>	Sets the port trunking mode dynamic parameter to auto to specify that the interface convert the link to a trunk link. This is the default switchport mode.	<b>dynamic desirable</b>	Sets the port trunking mode dynamic parameter to desirable to specify that the interface actively attempt to convert the link to a trunk link.	<b>trunk</b>	Sets the port to trunk unconditionally. The port is a trunking VLAN Layer 2 interface. The port sends and receives encapsulated (tagged) frames that identify the VLAN of origination. A trunk is a point-to-point link between two or between a and a router.
<b>access</b>	Sets the port to access mode (either static-access or dynamic-access depending on the setting of the <b>switchport access vlan</b> interface configuration command). The port is set to access unconditionally and operates as a nontrunking, single VLAN interface that sends and receives nonencapsulated (non-tagged) frames. An access port can be assigned to only one VLAN.								
<b>dynamic auto</b>	Sets the port trunking mode dynamic parameter to auto to specify that the interface convert the link to a trunk link. This is the default switchport mode.								
<b>dynamic desirable</b>	Sets the port trunking mode dynamic parameter to desirable to specify that the interface actively attempt to convert the link to a trunk link.								
<b>trunk</b>	Sets the port to trunk unconditionally. The port is a trunking VLAN Layer 2 interface. The port sends and receives encapsulated (tagged) frames that identify the VLAN of origination. A trunk is a point-to-point link between two or between a and a router.								
<b>Command Default</b>	<p>The default mode is <b>dynamic auto</b> for C9500-12Q-E, C9500-12Q-A, C9500-24Q-E, C9500-24Q-A, C9500-40X-E, and C9500-40X-A models of the Cisco Catalyst 9500 Series Switches.</p> <p>The default mode is <b>dynamic desirable</b> for C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches</p>								
<b>Command Modes</b>	Interface configuration								
<b>Command History</b>	<table border="1"> <thead> <tr> <th><b>Release</b></th> <th><b>Modification</b></th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	<b>Release</b>	<b>Modification</b>	Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Release</b>	<b>Modification</b>								
Cisco IOS XE Everest 16.5.1a	This command was introduced.								
<b>Usage Guidelines</b>	<p>A configuration that uses the <b>access</b>, or <b>trunk</b> keywords takes effect only when you configure the port in the appropriate mode by using the <b>switchport mode</b> command. The static-access and trunk configuration are saved, but only one configuration is active at a time.</p> <p>When you enter <b>access</b> mode, the interface changes to permanent nontrunking mode and negotiates to convert the link into a nontrunk link even if the neighboring interface does not agree to the change.</p> <p>When you enter <b>trunk</b> mode, the interface changes to permanent trunking mode and negotiates to convert the link into a trunk link even if the interface connecting to it does not agree to the change.</p> <p>When you enter <b>dynamic auto</b> mode, the interface converts the link to a trunk link if the neighboring interface is set to <b>trunk</b> or <b>desirable</b> mode.</p>								

When you enter **dynamic desirable** mode, the interface becomes a trunk interface if the neighboring interface is set to **trunk**, **desirable**, or **auto** mode.

To autonegotiate trunking, the interfaces must be in the same VLAN Trunking Protocol (VTP) domain. Trunk negotiation is managed by the Dynamic Trunking Protocol (DTP), which is a point-to-point protocol. However, some internetworking devices might forward DTP frames improperly, which could cause misconfigurations. To avoid this problem, configure interfaces connected to devices that do not support DTP to not forward DTP frames, which turns off DTP.

- If you do not intend to trunk across those links, use the **switchport mode access** interface configuration command to disable trunking.
- To enable trunking to a device that does not support DTP, use the **switchport mode trunk** and **switchport nonegotiate** interface configuration commands to cause the interface to become a trunk but to not generate DTP frames.

Access ports and trunk ports are mutually exclusive.

The IEEE 802.1x feature interacts with switchport modes in these ways:

- If you try to enable IEEE 802.1x on a trunk port, an error message appears, and IEEE 802.1x is not enabled. If you try to change the mode of an IEEE 802.1x-enabled port to trunk, the port mode is not changed.
- If you try to enable IEEE 802.1x on a port set to **dynamic auto** or **dynamic desirable**, an error message appears, and IEEE 802.1x is not enabled. If you try to change the mode of an IEEE 802.1x-enabled port to **dynamic auto** or **dynamic desirable**, the port mode is not changed.
- If you try to enable IEEE 802.1x on a dynamic-access (VLAN Query Protocol [VQP]) port, an error message appears, and IEEE 802.1x is not enabled. If you try to change an IEEE 802.1x-enabled port to dynamic VLAN assignment, an error message appears, and the VLAN configuration is not changed.

You can verify your settings by entering the **show interfaces interface-id switchport** privileged EXEC command and examining information in the *Administrative Mode* and *Operational Mode* rows.

## Examples

This example shows how to configure a port for access mode:

```
Device(config)# interface gigabitethernet2/0/1
Device(config-if)# switchport mode access
```

This example shows how set the port to dynamic desirable mode:

```
Device(config)# interface gigabitethernet2/0/1
Device(config-if)# switchport mode dynamic desirable
```

This example shows how to configure a port for trunk mode:

```
Device(config)# interface gigabitethernet2/0/1
Device(config-if)# switchport mode trunk
```



# switchport nonegotiate

To specify that Dynamic Trunking Protocol (DTP) negotiation packets are not sent on the Layer 2 interface, use the **switchport nonegotiate** command in interface configuration mode. Use the **no** form of this command to return to the default setting.

**switchport nonegotiate**  
**no switchport nonegotiate**

## Syntax Description

This command has no arguments or keywords.

## Command Default

The default is to use DTP negotiation to learn the trunking status.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **no switchport nonegotiate** command removes nonegotiate status.

This command is valid only when the interface switchport mode is access or trunk (configured by using the **switchport mode access** or the **switchport mode trunk** interface configuration command). This command returns an error if you attempt to execute it in dynamic (auto or desirable) mode.

Internetworking devices that do not support DTP might forward DTP frames improperly and cause misconfigurations. To avoid this problem, turn off DTP by using the **switchport nonegotiate** command to configure the interfaces connected to devices that do not support DTP to not forward DTP frames.

When you enter the **switchport nonegotiate** command, DTP negotiation packets are not sent on the interface. The device does or does not trunk according to the **mode** parameter: **access** or **trunk**.

- If you do not intend to trunk across those links, use the **switchport mode access** interface configuration command to disable trunking.
- To enable trunking on a device that does not support DTP, use the **switchport mode trunk** and **switchport nonegotiate** interface configuration commands to cause the interface to become a trunk but to not generate DTP frames.

This example shows how to cause a port to refrain from negotiating trunking mode and to act as a trunk or access port (depending on the mode set):

```
Device(config)# interface gigabitethernet2/0/1
Device(config-if)# switchport nonegotiate
```

You can verify your setting by entering the **show interfaces interface-id switchport** privileged EXEC command.

## switchport voice vlan

To configure voice VLAN on the port, use the **switchport voice vlan** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

**switchport voice vlan** {*vlan-id* | **dot1p** | **none** | **untagged** | **name** *vlan\_name*}  
**no switchport voice vlan**

Syntax Description		
<i>vlan-id</i>		The VLAN to be used for voice traffic. The range is 1 to 4094. By default, the IP phone forwards the voice traffic with an IEEE 802.1Q priority of 5.
<b>dot1p</b>		Configures the telephone to use IEEE 802.1p priority tagging and uses VLAN 0 (the native VLAN). By default, the Cisco IP phone forwards the voice traffic with an IEEE 802.1p priority of 5.
<b>none</b>		Does not instruct the IP telephone about the voice VLAN. The telephone uses the configuration from the telephone key pad.
<b>untagged</b>		Configures the telephone to send untagged voice traffic. This is the default for the telephone.
<b>name</b> <i>vlan_name</i>	(Optional)	Specifies the VLAN name to be used for voice traffic. You can enter up to 128 characters.

**Command Default** The default is not to automatically configure the telephone (**none**).  
 The telephone default is not to tag frames.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
		Option to specify a VLAN name for voice VLAN. The ' <b>name</b> ' keyword was added.

**Usage Guidelines** You should configure voice VLAN on Layer 2 access ports.

You must enable Cisco Discovery Protocol (CDP) on the switch port connected to the Cisco IP phone for the to send configuration information to the phone. CDP is enabled by default globally and on the interface.

When you enter a VLAN ID, the IP phone forwards voice traffic in IEEE 802.1Q frames, tagged with the specified VLAN ID. The puts IEEE 802.1Q voice traffic in the voice VLAN.

When you select **dot1p**, **none**, or **untagged**, the puts the indicated voice traffic in the access VLAN.

In all configurations, the voice traffic carries a Layer 2 IP precedence value. The default is 5 for voice traffic.

When you enable port security on an interface that is also configured with a voice VLAN, set the maximum allowed secure addresses on the port to 2. When the port is connected to a Cisco IP phone, the IP phone requires one MAC address. The Cisco IP phone address is learned on the voice VLAN, but not on the access

VLAN. If you connect a single PC to the Cisco IP phone, no additional MAC addresses are required. If you connect more than one PC to the Cisco IP phone, you must configure enough secure addresses to allow one for each PC and one for the Cisco IP phone.

If any type of port security is enabled on the access VLAN, dynamic port security is automatically enabled on the voice VLAN.

You cannot configure static secure MAC addresses in the voice VLAN.

The Port Fast feature is automatically enabled when voice VLAN is configured. When you disable voice VLAN, the Port Fast feature is not automatically disabled.

This example show how to first populate the VLAN database by associating a VLAN ID with a VLAN name, and then configure the VLAN (using the name) on an interface, in the access mode: You can also verify your configuration by entering the **show interfaces interface-id switchport** in privileged EXEC command and examining information in the Voice VLAN: row.

Part 1 - Making the entry in the VLAN database:

```
Device# configure terminal
Device(config)# vlan 55
Device(config-vlan)# name test
Device(config-vlan)# end
Device#
```

Part 2 - Checking the VLAN database:

```
Device# show vlan id 55
VLAN Name Status Ports
-----
55 test active
VLAN Type SAID MTU Parent RingNo BridgeNo Stp BrdgMode Trans1 Trans2
-----
55 enet 100055 1500 - - - - - 0 0
Remote SPAN VLAN
-----
Disabled
Primary Secondary Type Ports
-----
```

Part 3- Assigning VLAN to the interface by using the name of the VLAN:

```
Device# configure terminal
Device(config)# interface gigabitethernet3/1/1
Device(config-if)# switchport mode access
Device(config-if)# switchport voice vlan name test
Device(config-if)# end
Device#
```

Part 4 - Verifying configuration:

```
Device# show running-config
interface gigabitethernet3/1/1
Building configuration...
Current configuration : 113 bytes
!
interface GigabitEthernet3/1/1
switchport voice vlan 55
switchport mode access
Switch#
```

Part 5 - Also can be verified in interface switchport:

```
Device# show interface GigabitEthernet3/1/1 switchport
Name: Gi3/1/1
Switchport: Enabled
Administrative Mode: static access
Operational Mode: static access
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: native
Negotiation of Trunking: Off
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Administrative Native VLAN tagging: enabled
Voice VLAN: 55 (test)
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk Native VLAN tagging: enabled
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk associations: none
Administrative private-vlan trunk mappings: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none
Device#
```

# udld

To enable aggressive or normal mode in the UniDirectional Link Detection (UDLD) and to set the configurable message timer time, use the **udld** command in global configuration mode. To disable aggressive or normal mode UDLD on all fiber-optic ports, use the **no** form of the command.

```
udld aggressive | enable | message time message-timer-interval
no udld aggressive | enable | message
```

Syntax Description	aggressive	Enables UDLD in aggressive mode on all fiber-optic interfaces.
	<b>enable</b>	Enables UDLD in normal mode on all fiber-optic interfaces.
	<b>message time</b> <i>message-timer-interval</i>	Configures the period of time between UDLD probe messages on ports that are in the advertisement phase and are determined to be bidirectional. The range is 1 to 90 seconds. The default is 15 seconds.

**Command Default** UDLD is disabled on all interfaces.  
The message timer is set at 15 seconds.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** UDLD supports two modes of operation: normal (the default) and aggressive. In normal mode, UDLD detects unidirectional links due to misconnected interfaces on fiber-optic connections. In aggressive mode, UDLD also detects unidirectional links due to one-way traffic on fiber-optic and twisted-pair links and due to misconnected interfaces on fiber-optic links. For information about normal and aggressive modes, see the *Catalyst 2960-X Switch Layer 2 Configuration Guide* and *Catalyst 2960-XR Switch Layer 2 Configuration Guide*.

If you change the message time between probe packets, you are making a compromise between the detection speed and the CPU load. By decreasing the time, you can make the detection-response faster but increase the load on the CPU.

This command affects fiber-optic interfaces only. Use the **udld** interface configuration command to enable UDLD on other interface types.

You can use these commands to reset an interface shut down by UDLD:

- The **udld reset** privileged EXEC command to reset all interfaces shut down by UDLD.
- The **shutdown** and **no shutdown** interface configuration commands.
- The **no udld enable** global configuration command followed by the **udld {aggressive | enable}** global configuration command to reenables UDLD globally.
- The **no udld port** interface configuration command followed by the **udld port** or **udld port aggressive** interface configuration command to reenables UDLD on the specified interface.

- The **errdisable recovery cause udld** and **errdisable recovery interval** *interval* global configuration commands to automatically recover from the UDLD error-disabled state.

This example shows how to enable UDLD on all fiber-optic interfaces:

```
Device(config)# udld enable
```

You can verify your setting by entering the **show udld** privileged EXEC command.

# udld port

To enable UniDirectional Link Detection (UDLD) on an individual interface or to prevent a fiber-optic interface from being enabled by the **udld** global configuration command, use the **udld port** command in interface configuration mode. To return to the **udld** global configuration command setting or to disable UDLD if entered for a nonfiber-optic port, use the **no** form of this command.

**udld port** [**aggressive**]  
**no udld port** [**aggressive**]

## Syntax Description

**aggressive** (Optional) Enables UDLD in aggressive mode on the specified interface.

## Command Default

On fiber-optic interfaces, UDLD is disabled and fiber-optic interfaces enable UDLD according to the state of the **udld enable** or **udld aggressive** global configuration command.

On nonfiber-optic interfaces, UDLD is disabled.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

A UDLD-capable port cannot detect a unidirectional link if it is connected to a UDLD-incapable port of another .

UDLD supports two modes of operation: normal (the default) and aggressive. In normal mode, UDLD detects unidirectional links due to misconnected interfaces on fiber-optic connections. In aggressive mode, UDLD also detects unidirectional links due to one-way traffic on fiber-optic and twisted-pair links and due to misconnected interfaces on fiber-optic links.

To enable UDLD in normal mode, use the **udld port** interface configuration command. To enable UDLD in aggressive mode, use the **udld port aggressive** interface configuration command.

Use the **no udld port** command on fiber-optic ports to return control of UDLD to the **udld enable** global configuration command or to disable UDLD on nonfiber-optic ports.

Use the **udld port aggressive** command on fiber-optic ports to override the setting of the **udld enable** or **udld aggressive** global configuration command. Use the **no** form on fiber-optic ports to remove this setting and to return control of UDLD enabling to the **udld** global configuration command or to disable UDLD on nonfiber-optic ports.

You can use these commands to reset an interface shut down by UDLD:

- The **udld reset** privileged EXEC command resets all interfaces shut down by UDLD.
- The **shutdown** and **no shutdown** interface configuration commands.
- The **no udld enable** global configuration command, followed by the **udld {aggressive | enable}** global configuration command reenables UDLD globally.
- The **no udld port** interface configuration command, followed by the **udld port** or **udld port aggressive** interface configuration command reenables UDLD on the specified interface.

- The **errdisable recovery cause udld** and **errdisable recovery interval** *interval* global configuration commands automatically recover from the UDLD error-disabled state.

This example shows how to enable UDLD on an port:

```
Device(config)# interface gigabitethernet6/0/1
Device(config-if)# udld port
```

This example shows how to disable UDLD on a fiber-optic interface despite the setting of the **udld** global configuration command:

```
Device(config)# interface gigabitethernet6/0/1
Device(config-if)# no udld port
```

You can verify your settings by entering the **show running-config** or the **show udld** *interface* privileged EXEC command.



# udld reset

To reset all interfaces disabled by UniDirectional Link Detection (UDLD) and permit traffic to begin passing through them again (though other features, such as spanning tree, Port Aggregation Protocol (PAgP), and Dynamic Trunking Protocol (DTP) still have their normal effects, if enabled), use the **udld reset** command in privileged EXEC mode.

## **udld reset**

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** None

---

**Command Modes** Privileged EXEC

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

**Usage Guidelines** If the interface configuration is still enabled for UDLD, these ports begin to run UDLD again and are disabled for the same reason if the problem has not been corrected.

This example shows how to reset all interfaces disabled by UDLD:

```
Device# udld reset  
1 ports shutdown by UDLD were reset.
```





## PART **VII**

# Multiprotocol Label Switching

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## MPLS Commands

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- [mpls ip \(global configuration\)](#), on page 615
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- [mpls label protocol \(global configuration\)](#), on page 617
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## mpls ip default-route

To enable the distribution of labels associated with the IP default route, use the **mpls ip default-route** command in global configuration mode.

### mpls ip default-route

**Syntax Description** This command has no arguments or keywords.

**Command Default** No distribution of labels for the IP default route.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.1	This command was introduced.

**Usage Guidelines** Dynamic label switching (that is, distribution of labels based on routing protocols) must be enabled before you can use the **mpls ip default-route** command.

**Examples** The following example shows how to enable the distribution of labels associated with the IP default route:

```
Switch# configure terminal
Switch(config)# mpls ip
Switch(config)# mpls ip default-route
```

Related Commands	Command	Description
	<b>mpls ip</b> (global configuration)	Enables MPLS forwarding of IPv4 packets along normally routed paths for the platform.
	<b>mpls ip</b> (interface configuration)	Enables MPLS forwarding of IPv4 packets along normally routed paths for a particular interface.

## mpls ip (global configuration)

To enable Multiprotocol Label Switching (MPLS) forwarding of IPv4 and IPv6 packets along normally routed paths for the platform, use the **mpls ip** command in global configuration mode. To disable this feature, use the **no** form of this command.

**mpls ip**  
**no mpls ip**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Label switching of IPv4 and IPv6 packets along normally routed paths is enabled for the platform.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.1	This command was introduced.

**Usage Guidelines** MPLS forwarding of IPv4 and IPv6 packets along normally routed paths (sometimes called dynamic label switching) is enabled by this command. For a given interface to perform dynamic label switching, this switching function must be enabled for the interface and for the platform.

The **no** form of this command stops dynamic label switching for all platform interfaces regardless of the interface configuration; it also stops distribution of labels for dynamic label switching. However, the **no** form of this command does not affect the sending of labeled packets through label switch path (LSP) tunnels.

### Examples

The following example shows that dynamic label switching is disabled for the platform, and all label distribution is terminated for the platform:

```
Switch(config)# no mpls ip
```

Related Commands	Command	Description
	<b>mpls ip</b> (interface configuration)	Enables MPLS forwarding of IPv4 and IPv6 packets along normally routed paths for the associated interface.

## mpls ip (interface configuration)

To enable Multiprotocol Label Switching (MPLS) forwarding of IPv4 and IPv6 packets along normally routed paths for a particular interface, use the **mpls ip** command in interface configuration mode. To disable this configuration, use the **no** form of this command.

**mpls ip**  
**no mpls ip**

**Syntax Description** This command has no arguments or keywords.

**Command Default** MPLS forwarding of IPv4 and IPv6 packets along normally routed paths for the interface is disabled.

**Command Modes** Interface configuration (config-if)

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

**Usage Guidelines** MPLS forwarding of IPv4 and IPv6 packets along normally routed paths is sometimes called dynamic label switching. If dynamic label switching has been enabled for the platform when this command is issued on an interface, label distribution for the interface begins with the periodic transmission of neighbor discovery Hello messages on the interface. When the outgoing label for a destination routed through the interface is known, packets for the destination are labeled with that outgoing label and forwarded through the interface.

The **no** form of this command causes packets routed out through the interface to be sent unlabeled; this form of the command also terminates label distribution for the interface. However, the no form of the command does not affect the sending of labeled packets through any link-state packet (LSP) tunnels that might use the interface.

### Examples

The following example shows how to enable label switching on the specified Ethernet interface:

```
Switch(config)# configure terminal
Switch(config-if)# interface TenGigabitEthernet1/0/3
Switch(config-if)# mpls ip
```

The following example shows that label switching is enabled on the specified vlan interface (SVI) on a Cisco Catalyst switch:

```
Switch(config)# configure terminal
Switch(config-if)# interface vlan 1
Switch(config-if)# mpls ip
```



# mpls label protocol (global configuration)

To specify the Label Distribution Protocol (LDP) for a platform, use the **mpls label protocol** command in global configuration mode. To restore the default LDP, use the **no** form of this command.

**mpls label protocol ldp**  
**no mpls label protocol ldp**

## Syntax Description

<b>ldp</b>	Specifies that LDP is the default label distribution protocol.
------------	--

## Command Default

LDP is the default label distribution protocol.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

## Usage Guidelines

If neither the global **mpls label protocol ldp** command nor the interface **mpls label protocol ldp** command is used, all label distribution sessions use LDP.

## Examples

The following command establishes LDP as the label distribution protocol for the platform:

```
Switch(config)# mpls label protocol ldp
```

## mpls label protocol (interface configuration)

To specify the label distribution protocol for an interface, use the **mpls label protocol** command in interface configuration mode. To remove the label distribution protocol from the interface, use the **no** form of this command.

**mpls label protocol ldp**  
**no mpls label protocol ldp**

### Syntax Description

<b>ldp</b>	Specifies that the label distribution protocol (LDP) is to be used on the interface.
------------	--

### Command Default

If no protocol is explicitly configured for an interface, the label distribution protocol that was configured for the platform is used. To set the platform label distribution protocol, use the global **mpls label protocol** command.

### Command Modes

Interface configuration (config-if)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

### Usage Guidelines

To successfully establish a session for label distribution for a link connecting two label switch routers (LSRs), the link interfaces on the LSRs must be configured to use the same label distribution protocol. If there are multiple links connecting two LSRs, all of the link interfaces connecting the two LSRs must be configured to use the same protocol.

### Examples

The following example shows how to establish LDP as the label distribution protocol for the interface:

```
Switch(config-if)# mpls label protocol ldp
```

# mpls label range

To configure the range of local labels available for use with Multiprotocol Label Switching (MPLS) applications on packet interfaces, use the **mpls label range** command in global configuration mode. To revert to the platform defaults, use the **no** form of this command.

**mpls label range** *minimum-value maximum-value* [**static** *minimum-static-value maximum-static-value*]  
**no mpls label range**

Syntax Description		
<i>minimum-value</i>		The value of the smallest label allowed in the label space. The default is 16.
<i>maximum-value</i>		The value of the largest label allowed in the label space. The default is platform-dependent.
<b>static</b>		(Optional) Reserves a block of local labels for static label assignments. If you omit the <b>static</b> keyword and the <i>minimum-static-value maximum-static-value</i> arguments, no labels are reserved for static assignment.
<i>minimum-static-value</i>		(Optional) The minimum value for static label assignments. There is no default value.
<i>maximum-static-value</i>		(Optional) The maximum value for static label assignments. There is no default value.

**Command Default** The platform's default values are used.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.1	This command was introduced.

**Usage Guidelines** The labels 0 through 15 are reserved by the IETF (see RFC 3032, MPLS Label Stack Encoding, for details) and cannot be included in the range specified in the **mpls label range** command. If you enter a 0 in the command, you will get a message that indicates that the command is an unrecognized command.

The label range defined by the **mpls label range** command is used by all MPLS applications that allocate local labels (for dynamic label switching, MPLS traffic engineering, MPLS Virtual Private Networks (VPNs), and so on).

You can use label distribution protocols, such as Label Distribution Protocol (LDP), to reserve a generic range of labels from 16 through 1048575 for dynamic assignment.

You specify the optional **static** keyword, to reserve labels for static assignment. The MPLS Static Labels feature requires that you configure a range of labels for static assignment. You can configure static bindings only from the current static range. If the static range is not configured or is exhausted, then you cannot configure static bindings.

The range of label values is 16 to 4096. The maximum value defaults to 4096. You can split for static label space between say 16 to 100 and for dynamic label space between 101 to 4096.

The upper and lower minimum static label values are displayed in the help line. For example, if you configure the dynamic label with a minimum value of 16 and a maximum value of 100, the help lines display as follows:

```
Switch(config)# mpls label range 16 100 static ?
<100> Upper Minimum static label value
<16> Lower Minimum static label value
Reserved Label Range --> 0 to 15
Available Label Range --> 16 to 4096
Static Label Range --> 16 to 100
Dynamic Label Range --> 101 to 4096
```

In this example, you can configure a static range from 16 to 100.

If the lower minimum static label space is not available, the lower minimum is not displayed in the help line. For example:

```
Switch(config)# mpls label range 16 100 static ?
<16-100> static label value range
```

## Examples

The following example shows how to configure the size of the local label space. In this example, the minimum static value is set to 200, and the maximum static value is set to 4000.

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# mpls label range 200 4000
Switch(config)#
```

If you had specified a new range that overlaps the current range (for example, the new range of the minimum static value set to 16 and the maximum static value set to 1000), then the new range takes effect immediately.

The following example show how to configure a dynamic local label space with a minimum static value set to 100 and the maximum static value set to 1000 and a static label space with a minimum static value set to 16 and a maximum static value set to 99:

```
Switch(config)# mpls label range 100 1000 static 16 99
Switch(config)#
```

In the following output, the **show mpls label range** command, executed after a reload, shows that the configured range is now in effect:

```
Switch# show mpls label range
Downstream label pool: Min/Max label: 100/1000
Range for static labels: Min/Max/Number: 16/99
```

The following example shows how to restore the label range to its default value:

```
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# no mpls label range
Switch(config)# end
```

## Related Commands

Command	Description
<b>show mpls label range</b>	Displays the range of the MPLS local label space.

## mpls static binding ipv4

To bind a prefix to a local or remote label, use the **mpls static binding ipv4** command in global configuration mode. To remove the binding between the prefix and label, use the **no** form of this command.

**mpls static binding ipv4** *prefix mask label* | **input** *label* | **output** *nexthop explicit-null* | **implicit-null***label*

**no mpls static binding ipv4** *prefix mask label* | **input** *label* | **output** *nexthop explicit-null* | **implicit-null***label*

<i>prefix mask</i>	Specifies the prefix and mask to bind to a label. (When you do not use the <b>input</b> or <b>output</b> keyword, the specified label is an incoming label.)  <b>Note</b> Without the arguments, the <b>no</b> form of the command removes all static bindings.
<i>label</i>	Binds a prefix or a mask to a local (incoming) label. (When you do not use the <b>input</b> or <b>output</b> keyword, the specified label is an incoming label.)
<b>input</b> <i>label</i>	Binds the specified label to the prefix and mask as a local (incoming) label.
<b>output</b> <i>nexthop explicit-null</i>	Binds the Internet Engineering Task Force (IETF) Multiprotocol Label Switching (MPLS) IPv4 explicit null label (0) as a remote (outgoing) label.
<b>output</b> <i>nexthop implicit-null</i>	Binds the IETF MPLS implicit null label (3) as a remote (outgoing) label.
<b>output</b> <i>nexthop label</i>	Binds the specified label to the prefix/mask as a remote (outgoing) label.

### Command Default

Prefixes are not bound to local or remote labels.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **mpls static binding ipv4** command pushes bindings into Label Distribution Protocol (LDP). LDP then needs to match the binding with a route in the Routing Information Base (RIB) or Forwarding Information Base (FIB) before installing forwarding information.

The **mpls static binding ipv4** command installs the specified bindings into the LDP Label Information Base (LIB). LDP will install the binding labels for forwarding use if or when the binding prefix or mask matches a known route.

Static label bindings are not supported for local prefixes, which are connected networks, summarized routes, default routes, and supernets. These prefixes use **implicit-null** or **explicit-null** as the local label.

If you do not specify the **input** or the **output** keyword, **input** (local label) is assumed.

For the **no** form of the command:

- If you specify the command name without any keywords or arguments, all static bindings are removed.
- Specifying the prefix and mask but no label parameters removes all static bindings for that prefix or mask.

## Examples

In the following example, the **mpls static binding ipv4** command configures a static prefix and label binding before the label range is reconfigured to define a range for static assignment. The output of the command indicates that the binding has been accepted, but cannot be used for MPLS forwarding until you configure a range of labels for static assignment that includes that label.

```
Device# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# mpls static binding ipv4 10.0.0.0 255.0.0.0 55
% Specified label 55 for 10.0.0.0/8 out of configured
% range for static labels. Cannot be used for forwarding until
% range is extended.
Router(config)# end
```

The following **mpls static binding ipv4** commands configure input and output labels for several prefixes:

```
Device(config)# mpls static binding ipv4 10.0.0.0 255.0.0.0 55
Device(config)# mpls static binding ipv4 10.0.0.0 255.0.0.0 output 10.0.0.66 2607
Device(config)# mpls static binding ipv4 10.66.0.0 255.255.0.0 input 17
Device(config)# mpls static binding ipv4 10.66.0.0 255.255.0.0 output 10.13.0.8 explicit-null
Device(config)# end
```

The following **show mpls static binding ipv4** command displays the configured bindings:

```
Device# show mpls static binding ipv4

10.0.0.0/8: Incoming label: 55
Outgoing labels:
 10.0.0.66 2607
10.66.0.0/24: Incoming label: 17
Outgoing labels:
 10.13.0.8 explicit-null
```

## Related Commands

Command	Description
<b>show mpls forwarding-table</b>	Displays labels currently being used for MPLS forwarding.
<b>show mpls label range</b>	Displays statically configured label bindings.

## show mpls forwarding-table

To display the contents of the Multiprotocol Label Switching (MPLS) Label Forwarding Information Base (LFIB), use the **show mpls forwarding-table** command in user EXEC or privileged EXEC mode.



**Note** When a local label is present, the forwarding entry for IP imposition will not be showed; if you want to see the IP imposition information, use **show ip cef**.

**show mpls forwarding-table** [*network masklength*] **interface** *interface* | **labels** *label* [**dash** *label*] | **lcatm atm** *atm-interface-number* | **next-hop** *address* | **lsp-tunnel** [*tunnel-id*] [**vrf** *vrf-name*] [**detail** *slot slot-number*]

<i>network</i>	(Optional) Destination network number.
<i>mask</i>	IP address of the destination mask whose entry is to be shown.
<i>length</i>	Number of bits in the mask of the destination.
<b>interface</b> <i>interface</i>	(Optional) Displays entries with the outgoing interface specified.
<b>labels</b> <i>label-label</i>	(Optional) Displays entries with the local labels specified.
<b>lcatm atm</b> <i>atm-interface-number</i>	Displays ATM entries with the specified Label Controlled Asynchronous Transfer Mode (LCATM).
<b>next-hop</b> <i>address</i>	(Optional) Displays only entries with the specified neighbor as the next hop.
<b>lsp-tunnel</b>	(Optional) Displays only entries with the specified label switched path (LSP) tunnel, or with all LSP tunnel entries.
<i>tunnel-id</i>	(Optional) Specifies the LSP tunnel for which to display entries.
<b>vrf</b> <i>vrf-name</i>	(Optional) Displays entries with the specified VPN routing and forwarding (VRF) instance.
<b>detail</b>	(Optional) Displays information in long form (includes length of encapsulation, length of MAC string, maximum transmission unit [MTU], and all labels).
<b>slot</b> <i>slot-number</i>	(Optional) Specifies the slot number, which is always 0.

### Command Modes

User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following is sample output from the **show mpls forwarding-table** command:

```
Device# show mpls forwarding-table
Local Outgoing Prefix Bytes label Outgoing Next Hop
Label Label or VC or Tunnel Id switched interface
26 No Label 10.253.0.0/16 0 Et4/0/0 10.27.32.4
28 1/33 10.15.0.0/16 0 AT0/0.1 point2point
29 Pop Label 10.91.0.0/16 0 Hs5/0 point2point
1/36 10.91.0.0/16 0 AT0/0.1 point2point
30 32 10.250.0.97/32 0 Et4/0/2 10.92.0.7
32 10.250.0.97/32 0 Hs5/0 point2point
34 26 10.77.0.0/24 0 Et4/0/2 10.92.0.7
26 10.77.0.0/24 0 Hs5/0 point2point
35 No Label[T] 10.100.100.101/32 0 Tu301 point2point
36 Pop Label 10.1.0.0/16 0 Hs5/0 point2point
1/37 10.1.0.0/16 0 AT0/0.1 point2point
[T] Forwarding through a TSP tunnel.
View additional labeling info with the 'detail' option
```

The following is sample output from the **show mpls forwarding-table** command when the IPv6 Provider Edge Router over MPLS feature is configured to allow IPv6 traffic to be transported across an IPv4 MPLS backbone. The labels are aggregated because there are several prefixes for one local label, and the prefix column contains “IPv6” instead of a target prefix.

```
Device# show mpls forwarding-table
Local Outgoing Prefix Bytes label Outgoing Next Hop
Label Label or VC or Tunnel Id switched interface
16 Aggregate IPv6 0
17 Aggregate IPv6 0
18 Aggregate IPv6 0
19 Pop Label 192.168.99.64/30 0 Se0/0 point2point
20 Pop Label 192.168.99.70/32 0 Se0/0 point2point
21 Pop Label 192.168.99.200/32 0 Se0/0 point2point
22 Aggregate IPv6 5424
23 Aggregate IPv6 3576
24 Aggregate IPv6 2600
```

The following is sample output from the **show mpls forwarding-table detail** command. If the MPLS EXP level is used as a selection criterion for packet forwarding, a bundle adjacency exp (vcd) field is included in the display. This field includes the EXP value and the corresponding virtual circuit descriptor (VCD) in parentheses. The line in the output that reads “No output feature configured” indicates that the MPLS egress NetFlow accounting feature is not enabled on the outgoing interface for this prefix.

```
Device# show mpls forwarding-table detail
Local Outgoing Prefix Bytes label Outgoing Next Hop
label label or VC or Tunnel Id switched interface
16 Pop label 10.0.0.6/32 0 AT1/0.1 point2point
Bundle adjacency exp(vcd)
0(1) 1(1) 2(1) 3(1) 4(1) 5(1) 6(1) 7(1)
MAC/Encaps=12/12, MTU=4474, label Stack{}
00010000AAAA030000008847
No output feature configured
```



```

17 18 10.0.0.9/32 0 AT1/0.1 point2point
Bundle adjacency exp(vcd)
0(1) 1(1) 2(1) 3(1) 4(1) 5(1) 6(1) 7(1)
MAC/Encaps=12/16, MTU=4470, label Stack{18}
00010000AAAA030000008847 00012000
No output feature configured
18 19 10.0.0.10/32 0 AT1/0.1 point2point
Bundle adjacency exp(vcd)
0(1) 1(1) 2(1) 3(1) 4(1) 5(1) 6(1) 7(1)
MAC/Encaps=12/16, MTU=4470, label Stack{19}
00010000AAAA030000008847 00013000
No output feature configured
19 17 10.0.0.0/8 0 AT1/0.1 point2point
Bundle adjacency exp(vcd)
0(1) 1(1) 2(1) 3(1) 4(1) 5(1) 6(1) 7(1)
MAC/Encaps=12/16, MTU=4470, label Stack{17}
00010000AAAA030000008847 00011000
No output feature configured
20 20 10.0.0.0/8 0 AT1/0.1 point2point
Bundle adjacency exp(vcd)
0(1) 1(1) 2(1) 3(1) 4(1) 5(1) 6(1) 7(1)
MAC/Encaps=12/16, MTU=4470, label Stack{20}
00010000AAAA030000008847 00014000
No output feature configured
21 Pop label 10.0.0.0/24 0 AT1/0.1 point2point
Bundle adjacency exp(vcd)
0(1) 1(1) 2(1) 3(1) 4(1) 5(1) 6(1) 7(1)
MAC/Encaps=12/12, MTU=4474, label Stack{}
00010000AAAA030000008847
No output feature configured
22 Pop label 10.0.0.4/32 0 Et2/3 10.0.0.4
MAC/Encaps=14/14, MTU=1504, label Stack{}
000427AD10430005DDFE043B8847
No output feature configured

```

The following is sample output from the **show mpls forwarding-table detail** command. In this example, the MPLS egress NetFlow accounting feature is enabled on the first three prefixes, as indicated by the line in the output that reads “Feature Quick flag set.”

```

Device# show mpls forwarding-table detail
Local  Outgoing  Prefix          Bytes label  Outgoing  Next Hop
label  label or VC  or Tunnel Id   switched     interface
16  Aggregate  10.0.0.0/8[V]  0
MAC/Encaps=0/0, MTU=0, label Stack{}
VPN route: vpn1
Feature Quick flag set
Per-packet load-sharing, slots: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
17  No label   10.0.0.0/8[V]  0           Et0/0/2    10.0.0.1
MAC/Encaps=0/0, MTU=1500, label Stack{}
VPN route: vpn1
Feature Quick flag set
Per-packet load-sharing, slots: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
18  No label   10.42.42.42/32[V]  4185       Et0/0/2    10.0.0.1
MAC/Encaps=0/0, MTU=1500, label Stack{}
VPN route: vpn1
Feature Quick flag set
Per-packet load-sharing, slots: 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
19  2/33      10.41.41.41/32   0           AT1/0/0.1  point2point
MAC/Encaps=4/8, MTU=4470, label Stack{2/33(vcd=2)}
00028847 00002000
No output feature configured

```

The table below describes the significant fields shown in the displays.

**Table 93: show mpls forwarding-table Field Descriptions**

Field	Description
Local label	Label assigned by this device.
Outgoing Label or VC <b>Note</b> This field is not supported on the Cisco 10000 series routers.	Label assigned by the next hop or the virtual path identifier (VPI)/virtual channel identifier (VCI) used to get to next hop. The entries in this column are the following: <ul style="list-style-type: none"> <li>• [T]--Forwarding is through an LSP tunnel.</li> <li>• No Label--There is no label for the destination from the next hop or label switching is not enabled on the outgoing interface.</li> <li>• Pop Label--The next hop advertised an implicit NULL label for the destination and the device removed the top label.</li> <li>• Aggregate--There are several prefixes for one local label. This entry is used when IPv6 is configured on edge devices to transport IPv6 traffic over an IPv4 MPLS network.</li> </ul>
Prefix or Tunnel Id	Address or tunnel to which packets with this label are sent. <b>Note</b> If IPv6 is configured on edge devices to transport IPv6 traffic over an IPv4 MPLS network, "IPv6" is displayed here. <ul style="list-style-type: none"> <li>• [V]--The corresponding prefix is in a VRF.</li> </ul>
Bytes label switched	Number of bytes switched with this incoming label. This includes the outgoing label and Layer 2 header.
Outgoing interface	Interface through which packets with this label are sent.
Next Hop	IP address of the neighbor that assigned the outgoing label.
Bundle adjacency exp(vcd)	Bundle adjacency information. Includes the MPLS EXP value and the corresponding VCD.
MAC/Encaps	Length in bytes of the Layer 2 header and length in bytes of the packet encapsulation, including the Layer 2 header and label header.
MTU	MTU of the labeled packet.
label Stack	All the outgoing labels. If the outgoing interface is transmission convergence (TC)-ATM, the VCD is also shown. <b>Note</b> TC-ATM is not supported on Cisco 10000 series routers.
00010000AAAA030000008847 00013000	The actual encapsulation in hexadecimal form. A space is shown between Layer 2 and the label header.

### Explicit-Null Label Example

The following is sample output, including the explicit-null label = 0 (commented in bold), for the **show mpls forwarding-table** command on a CSC-PE device:

```
Device# show mpls forwarding-table
Local  Outgoing  Prefix          Bytes label  Outgoing  Next Hop
label  label or VC or Tunnel Id    switched     interface
17     Pop label  10.10.0.0/32    0             Et2/0     10.10.0.1
18     Pop label  10.10.10.0/24   0             Et2/0     10.10.0.1
19     Aggregate 10.10.20.0/24[V] 0
20     Pop label  10.10.200.1/32[V] 0             Et2/1     10.10.10.1
21     Aggregate 10.10.1.1/32[V]  0
22     0          192.168.101.101/32[V] \
                                0             Et2/1     192.168.101.101
23     0          192.168.101.100/32[V] \
                                0             Et2/1     192.168.101.100
25     0          192.168.102.125/32[V] 0             Et2/1     192.168.102.125 !outlabel
value 0
```

The table below describes the significant fields shown in the display.

**Table 94: show mpls forwarding-table Field Descriptions**

Field	Description
Local label	Label assigned by this device.
Outgoing label or VC	Label assigned by the next hop or VPI/VCI used to get to the next hop. The entries in this column are the following: <ul style="list-style-type: none"> <li>• [T]--Forwarding is through an LSP tunnel.</li> <li>• No label--There is no label for the destination from the next hop or that label switching is not enabled on the outgoing interface.</li> <li>• Pop label--The next hop advertised an implicit NULL label for the destination and that this device popped the top label.</li> <li>• Aggregate--There are several prefixes for one local label. This entry is used when IPv6 is configured on edge devices to transport IPv6 traffic over an IPv4 MPLS network.</li> <li>• 0--The explicit null label value = 0.</li> </ul>
Prefix or Tunnel Id	Address or tunnel to which packets with this label are sent. <p><b>Note</b> If IPv6 is configured on edge devices to transport IPv6 traffic over an IPv4 MPLS network, IPv6 is displayed here.</p> <ul style="list-style-type: none"> <li>• [V]--Means that the corresponding prefix is in a VRF.</li> </ul>
Bytes label switched	Number of bytes switched with this incoming label. This includes the outgoing label and Layer 2 header.
Outgoing interface	Interface through which packets with this label are sent.

Field	Description
Next Hop	IP address of the neighbor that assigned the outgoing label.

### Cisco IOS Software Modularity: MPLS Layer 3 VPNs Example

The following is sample output from the **show mpls forwarding-table** command:

```

Device# show mpls forwarding-table
Local      Outgoing  Prefix          Bytes Label  Outgoing  Next Hop
Label      Label     or Tunnel Id   Switched     interface
16         Pop Label IPv4 VRF[V]    62951000    aggregate/v1
17   [H]   No Label  10.1.1.0/24    0           AT1/0/0.1 point2point
          No Label  10.1.1.0/24    0           PO3/1/0 point2point
          [T]   No Label  10.1.1.0/24    0           Tu1 point2point
18   [HT]  Pop Label 10.0.0.3/32    0           Tu1 point2point
19   [H]   No Label  10.0.0.0/8     0           AT1/0/0.1 point2point
          No Label  10.0.0.0/8     0           PO3/1/0 point2point
20   [H]   No Label  10.0.0.0/8     0           AT1/0/0.1 point2point
          No Label  10.0.0.0/8     0           PO3/1/0 point2point
21   [H]   No Label  10.0.0.1/32    812        AT1/0/0.1 point2point
          No Label  10.0.0.1/32    0           PO3/1/0 point2point
22   [H]   No Label  10.1.14.0/24   0           AT1/0/0.1 point2point
          No Label  10.1.14.0/24   0           PO3/1/0 point2point
23   [HT]  16       172.1.1.0/24[V] 0           Tu1 point2point
24   [HT]  24       10.0.0.1/32[V]  0           Tu1 point2point
25   [H]   No Label  10.0.0.0/8[V]  0           AT1/1/0.1 point2point
26   [HT]  16       10.0.0.3/32[V]  0           Tu1 point2point
27   [H]   No Label  10.0.0.1/32[V]  0           AT1/1/0.1 point2point
[T]       Forwarding through a TSP tunnel.
          View additional labelling info with the 'detail' option
[H]       Local label is being held down temporarily.

```

The table below describes the Local Label fields relating to the Cisco IOS Software Modularity: MPLS Layer 3 VPNs feature.

Table 95: show mpls forwarding-table Field Descriptions

Field	Description
Local Label	<p>Label assigned by this device.</p> <ul style="list-style-type: none"> <li>• [H]--Local labels are in holddown, which means that the application that requested the labels no longer needs them and stops advertising them to its labeling peers.</li> </ul> <p>The label's forwarding-table entry is deleted after a short, application-specific time.</p> <p>If any application starts advertising a held-down label to its labeling peers, the label could come out of holddown.</p> <p><b>Note</b> [H] is not shown if labels are held down globally.</p> <p>A label enters global holddown after a stateful switchover or a restart of certain processes in a Cisco IOS modularity environment.</p> <ul style="list-style-type: none"> <li>• [T]--The label is forwarded through an LSP tunnel.</li> </ul> <p><b>Note</b> Although [T] is still a property of the outgoing interface, it is shown in the Local Label column.</p> <ul style="list-style-type: none"> <li>• [HT]--Both conditions apply.</li> </ul>

### L2VPN Inter-AS Option B: Example

The following is sample output from the **show mpls forwarding-table interface** command. In this example, the pseudowire identifier (that is, 4096) is displayed in the Prefix or Tunnel Id column. The **show mpls l2transport vc detail** command can be used to obtain more information about the specific pseudowire displayed.

```
Device# show mpls forwarding-table
Local      Outgoing  Prefix          Bytes Label    Outgoing  Next Hop
Label      Label    or Tunnel Id   Switched       interface
1011      No Label  l2ckt(4096)    0              none       point2point
```

The table below describes the fields shown in the display.

Table 96: show mpls forwarding-table interface Field Descriptions

Field	Description
Local Label	Label assigned by this device.
Outgoing Label	Label assigned by the next hop or virtual path identifier (VPI)/virtual channel identifier (VCI) used to get to the next hop.
Prefix or Tunnel Id	Address or tunnel to which packets with this label are going.
Bytes Label Switched	Number of bytes switched with this incoming label. This includes the outgoing label and Layer 2 header.

<b>Field</b>	<b>Description</b>
Outgoing interface	Interface through which packets with this label are sent.
Next Hop	IP address of the neighbor that assigned the outgoing label.

# show mpls label range

To display the range of local labels available for use on packet interfaces, use the `show mpls label range` command in privileged EXEC mode.

**show mpls label range**

## Syntax Description

This command has no arguments or keywords.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

## Usage Guidelines

You can use the **mpls label range** command to configure a range for local labels that is different from the default range. The **show mpls label range** command displays both the label range currently in use and the label range that will be in use following the next switch reload.

## Examples

In the following example, the use of the **show mpls label range** command is shown before and after the **mpls label range** command is used to configure a label range that does not overlap the starting label range:

```
Switch# show mpls label range
Downstream label pool: Min/Max label: 16/100
Switch# configure terminal
Switch(config)# mpls label range 101 4000
Switch(config)# exit
Switch# show mpls label range
Downstream label pool: Min/Max label: 101/4000
```

## Related Commands

Command	Description
<b>mpls label range</b>	Configures a range of values for use as local labels.

# show mpls static binding

To display Multiprotocol Label Switching (MPLS) static label bindings, use the **show mpls static binding** command in privileged EXEC mode.

**show mpls static binding**[**ipv4** [**vrf** *vrf-name*]][*prefixmask-lengthmask*][**local** | **remote**][**nexthop** *address*]

Syntax Description		
<b>ipv4</b>	(Optional) Displays IPv4 static label bindings.	
<b>vrf</b> <i>vrf-name</i>	(Optional) The static label bindings for a specified VPN routing and forwarding instance.	
<i>prefix</i> { <i>mask-length</i> / <i>mask</i> }	(Optional) Labels for a specific prefix.	
<b>local</b>	(Optional) Displays the incoming (local) static label bindings.	
<b>remote</b>	(Optional) Displays the outgoing (remote) static label bindings.	
<b>nexthop</b> <i>address</i>	(Optional) Displays the label bindings for prefixes with outgoing labels for which the specified next hop is to be displayed.	

## Command Modes

Privileged EXEC (#)

## Command History

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

If you do not specify any optional arguments, the **show mpls static binding** command displays information about all static label bindings. Or the information can be limited to any of the following:

- Bindings for a specific prefix or mask
- Local (incoming) labels
- Remote (outgoing) labels
- Outgoing labels for a specific next hop router

## Examples

In the following output, the **show mpls static binding ipv4** command with no optional arguments displays all static label bindings:

```
Device# show mpls static binding ipv4
10.0.0.0/8: Incoming label: none;
  Outgoing labels:
    10.13.0.8          explicit-null
10.0.0.0/8: Incoming label: 55 (in LIB)
  Outgoing labels:
    10.0.0.66          2607
```



```
10.66.0.0/16: Incoming label: 17 (in LIB)
Outgoing labels: None
```

In the following output, the **show mpls static binding ipv4** command displays remote (outgoing) statically assigned labels only:

```
Device# show mpls static binding ipv4 remote
10.0.0.0/8:
  Outgoing labels:
    10.13.0.8          explicit-null
10.0.0.0/8:
  Outgoing labels:
    10.0.0.66          2607
```

In the following output, the **show mpls static binding ipv4** command displays local (incoming) statically assigned labels only:

```
Device# show mpls static binding ipv4 local
10.0.0.0/8: Incoming label: 55 (in LIB)
10.66.0.0/16: Incoming label: 17 (in LIB)
```

In the following output, the **show mpls static binding ipv4** command displays statically assigned labels for prefix 10.0.0.0 / 8 only:

```
Device# show mpls static binding ipv4 10.0.0.0/8
10.0.0.0/8: Incoming label: 55 (in LIB)
  Outgoing labels:
    10.0.0.66          2607
```

In the following output, the **show mpls static binding ipv4** command displays prefixes with statically assigned outgoing labels for next hop 10.0.0.66:

```
Device# show mpls static binding ipv4 10.0.0.0 8 nexthop 10.0.0.66
10.0.0.0/8: Incoming label: 55 (in LIB)
  Outgoing labels:
    10.0.0.66          2607
```

The following output, the **show mpls static binding ipv4 vrf** command displays static label bindings for a VPN routing and forwarding instance vpn100:

```
Device# show mpls static binding ipv4 vrf vpn100
192.168.2.2/32: (vrf: vpn100) Incoming label: 100020
Outgoing labels: None
192.168.0.29/32: Incoming label: 100003 (in LIB)
Outgoing labels: None
```

#### Related Commands

Command	Description
<b>mpls static binding ipv4</b>	Binds an IPv4 prefix or mask to a local or remote label.

# show mpls static crossconnect

To display statically configured Label Forwarding Information Database (LFIB) entries, use the **show mpls static crossconnect** command in privileged EXEC mode.

**show mpls static crossconnect** [*low label* [*high label*]]

## Syntax Description

<i>low label high label</i>	(Optional) The statically configured LFIB entries.
-----------------------------	--

## Command Modes

Privileged EXEC (#)

## Command History

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

If you do not specify any label arguments, then all the configured static cross-connects are displayed.

## Examples

The following sample output from the **show mpls static crossconnect** command shows the local and remote labels:

```
Device# show mpls static crossconnect
Local  Outgoing  Outgoing  Next Hop
label  label      interface
45     46         pos5/0    point2point
```

The table below describes the significant fields shown in the display.

**Table 97: show mpls static crossconnect Field Descriptions**

Field	Description
Local label	Label assigned by this router.
Outgoing label	Label assigned by the next hop.
Outgoing interface	Interface through which packets with this label are sent.
Next Hop	IP address of the next hop router's interface that is connected to this router's outgoing interface.

## Related Commands

Command	Description
<b>mpls static crossconnect</b>	Configures an LFIB entry for the specified incoming label and outgoing interface.



## Multicast VPN Commands

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- [ip multicast mroute-filter](#), on page 637
- [ip ospf network](#), on page 638
- [mdt data](#), on page 640
- [mdt default](#), on page 642
- [mdt log-reuse](#), on page 644
- [ip pim nbma-mode](#), on page 645
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- [show ip pim mdt bgp](#), on page 647
- [show ip pim mdt history](#), on page 648
- [show ip pim mdt receive](#), on page 649
- [show ip pim mdt send](#), on page 651
- [tunnel mode gre multipoint](#), on page 652

## ip multicast-routing

To enable IP multicast routing, use the **ip multicast-routing** command in global configuration mode. To disable IP multicast routing, use the **no** form of this command.

```
ip multicast-routing [vrf vrf-name]
no ip multicast-routing [vrf vrf-name]
```

### Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Enables IP multicast routing for the Multicast VPN routing and forwarding (MVRP) instance specified for the <i>vrf-name</i> argument.
----------------------------	--

### Command Default

IP multicast routing is disabled.

### Command Modes

Global configuration (config).

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.2	This command was introduced.

### Usage Guidelines

When IP multicast routing is disabled, the Cisco IOS software does not forward any multicast packets.



#### Note

For IP multicast, after enabling IP multicast routing, PIM must be configured on all interfaces. Disabling IP multicast routing does not remove PIM; PIM still must be explicitly removed from the interface configurations.

### Examples

The following example shows how to enable IP multicast routing:

```
Switch(config)# ip multicast-routing
```

The following example shows how to enable IP multicast routing on a specific VRF:

```
Switch(config)#
ip multicast-routing vrf vrf1
```

The following example shows how to disable IP multicast routing:

```
Switch(config)#
no ip multicast-routing
```

The following example shows how to enable MDS in Cisco IOS XE Release 3.3S a specific VRF:

```
Switch(config)#
ip multicast-routing vrf vrf1
```

### Related Commands

Command	Description
<b>ip pim</b>	Enables PIM on an interface.

## ip multicast mrimfo-filter

To filter multicast router information (mrimfo) request packets, use the **ip multicast mrimfo-filter** command in global configuration mode. To remove the filter on mrimfo requests, use the **no** form of this command.

```
ip multicast [vrf vrf-name] mrimfo-filter access-list
no ip multicast [vrf vrf-name] mrimfo-filter
```

Syntax Description	Parameter	Description
	<b>vrf</b>	(Optional) Supports the multicast VPN routing and forwarding (VRF) instance.
	<i>vrf-name</i>	(Optional) Name assigned to the VRF.
	<i>access-list</i>	IP standard numbered or named access list that determines which networks or hosts can query the local multicast device with the <b>mrimfo</b> command.

**Command Default** No default behavior or values

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.2	This command was introduced.

**Usage Guidelines** The **ip multicast mrimfo-filter** command filters the mrimfo request packets from all of the sources denied by the specified access list. That is, if the access list denies a source, that source's mrimfo requests are filtered. mrimfo requests from any sources permitted by the ACL are allowed to proceed.

**Examples** The following example shows how to filter mrimfo request packets from all hosts on network 192.168.1.1 while allowing requests from any other hosts:

```
ip multicast mrimfo-filter 51
access-list 51 deny 192.168.1.1
access list 51 permit any
```

Related Commands	Command	Description
	<b>mrimfo</b>	Queries a multicast device about which neighboring multicast devices are peering with it.

## ip ospf network

To configure the Open Shortest Path First (OSPF) network type to a type other than the default for a given medium, use the **ip ospf network** command in interface configuration mode. To return to the default value, use the **no** form of this command.

**ip ospf network broadcast | non-broadcast | point-to-multipoint [non-broadcast] | point-to-point**  
**no ip ospf network**

### Syntax Description

<b>broadcast</b>	Sets the network type to broadcast.
<b>non-broadcast</b>	Sets the network type to nonbroadcast multiaccess (NBMA).
<b>point-to-multipoint non-broadcast</b>	Sets the network type to point-to-multipoint. The optional <b>non-broadcast</b> keyword sets the point-to-multipoint network to be nonbroadcast. If you use the <b>non-broadcast</b> keyword, the <b>neighbor</b> command is required.
<b>point-to-point</b>	Sets the network type to point-to-point.

### Command Default

Depends on the network type.

### Command Modes

Interface configuration (config-if)

Virtual network interface (config-if-vnet)

### Command History

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

### Usage Guidelines

Using this feature, you can configure broadcast networks as NBMA networks when, for example, routers in your network do not support multicast addressing. You can also configure nonbroadcast multiaccess networks (such as X.25, Frame Relay, and Switched Multimegabit Data Service (SMDS)) as broadcast networks. This feature saves you from needing to configure neighbors.

Configuring NBMA networks as either broadcast or nonbroadcast assumes that there are virtual circuits from every router to every router or fully meshed networks. However, there are other configurations where this assumption is not true. For example, a partially meshed network. In these cases, you can configure the OSPF network type as a point-to-multipoint network. Routing between two routers that are not directly connected will go through the router that has virtual circuits to both routers. You need not configure neighbors when using this feature.

If this command is issued on an interface that does not allow it, this command will be ignored.

OSPF has two features related to point-to-multipoint networks. One feature applies to broadcast networks; the other feature applies to nonbroadcast networks:

- On point-to-multipoint, broadcast networks, you can use the **neighbor** command, and you must specify a cost to that neighbor.
- On point-to-multipoint, nonbroadcast networks, you must use the **neighbor** command to identify neighbors. Assigning a cost to a neighbor is optional.

## Examples

The following example sets your OSPF network as a broadcast network:

```
Device(config)# interface serial 0
Device(config-if)# ip address 192.168.77.17 255.255.255.0
Device(config-if)# ip ospf network broadcast
Device(config-if)# encapsulation frame-relay
```

The following example illustrates a point-to-multipoint network with broadcast:

```
Device(config)# interface serial 0
Device(config-if)# ip address 10.0.1.1 255.255.255.0
Device(config-if)# encapsulation frame-relay
Device(config-if)# ip ospf cost 100
Device(config-if)# ip ospf network point-to-multipoint
Device(config-if)# frame-relay map ip 10.0.1.3 202 broadcast
Device(config-if)# frame-relay map ip 10.0.1.4 203 broadcast
Device(config-if)# frame-relay map ip 10.0.1.5 204 broadcast
Device(config-if)# frame-relay local-dlci 200
!
Device(config-if)# router ospf 1
Device(config-if)# network 10.0.1.0 0.0.0.255 area 0
Device(config-if)# neighbor 10.0.1.5 cost 5
Device(config-if)# neighbor 10.0.1.4 cost 10
```

## Related Commands

Command	Description
<b>frame-relay map</b>	Defines mapping between a destination protocol address and the DLCI used to connect to the destination address.
<b>neighbor (OSPF)</b>	Configures OSPF routers interconnecting to nonbroadcast networks.
<b>x25 map</b>	Sets up the LAN protocols-to-remote host mapping.

## mdt data

To specify a range of addresses to be used in the data multicast distribution tree (MDT) pool, use the **mdt data** command in VRF configuration or VRF address family configuration mode. To disable this function, use the **no** form of this command.

**mdt data threshold** *kb/s*

**no mdt data threshold** *kb/s*

### Syntax Description

<b>threshold</b> <i>kb/s</i>	(Optional) Defines the bandwidth threshold value in kilobits per second (kb/s). The range is from 1 to 4294967.
------------------------------	---

### Command Default

A data MDT pool is not configured.

### Command Modes

VRF address family configuration (config-vrf-af)

VRF configuration (config-vrf)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.2	This command was introduced.

### Usage Guidelines

A data MDT can include a maximum of 256 multicast groups per MVPN. Multicast groups used to create the data MDT are dynamically chosen from a pool of configured IP addresses.

Use the **mdt data** command to specify a range of addresses to be used in the data MDT pool. The threshold is specified in kb/s. Using the optional **list** keyword and *access-list* argument, you can define the (S, G) MVPN entries to be used in a data MDT pool, which would further limit the creation of a data MDT pool to the particular (S, G) MVPN entries defined in the access list specified for the *access-list* argument.

You can access the **mdt data** command by using the **ip vrf** global configuration command. You can also access the **mdt data** command by using the **vrf definition** global configuration command followed by the **address-family ipv4** VRF configuration command.

### Examples

The following example shows how to configure the range of group addresses for the MDT data pool. A threshold of 500 kb/s has been set, which means that if a multicast stream exceeds 1 kb/s, then a data MDT is created.

```
ip vrf vrf1
 rd 1000:1
  route-target export 10:27
  route-target import 10:27
  mdt default 236.1.1.1
  mdt data 228.0.0.0 0.0.0.127 threshold 500 list 101
!
.
.
.
!
ip pim ssm default
```



```
ip pim vrf vrf1 accept-rp auto-rp
!
```

**Related Commands**

Command	Description
<b>mdt default</b>	Configures a default MDT group for a VPN VRF.

## mdt default

To configure a default multicast distribution tree (MDT) group for a Virtual Private Network (VPN) routing and forwarding (VRF) instance, use the **mdt default** command in VRF configuration or VRF address family configuration mode. To disable this function, use the **no** form of this command.

**mdt default** *group-address*  
**no mdt default** *group-address*

### Syntax Description

<i>group-address</i>	IP address of the default MDT group. This address serves as an identifier for the community in that provider edge (PE) devices configured with the same group address become members of the group, allowing them to receive packets sent by each other.
----------------------	---

### Command Default

The command is disabled.

### Command Modes

VRF address family configuration (config-vrf-af) VRF configuration (config-vrf)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.2	This command was introduced.

### Usage Guidelines

The default MDT group must be the same group configured on all PE devices that belong to the same VPN.

If Source Specific Multicast (SSM) is used as the protocol for the default MDT, the source IP address will be the address used to source the Border Gateway Protocol (BGP) sessions.

A tunnel interface is created as a result of this command. By default, the destination address of the tunnel header is the *group-address* argument.

You can access the **mdt default** command by using the **ip vrf** global configuration command. You can also access the **mdt default** command by using the **vrf definition** global configuration command followed by the **address-family ipv4** VRF configuration command.

### Examples

In the following example, Protocol Independent Multicast (PIM) SSM is configured in the backbone. Therefore, the default and data MDT groups are configured within the SSM range of IP addresses. Inside the VPN, PIM sparse mode (PIM-SM) is configured and only Auto-RP announcements are accepted.

```
ip vrf vrf1
 rd 1000:1
  mdt default 236.1.1.1
  mdt data 228.0.0.0 0.0.0.127 threshold 50
  mdt data threshold 50
  route-target export 1000:1
  route-target import 1000:1
!
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>mdt data</b>	Configures the multicast group address range for data MDT groups.

# mdt log-reuse

To enable the recording of data multicast distribution tree (MDT) reuse, use the **mdt log-reuse** command in VRF configuration or in VRF address family configuration mode. To disable this function, use the **no** form of this command.

**mdt log-reuse**  
**no mdt log-reuse**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The command is disabled.

**Command Modes** VRF address family configuration (config-vrf-af) VRF configuration (config-vrf)

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.2	This command was introduced.

**Usage Guidelines** The **mdt log-reuse** command generates a syslog message whenever a data MDT is reused.

You can access the **mdt log-reuse** command by using the **ip vrf** global configuration command. You can also access the **mdt log-reuse** command by using the **vrf definition** global configuration command followed by the **address-family ipv4** VRF configuration command.

## Examples

The following example shows how to enable MDT log reuse:

```
mdt log-reuse
```

Related Commands	Command	Description
	<b>mdt data</b>	Configures the multicast group address range for data MDT groups.
	<b>mdt default</b>	Configures a default MDT group for a VPN VRF.

## ip pim nbma-mode

To configure a multiaccess WAN interface to be in nonbroadcast multiaccess (NBMA) mode, use the **ip pim nbma-mode** command in interface configuration mode. To disable this function, use the **no** form of this command.

```
ip pim nbma-mode
no ip pim nbma-mode
```

**Syntax Description** This command has no arguments or keywords.

**Command Default** The command is disabled.

**Command Modes** Interface configuration (config-if)  
Virtual network interface (config-if-vnet)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines** Use this command on Frame Relay, Switched Multimegabit Data Service (SMDS), or ATM only, especially when these media do not have native multicast available. Do not use this command on multicast-capable LANs such as Ethernet or FDDI.

When this command is configured, each Protocol Independent Multicast (PIM) join message is tracked in the outgoing interface list of a multicast routing table entry. Therefore, only PIM WAN neighbors that have joined for the group will get packets sent as data-link unicasts. This command should only be used when the **ip pim sparse-mode** command is configured on the interface. This command is not recommended for LANs that have natural multicast capabilities.

### Examples

The following example configures an interface to be in NBMA mode:

```
Device(config-if)# ip pim nbma-mode
```

Related Commands	Command	Description
	<b>ip pim</b>	Enables PIM on an interface.

# ip pim sparse-mode

To configure a multiaccess WAN interface to be in sparse mode, use the **ip pim sparse-mode** command in interface configuration mode. To disable this function, use the **no** form of this command.

**ip pim sparse-mode**  
**no ip pim sparse-mode**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The command is disabled.

**Command Modes** Interface configuration (config-if)  
 Virtual network interface (config-if-vnet)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines** When this command is configured on all interfaces, any existing groups running in sparse mode will continue to operate in sparse mode but will use an RP address set to 0.0.0.0. Multicast entries with an RP address set to 0.0.0.0 will exhibit the following behavior:

- Existing (S, G) states will be maintained.
- No PIM Join or Prune messages for (\*, G) or (S, G, RPbit) are sent.
- Received (\*, G) or (S, G, RPbit) Joins or Prune messages are ignored.
- No registers are sent and traffic at the first hop is dropped.
- Received registers are answered with register stop.
- Asserts are unchanged.
- The (\*, G) outgoing interface list (olist) is maintained only for the Internet Group Management Protocol (IGMP) state.
- Multicast Source Discovery Protocol (MSDP) source active (SA) messages for RP 0.0.0.0 groups are still accepted and forwarded.

## Examples

The following example configures an interface to be in sparse mode:

```
Device(config-if) # ip pim sparse-mode
```

Related Commands	Command	Description
	<b>ip pim</b>	Enables PIM on an interface.

# show ip pim mdt bgp

To show details about the Border Gateway Protocol (BGP) advertisement of the route distinguisher (RD) for the multicast distribution tree (MDT) default group, use the `show ip pim mdt bgp` command in user EXEC or privileged EXEC mode.

**show ip pim** [*vrf vrf-name*] **mdt bgp**

## Syntax Description

<b>vrf</b> <i>vrf-name</i>	(Optional) Displays information about the BGP advertisement of the RD for the MDT default group associated with Multicast Virtual Private Network (MVPN) routing and forwarding (MVRF) instance specified for the <i>vrf-name</i> argument.
----------------------------	---

## Command Modes

User EXEC Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Denali 16.3.2	This command was introduced.

## Usage Guidelines

Use this command to show detailed BGP advertisement of the RD for the MDT default group.

## Examples

The following is sample output from the `show ip pim mdt bgp` command:

```
Device# show ip pim mdt bgp
MDT-default group 232.2.1.4
  rid:10.1.1.1 next_hop:10.1.1.1
```

The table below describes the significant fields shown in the display.

**Table 98: show ip pim mdt bgp Field Descriptions**

Field	Description
MDT-default group	The MDT default groups that have been advertised to this router.
rid:10.1.1.1	The BGP router ID of the advertising router.
next_hop:10.1.1.1	The BGP next hop address that was contained in the advertisement.

# show ip pim mdt history

To display information about the history of data multicast distribution tree (MDT) groups that have been reused, use the **show ip pim mdt history** command in privileged EXEC mode.

**show ip pim vrf** *vrf-name* **mdt history interval** *minutes*

Syntax Description	Parameter	Description
	<b>vrf</b> <i>vrf-name</i>	Displays the history of data MDT groups that have been reused for the Multicast VPN (MVPN) routing and forwarding (MVRF) instance specified for the <i>vrf-name</i> argument.
	<b>interval</b> <i>minutes</i>	Specifies the interval (in minutes) for which to display information about the history of data MDT groups that have been reused. The range is from 1 to 71512 minutes (7 weeks).

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.2	This command was introduced.

**Usage Guidelines** The output of the **show ip pim mdt history** command displays the history of reused MDT data groups for the interval specified with the **interval** keyword and *minutes* argument. The interval is from the past to the present, that is, from the time specified for the *minutes* argument to the time at which the command is issued.

## Examples

The following is sample output from the **show ip pim mdt history** command:

```
Device# show ip pim vrf vrf1 mdt history interval 20
MDT-data send history for VRF - vrf1 for the past 20 minutes
MDT-data group      Number of reuse
 10.9.9.8            3
 10.9.9.9            2
```

The table below describes the significant fields shown in the display.

**Table 99: show ip pim mdt history Field Descriptions**

Field	Description
MDT-data group	The MDT data group for which information is being shown.
Number of reuse	The number of data MDTs that have been reused in this group.



# show ip pim mdt receive

To display the data multicast distribution tree (MDT) group mappings received from other provider edge (PE) routers, use the **show ip pim mdt receive** command in privileged EXEC mode.

**show ip pim vrf *vrf-name* mdt receive [detail]**

Syntax Description	Field	Description
	<b>vrf</b> <i>vrf-name</i>	Displays the data MDT group mappings for the Multicast VPN (MVPN) routing and forwarding (MVRF) instance specified for the <i>vrf-name</i> argument.
	<b>detail</b>	(Optional) Provides a detailed description of the data MDT advertisements received.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.2	This command was introduced.

**Usage Guidelines** When a router wants to switch over from the default MDT to a data MDT, it advertises the VRF source, the group pair, and the global multicast address over which the traffic will be sent. If the remote router wants to receive this data, then it will join this global address multicast group.

## Examples

The following is sample output from the **show ip pim mdt receive** command using the **detail** keyword for further information:

```
Device# show ip pim vrf vpn8 mdt receive detail
Joined MDT-data groups for VRF:vpn8
group:172.16.8.0 source:10.0.0.100 ref_count:13
(10.101.8.10, 225.1.8.1), 1d13h/00:03:28/00:02:26, OIF count:1, flags:TY
(10.102.8.10, 225.1.8.1), 1d13h/00:03:28/00:02:27, OIF count:1, flags:TY
```

The table below describes the significant fields shown in the display.

**Table 100: show ip pim mdt receive Field Descriptions**

Field	Description
group:172.16.8.0	Group that caused the data MDT to be built.
source:10.0.0.100	VRF source that caused the data MDT to be built.
ref_count:13	Number of (S, G) pairs that are reusing this data MDT.
OIF count:1	Number of interfaces out of which this multicast data is being forwarded.

Field	Description
flags:	<p>Information about the entry.</p> <ul style="list-style-type: none"> <li>• A--candidate Multicast Source Discovery Protocol (MSDP) advertisement</li> <li>• B--bidirectional group</li> <li>• D--dense</li> <li>• C--connected</li> <li>• F--register flag</li> <li>• I--received source-specific host report</li> <li>• J--join shortest path source tree (SPT)</li> <li>• L--local</li> <li>• M--MSDP created entry</li> <li>• P--pruned</li> <li>• R--RP bit set</li> <li>• S--sparse</li> <li>• s--Source Specific Multicast (SSM) group</li> <li>• T--SPT bit set</li> <li>• X--proxy join timer running</li> <li>• U--URL Rendezvous Directory (URD)</li> <li>• Y--joined MDT data group</li> <li>• y--sending to MDT data group</li> <li>• Z--multicast tunnel</li> </ul>

# show ip pim mdt send

To display the data multicast distribution tree (MDT) groups in use, use the **show ip pim mdt send** command in privileged EXEC mode.

**show ip pim vrf vrf-name mdt send**

<b>Syntax Description</b>	<b>vrf vrf-name</b>	Displays the data MDT groups in use by the Multicast VPN (MVPN) routing and forwarding (MVRF) instance specified for the <i>vrf-name</i> argument.
---------------------------	---------------------	--

**Command Modes** Privileged EXEC

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Denali 16.3.2	This command was introduced.

**Usage Guidelines** Use this command to show the data MDT groups in use by a specified MVRF.

## Examples

The following is sample output from the **show ip pim mdt send** command:

```
Device# show ip pim vrf vpn8 mdt send
MDT-data send list for VRF:vpn8
 (source, group)                MDT-data group    ref_count
(10.100.8.10, 225.1.8.1)        232.2.8.0         1
(10.100.8.10, 225.1.8.2)        232.2.8.1         1
(10.100.8.10, 225.1.8.3)        232.2.8.2         1
(10.100.8.10, 225.1.8.4)        232.2.8.3         1
(10.100.8.10, 225.1.8.5)        232.2.8.4         1
(10.100.8.10, 225.1.8.6)        232.2.8.5         1
(10.100.8.10, 225.1.8.7)        232.2.8.6         1
(10.100.8.10, 225.1.8.8)        232.2.8.7         1
(10.100.8.10, 225.1.8.9)        232.2.8.8         1
(10.100.8.10, 225.1.8.10)       232.2.8.9         1
```

The table below describes the significant fields shown in the display.

**Table 101: show ip pim mdt send Field Descriptions**

Field	Description
source, group	Source and group addresses that this router has switched over to data MDTs.
MDT-data group	Multicast address over which these data MDTs are being sent.
ref_count	Number of (S, G) pairs that are reusing this data MDT.

# tunnel mode gre multipoint

To set the global encapsulation mode on all roaming interfaces of a mobile device to multipoint generic routing encapsulation (GRE), use the **tunnel mode gre multipoint** command in mobile device configuration mode. To restore the global default encapsulation mode, use the **no** form of this command.

**tunnel mode gre multipoint**  
**no tunnel mode gre multipoint**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The default encapsulation mode for Mobile IP is IP-in-IP encapsulation.

**Command Modes** Interface configuration (config-if)

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines** Use this command to configure multipoint GRE as the tunnel mode.

The **no tunnel mode gre multipoint** command instructs the mobile device to revert to the default and register with IP-in-IP encapsulation.

**Examples** The following example configures multipoint GRE as the tunnel mode:

```
Device(config-if)# tunnel mode gre multipoint
```



# PART **VIII**

## **Network Management**

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## Network Management Commands

---

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## description (ERSPAN)

To describe an Encapsulated Remote Switched Port Analyzer (ERSPAN) source session, use the **description** command in ERSPAN monitor source session configuration mode. To remove a description, use the **no** form of this command.

**description** *description*  
**no description**

---

**Syntax Description**      *description* Describes the properties for this session.

---



---

**Command Default**      Description is not configured.

---

**Command Modes**      ERSPAN monitor source session configuration mode (config-mon-erspan-src)

---

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.1	This command was introduced.

---



---

**Usage Guidelines**      The *description* argument can be up to 240 characters.

---

**Examples**      The following example shows how to describe an ERSPAN source session:

```
Switch(config)# monitor session 2 type erspan-source
Switch(config-mon-erspan-src)# description source1
```

---

Related Commands	Command	Description
	<b>monitor session type erspan-source</b>	Configures a local ERSPAN source session.

## destination (ERSPAN)

To configure an Encapsulated Remote Switched Port Analyzer (ERSPAN) source session destination and specify destination properties, use the **destination** command in ERSPAN monitor source session configuration mode. To remove a destination session, use the **no** form of this command.

**destination**  
**no destination**

<b>Syntax Description</b>	This command has no arguments or keywords.				
<b>Command Default</b>	A source session destination is not configured.				
<b>Command Modes</b>	ERSPAN monitor source session configuration mode (config-mon-erspan-src)				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Denali 16.3.1</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Denali 16.3.1	This command was introduced.
Release	Modification				
Cisco IOS XE Denali 16.3.1	This command was introduced.				

**Usage Guidelines** ERSPAN traffic is GRE-encapsulated SPAN traffic that can only be processed by an ERSPAN destination session.

All ERSPAN source session (maximum 8) destination IP address need not be same. Enter the **ip address** command to configure the IP address for the ERSPAN destination sessions.

The ERSPAN source session destination IP address, which is configured on an interface on the destination switch, is the source of traffic that an ERSPAN destination session sends to destination ports. Configure the same address in both the source and destination sessions with the **ip address** command.

### Examples

The following example shows how to configure an ERSPAN source session destination and enter the ERSPAN monitor destination session configuration mode to specify the destination properties:

```
Switch(config)# monitor session 2 type erspan-source
Switch(config-mon-erspan-src)# destination
Switch(config-mon-erspan-src-dst)# ip address 10.1.1.1
Switch(config-mon-erspan-src-dst)#
```

The following sample output from the **show monitor session all** displays different IP addresses for source session destinations:

```
Switch# show monitor session all

Session 1
-----
Type : ERSPAN Source Session
Status : Admin Disabled
Description : session1
Destination IP Address : 10.1.1.1

Session 2
-----
Type : ERSPAN Source Session
```

```
Status : Admin Disabled
Description : session2
Destination IP Address : 192.0.2.1
```

```
Session 3
-----
Type : ERSPAN Source Session
Status : Admin Disabled
Description : session3
Destination IP Address : 198.51.100.1
```

```
Session 4
-----
Type : ERSPAN Source Session
Status : Admin Disabled
Description : session4
Destination IP Address : 203.0.113.1
```

```
Session 5
-----
Type : ERSPAN Source Session
Status : Admin Disabled
Description : session5
Destination IP Address : 209.165.200.225
```

**Related Commands**

Command	Description
<b>erspan-id</b>	Configures the ID used by the destination session to identify the ERSPAN traffic.
<b>ip ttl</b>	Configures TTL values for packets in the ERSPAN traffic.
<b>monitor session type erspan-source</b>	Configures a local ERSPAN source session.
<b>origin</b>	Configures an IP address used as the source of the ERSPAN traffic.

# erspan-id

To configure the ID used by the destination session to identify the Encapsulated Remote Switched Port Analyzer (ERSPAN) traffic, use the **erspan-id** command in ERSPAN monitor destination session configuration mode. To remove the configuration, use the **no** form of this command.

```
erspan-id erspan-ID
no erspan-id erspan-ID
```

<b>Syntax Description</b>	<i>erspan-id</i> ERSPAN ID used by the destination session. Valid values are from 1 to 1023.
---------------------------	--

<b>Command Default</b>	ERSPAN IDs for destination sessions are not configured.
------------------------	---

<b>Command Modes</b>	ERSPAN monitor destination session configuration mode (config-mon-erspan-src-dst)
----------------------	---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following example shows how to configure an ERSPAN ID for a destination session:

```
Switch(config)# monitor session 2 type erspan-source
Switch(config-mon-erspan-src)# destination
Switch(config-mon-erspan-src-dst)# erspan-id 3
```

## Related Commands

<b>Command</b>	<b>Description</b>
<b>destination</b>	Configures an ERSPAN destination session and specifies destination properties.
<b>monitor session type erspan-source</b>	Configures a local ERSPAN source session.

# event manager applet

To register an applet with the Embedded Event Manager (EEM) and to enter applet configuration mode, use the **event manager applet** command in global configuration mode. To unregister the applet, use the **no** form of this command.

```
event manager applet applet-name [authorization bypass] [class class-options] [trap]
no event manager applet applet-name [authorization bypass] [class class-options] [trap]
```

Syntax Description	
<i>applet-name</i>	Name of the applet file.
<b>authorization</b>	(Optional) Specifies AAA authorization type for applet.
<b>bypass</b>	(Optional) Specifies EEM AAA authorization type bypass.
<b>class</b>	(Optional) Specifies the EEM policy class.
<i>class-options</i>	(Optional) The EEM policy class. You can specify either one of the following: <ul style="list-style-type: none"> <li>• <i>class-letter-</i> Letter from A to Z that identifies each policy class. You can specify any one <i>class-letter</i>.</li> <li>• <b>default</b> --Specifies the policies registered with the default class.</li> </ul>
<b>trap</b>	(Optional) Generates a Simple Network Management Protocol (SNMP) trap when the policy is triggered.

**Command Default** No EEM applets are registered.

**Command Modes** Global configuration (config)

## Command History

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** An EEM applet is a concise method for defining event screening criteria and the actions to be taken when that event occurs.

Only one event configuration command is allowed within an applet configuration. When applet configuration submode is exited and no event command is present, a warning is displayed stating that no event is associated with this applet. If no event is specified, this applet is not considered registered and the applet is not displayed. When no action is associated with this applet, events are still triggered but no actions are performed. Multiple action applet configuration commands are allowed within an applet configuration. Use the **show event manager policy registered** command to display a list of registered applets.

Before modifying an EEM applet, use the **no** form of this command to unregister the applet because the existing applet is not replaced until you exit applet configuration mode. While you are in applet configuration mode modifying the applet, the existing applet may be executing. When you exit applet configuration mode, the old applet is unregistered and the new version is registered.



**Note** Do not attempt making any partial modification. EEM does not support partial changes to already registered policies. EEM policy has to be always unregistered before registering again with changes.

Action configuration commands are uniquely identified using the *label* argument, which can be any string value. Actions are sorted in ascending alphanumeric key sequence using the *label* argument as the sort key and are run using this sequence.

The EEM schedules and runs policies on the basis of an event specification that is contained within the policy itself. When applet configuration mode is exited, EEM examines the event and action commands that are entered and registers the applet to be run when a specified event occurs.

The EEM policies will be assigned a class when **class** *class-letter* is specified when they are registered. EEM policies registered without a class will be assigned to the **default** class. Threads that have **default** as the class will service the default class when the thread is available for work. Threads that are assigned specific class letters will service any policy with a matching class letter when the thread is available for work.

If there is no EEM execution thread available to run the policy in the specified class and a scheduler rule for the class is configured, the policy will wait until a thread of that class is available for execution. Synchronous policies that are triggered from the same input event should be scheduled in the same execution thread. Policies will be queued in a separate queue for each class using the `queue_priority` as the queuing order.

When a policy is triggered and if AAA is configured it will contact the AAA server for authorization. Using the **authorization bypass** keyword combination, you can skip to contact the AAA server and run the policy immediately. EEM stores AAA bypassed policy names in a list. This list is checked when policies are triggered. If a match is found, AAA authorization is bypassed.

To avoid authorization for commands configured through the EEM policy, EEM will use named method lists, which AAA provides. These named method lists can be configured to have no command authorization.

The following is a sample AAA configuration.

This configuration assumes a TACACS+ server at 192.168.10.1 port 10000. If the TACACS+ server is not enabled, configuration commands are permitted on the console; however, EEM policy and applet CLI interactions will fail.

```
enable password lab
aaa new-model
tacacs-server host 128.107.164.152 port 10000
tacacs-server key cisco
aaa authentication login consoleline none
aaa authorization exec consoleline none
aaa authorization commands 1 consoleline none
aaa authorization commands 15 consoleline none
line con 0
  exec-timeout 0 0
  login authentication consoleline
aaa authentication login default group tacacs+ enable
aaa authorization exec default group tacacs+
aaa authorization commands 1 default group tacacs+
aaa authorization commands 15 default group tacacs+
```

The **authorization**, **class** and **trap** keywords can be used in any combination.

## Examples

The following example shows an EEM applet called IPSLAping1 being registered to run when there is an exact match on the value of a specified SNMP object ID that represents a successful IP SLA

ICMP echo operation (this is equivalent to a **ping** command). Four actions are triggered when the echo operation fails, and event monitoring is disabled until after the second failure. A message that the ICMP echo operation to a server failed is sent to syslog, an SNMP trap is generated, EEM publishes an application-specific event, and a counter called IPSLA1F is incremented by a value of one.

```
Router(config)# event manager applet IPSLAping1
Router(config-applet)# event snmp oid 1.3.6.1.4.1.9.9.42.1.2.9.1.6.4 get-type exact
entry-op eq entry-val 1 exit-op eq exit-val 2 poll-interval 5
Router(config-applet)# action 1.0 syslog priority critical msg "Server IP echo failed:
OID=$_snmp_oid_val"
Router(config-applet)# action 1.1 snmp-trap strdata "EEM detected server reachability
failure to 10.1.88.9"
Router(config-applet)# action 1.2 publish-event sub-system 88000101 type 1 arg1 10.1.88.9
arg2 IPSLAEcho arg3 fail
Router(config-applet)# action 1.3 counter name _IPSLA1F value 1 op inc
```

The following example shows how to register an applet with the name one and class A and enter applet configuration mode where the timer event detector is set to trigger an event every 10 seconds. When the event is triggered, the **action syslog** command writes the message “hello world” to syslog.

```
Router(config)# event manager applet one class A
Router(config-applet)# event timer watchdog time 10
Router(config-applet)# action syslog syslog msg "hello world"
Router(config-applet)# exit
```

The following example shows how to bypass the AAA authorization when registering an applet with the name one and class A.

```
Router(config)# event manager applet one class A authorization bypass
Router(config-applet)#
```

#### Related Commands

Command	Description
<b>show event manager policy registered</b>	Displays registered EEM policies.

## filter (ERSPAN)

To configure the Encapsulated Remote Switched Port Analyzer (ERSPAN) source VLAN filtering when the ERSPAN source is a trunk port, use the **filter** command in ERSPAN monitor source session configuration mode. To remove the configuration, use the **no** form of this command.

```
filter ip access-group standard-access-list extended-access-list acl-name | ipv6 access-group acl-name
| mac access-group acl-name | vlan vlan-id [,] [-]
no filter ip [access-group | [standard-access-list extended-access-list acl-name]] | ipv6 [access-group]
| mac [access-group] | vlan vlan-id [,] [-]
```

Syntax Description		
<b>ip</b>		Specifies the IP access control rules.
<b>access-group</b>		Specifies an access control group.
<i>standard-access-list</i>		Standard IP access list.
<i>extended-access-list</i>		Extended IP access list.
<i>acl-name</i>		Access list name.
<b>ipv6</b>		Specifies the IPv6 access control rules.
<b>mac</b>		Specifies the media access control (MAC) rules.
<b>vlan</b> <i>vlan-ID</i>		Specifies the ERSPAN source VLAN. Valid values are from 1 to 4094.
,		(Optional) Specifies another VLAN.
-		(Optional) Specifies a range of VLANs.

**Command Default** Source VLAN filtering is not configured.

**Command Modes** ERSPAN monitor source session configuration mode (config-mon-erspan-src)

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.1	This command was introduced.

**Usage Guidelines** You cannot include source VLANs and filter VLANs in the same session.

When you configure the **filter** command on a monitored trunk interface, only traffic on that set of specified VLANs is monitored.

**Examples** The following example shows how to configure source VLAN filtering:

```
Device(config)# monitor session 2 type erspan-source
Device(config-mon-erspan-src)# filter vlan 3
```



**Related Commands**

Command	Description
<b>monitor session type erspan-source</b>	Configures a local ERSPAN source session.

## ip ttl (ERSPAN)

To configure Time to Live (TTL) values for packets in the Encapsulated Remote Switched Port Analyzer (ERSPAN) traffic, use the **ip ttl** command in ERSPAN monitor destination session configuration mode. To remove the TTL values, use the **no** form of this command,

```
ip ttl ttl-value
no ip ttl ttl-value
```

<b>Syntax Description</b>	<i>ttl-value</i> TTL value. Valid values are from 2 to 255.
---------------------------	---

<b>Command Default</b>	TTL value is set as 255.
------------------------	--------------------------

<b>Command Modes</b>	ERSPAN monitor destination session configuration mode (config-mon-erspan-src-dst)
----------------------	---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Denali 16.3.1	This command was introduced.

### Examples

The following example shows how to configure TTL value for ERSPAN traffic:

```
Switch(config)# monitor session 2 type erspan-source
Switch(config-mon-erspan-src)# destination
Switch(config-mon-erspan-src-dst)# ip ttl 32
```

### Related Commands

<b>Command</b>	<b>Description</b>
<b>destination</b>	Configures an ERSPAN destination session and specifies destination properties.
<b>monitor session type erspan-source</b>	Configures a local ERSPAN source session.

## ip wccp

To enable the web cache service, and specify the service number that corresponds to a dynamic service that is defined by the application engine, use the **ip wccp** global configuration command on the . Use the **no** form of this command to disable the service.

```
ip wccp {web-cache | service-number} [group-address groupaddress] [group-list access-list]
[redirect-list access-list] [password encryption-number password]
no ip wccp {web-cache | service-number} [group-address groupaddress] [group-list access-list]
[redirect-list access-list] [password encryption-number password]
```

Syntax Description		
<b>web-cache</b>		Specifies the web-cache service (WCCP Version 1 and Version 2).
<i>service-number</i>		Dynamic service identifier, which means the service definition is dictated by the cache. The dynamic service number can be from 0 to 254. The maximum number of services is 256, which includes the web-cache service specified with the <b>web-cache</b> keyword.
<b>group-address</b> <i>groupaddress</i>		(Optional) Specifies the multicast group address used by the and the application engines to participate in the service group.
<b>group-list</b> <i>access-list</i>		(Optional) If a multicast group address is not used, specifies a list of valid IP addresses that correspond to the application engines that are participating in the service group.
<b>redirect-list</b> <i>access-list</i>		(Optional) Specifies the redirect service for specific hosts or specific packets from hosts.
<b>password</b> <i>encryption-number</i> <i>password</i>		(Optional) Specifies an encryption number. The range is 0 to 7. Use 0 for not encrypted, and use 7 for proprietary. Also, specifies a password name up to seven characters in length. The combines the password with the MD5 authentication value to create security for the connection between the and the application engine. By default, no password is configured, and no authentication is performed.

**Command Default** WCCP services are not enabled on the device.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** WCCP transparent caching bypasses Network Address Translation (NAT) when Cisco Express Forwarding switching is enabled. To work around this situation, configure WCCP transparent caching in the outgoing direction, enable Cisco Express Forwarding switching on the content engine interface, and specify the **ip wccp web-cache redirect out** command. Configure WCCP in the incoming direction on the inside interface by specifying the **ip wccp redirect exclude in** command on the router interface facing the cache. This configuration prevents the redirection of any packets arriving on that interface.

You can also include a redirect list when configuring a service group. The specified redirect list will deny packets with a NAT (source) IP address and prevent redirection.

This command instructs a to enable or disable support for the specified service number or the web-cache service name. A service number can be from 0 to 254. Once the service number or name is enabled, the router can participate in the establishment of a service group.

When the **no ip wccp** command is entered, the terminates participation in the service group, deallocates space if none of the interfaces still have the service configured, and terminates the WCCP task if no other services are configured.

The keywords following the **web-cache** keyword and the *service-number* argument are optional and may be specified in any order, but only may be specified once.

### Example

The following example configures a web cache, the interface connected to the application engine or the server, and the interface connected to the client:

```
Device(config)# ip wccp web-cache
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# no switchport
Device(config-if)# ip address 172.20.10.30 255.255.255.0
Device(config-if)# no shutdown
Device(config-if)# exit
Device(config)# interface gigabitethernet1/0/2
Device(config-if)# no switchport
Device(config-if)#
*Dec 6 13:11:29.507: %LINK-3-UPDOWN: Interface GigabitEthernet1/0/3, changed state to down

Device(config-if)# ip address 175.20.20.10 255.255.255.0
Device(config-if)# no shutdown
Device(config-if)# ip wccp web-cache redirect in
Device(config-if)# ip wccp web-cache group-listen
Device(config-if)# exit
```

## monitor capture (interface/control plane)

To configure monitor capture points specifying an attachment point and the packet flow direction or add more attachment points to a capture point, use the **monitor capture** command in privileged EXEC mode. To disable the monitor capture with the specified attachment point and the packet flow direction or disable one of multiple attachment points on a capture point, use the **no** form of this command.

**monitor capture** {*capture-name*} {**interface** *interface-type interface-id* | **control-plane**} {**in** | **out** | **both**}

**no monitor capture** {*capture-name*} {**interface** *interface-type interface-id* | **control-plane**} {**in** | **out** | **both**}

Syntax Description		
	<i>capture-name</i>	The name of the capture to be defined.
	<b>interface</b> <i>interface-type interface-id</i>	Specifies an interface with <i>interface-type</i> and <i>interface-id</i> as an attachment point. The arguments have these meanings:
	<b>control-plane</b>	Specifies the control plane as an attachment point.
	<b>in</b>   <b>out</b>   <b>both</b>	Specifies the traffic direction to be captured.

**Command Default** A Wireshark capture is not configured.

**Command Modes** Privileged EXEC

Command History	Release	Modification
		This command was introduced.

**Usage Guidelines** Once an attachment point has been associated with a capture point using this command, the only way to change its direction is to remove the attachment point using the **no** form of the command and reattach the attachment point with the new direction. An attachment point's direction cannot be overridden.

If an attachment point is removed from a capture point and only one attachment point is associated with it, the capture point is effectively deleted.

Multiple attachment points can be associated with a capture point by re-running this command with another attachment point. An example is provided below.

Packets captured in the output direction of an interface might not reflect the changes made by switch rewrite (includes TTL, VLAN tag, CoS, checksum, MAC addresses, DSCP, precedent, UP, etc.).

No specific order applies when defining a capture point; you can define capture point parameters in any order. The Wireshark CLI allows as many parameters as possible on a single line. This limits the number of commands required to define a capture point.

Neither VRFs, management ports, nor private VLANs can be used as attachment points.

Wireshark cannot capture packets on a destination SPAN port.

When a VLAN is used as a Wireshark attachment point, packets are captured in the input direction only.

## Examples

To define a capture point using a physical interface as an attachment point:

```
Device# monitor capture mycap interface GigabitEthernet1/0/1 in
Device# monitor capture mycap match ipv4 any any
```




---

**Note** The second command defines the core filter for the capture point. This is required for a functioning capture point.

---

To define a capture point with multiple attachment points:

```
Device# monitor capture mycap interface GigabitEthernet1/0/1 in
Device# monitor capture mycap match ipv4 any any
Device# monitor capture mycap control-plane in
Device# show monitor capture mycap parameter
    monitor capture mycap interface GigabitEthernet1/0/1 in
    monitor capture mycap control-plane in
```

To remove an attachment point from a capture point defined with multiple attachment points:

```
Device# show monitor capture mycap parameter
    monitor capture mycap interface GigabitEthernet1/0/1 in
    monitor capture mycap control-plane in
Device# no monitor capture mycap control-plane
Device# show monitor capture mycap parameter
    monitor capture mycap interface GigabitEthernet1/0/1 in
```

# monitor capture buffer

To configure the buffer for monitor capture (WireShark), use the **monitor capture buffer** command in privileged EXEC mode. To disable the monitor capture buffer or change the buffer back to a default linear buffer from a circular buffer, use the **no** form of this command.

```
monitor capture {capture-name} buffer {circular [size buffer-size ] | size buffer-size}
no monitor capture {capture-name} buffer [circular ]
```

<b>Syntax Description</b>	<i>capture-name</i>	The name of the capture whose buffer is to be configured.
	<b>circular</b>	Specifies that the buffer is of a circular type. The circular type of buffer continues to capture data, even after the buffer is consumed, by overwriting the data captured previously.
	<b>size</b> <i>buffer-size</i>	(Optional) Specifies the size of the buffer. The range is from 1 MB to 100 MB.
<b>Command Default</b>	A linear buffer is configured.	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.
<b>Usage Guidelines</b>	When you first configure a WireShark capture, a circular buffer of a small size is suggested.	

## Example

To configure a circular buffer with a size of 1 MB:

```
Device# monitor capture mycap buffer circular size 1
```

# monitor capture clear

To clear the monitor capture (WireShark) buffer, use the **monitor capture clear** command in privileged EXEC mode.

**monitor capture** {*capture-name*} **clear**

<b>Syntax Description</b>	<i>capture-name</i> The name of the capture whose buffer is to be cleared.
---------------------------	--

<b>Command Default</b>	The buffer content is not cleared.
------------------------	------------------------------------

<b>Command Modes</b>	Privileged EXEC
----------------------	-----------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.

<b>Usage Guidelines</b>	Use the <b>monitor capture clear</b> command either during capture or after the capture has stopped either because one or more end conditions has been met, or you entered the <b>monitor capture stop</b> command. If you enter the <b>monitor capture clear</b> command after the capture has stopped, the <b>monitor capture export</b> command that is used to store the contents of the captured packets in a file will have no impact because the buffer has no captured packets.
-------------------------	---

If you have more than one capture that is storing packets in a buffer, clear the buffer before starting a new capture to avoid memory loss.

## Example

To clear the buffer contents for capture mycap:

```
Device# monitor capture mycap clear
```



# monitor capture export

To export a monitor capture (WireShark) to a file, use the **monitor capture export** command in privileged EXEC mode.

```
monitor capture {capture-name} export file-location : file-name
```

<b>Syntax Description</b>	<i>capture-name</i>	The name of the capture to be exported.
	<i>file-location</i> : <i>file-name</i>	(Optional) Specifies the location and file name of the capture storage file. Acceptable values for <i>file-location</i> : <ul style="list-style-type: none"> <li>• flash—On-board flash storage</li> <li>• — USB drive</li> </ul>

**Command Default** The captured packets are not stored.

**Command Modes** Privileged EXEC

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.

**Usage Guidelines** Use the **monitor capture export** command only when the storage destination is a capture buffer. The file may be stored either remotely or locally. Use this command either during capture or after the packet capture has stopped. The packet capture is stopped when one or more end conditions have been met or you entered the **monitor capture stop** command.

When WireShark is used on switches in a stack, packet captures can be stored only on the devices specified for *file-location* above that are connected to the active switch. Example: flash1 is connected to the active switch. flash2 is connected to the secondary switch. Only flash1 can be used to store packet captures.



**Note** Attempts to store packet captures on unsupported devices or devices not connected to the active switch will probably result in errors.

## Example

To export the capture buffer contents to mycap.pcap on a flash drive:

# monitor capture file

To configure monitor capture (WireShark) storage file attributes, use the **monitor capture file** command in privileged EXEC mode. To remove a storage file attribute, use the **no** form of this command.

```
monitor capture {capture-name} file{ [ buffer-size temp-buffer-size ] [ location file-location :  
file-name ] [ ring number-of-ring-files ] [ size total-size ] }  
no monitor capture {capture-name} file{ [ buffer-size ] [ location ] [ ring ] [ size ] }
```

## Syntax Description

<b>capture-name</b>	The name of the capture to be modified.
<b>buffer-size</b> <i>temp-buffer-size</i>	(Optional) Specifies the size of the temporary buffer. The range for <i>temp-buffer-size</i> is 1 to 100 MB. This is specified to reduce packet loss.
<b>location</b> <i>file-location</i> : <i>file-name</i>	(Optional) Specifies the location and file name of the capture storage file. Acceptable values for <i>file-location</i> : <ul style="list-style-type: none"> <li>• flash—On-board flash storage</li> <li>• — USB drive</li> </ul>
<b>ring</b> <i>number-of-ring-files</i>	(Optional) Specifies that the capture is to be stored in a circular file chain and the number of files in the file ring.
<b>size</b> <i>total-size</i>	(Optional) Specifies the total size of the capture files.

## Command Default

None

## Command Modes

Privileged EXEC

## Command History

### Release

### Modification

This command was introduced.

## Usage Guidelines

Use the **monitor capture file** command only when the storage destination is a file. The file may be stored either remotely or locally. Use this command after the packet capture has stopped. The packet capture is stopped when one or more end conditions have been met or you entered the **monitor capture stop** command.

When WireShark is used on switches in a stack, packet captures can be stored only on the devices specified for *file-location* above that are connected to the active switch. Example: flash1 is connected to the active switch. flash2 is connected to the secondary switch. Only flash1 can be used to store packet captures.



### Note

Attempts to store packet captures on unsupported devices or devices not connected to the active switch will probably result in errors.

**Example**

To specify that the storage file name is mycap.pcap, stored on a flash drive:

```
Device# monitor capture mycap file location flash:mycap.pcap
```

## monitor capture limit

To configure capture limits, use the **monitor capture limit** command in privileged EXEC mode. To remove the capture limits, use the **no** form of this command.

**monitor capture** {*capture-name*} **limit** { [**duration** *seconds*] [**packet-length** *size*] [**packets** *num*] }  
**no monitor capture** {*capture-name*} **limit** [**duration**] [**packet-length**] [**packets**]

### Syntax Description

<i>capture-name</i>	The name of the capture to be assigned capture limits.
<b>duration</b> <i>seconds</i>	(Optional) Specifies the duration of the capture, in seconds. The range is from 1 to 1000000.
<b>packet-length</b> <i>size</i>	(Optional) Specifies the packet length, in bytes. If the actual packet is longer than the specified length, only the first set of bytes whose number is denoted by the bytes argument is stored.
<b>packets</b> <i>num</i>	(Optional) Specifies the number of packets to be processed for capture.

### Command Default

Capture limits are not configured.

### Command Modes

Privileged EXEC

### Command History

Release	Modification
	This command was introduced.

### Example

To configure a session limit of 60 seconds and a packet segment length of 400 bytes:

```
Device# monitor capture mycap limit duration 60 packet-len 400
```

# monitor capture match

To define an explicit inline core filter for a monitor (Wireshark) capture, use the **monitor capture match** command in privileged EXEC mode. To remove this filter, use the **no** form of this command.

```
monitor capture {capture-name} match {any | mac mac-match-string | ipv4 {any | host | protocol}{any | host} | ipv6 {any | host | protocol}{any | host}}
no monitor capture {capture-name} match
```

Syntax Description		
	<i>capture-name</i>	The name of the capture to be assigned a core filter.
	<b>any</b>	Specifies all packets.
	<b>mac</b> <i>mac-match-string</i>	Specifies a Layer 2 packet.
	<b>ipv4</b>	Specifies IPv4 packets.
	<b>host</b>	Specifies the host.
	<b>protocol</b>	Specifies the protocol.
	<b>ipv6</b>	Specifies IPv6 packets.

**Command Default** A core filter is not configured.

**Command Modes** Privileged EXEC

Command History	Release	Modification
		This command was introduced.

## Examples

To define a capture point and the core filter for the capture point that matches to any IP version 4 packets on the source or destination:

```
Device# monitor capture mycap interface GigabitEthernet1/0/1 in
Device# monitor capture mycap match ipv4 any any
```

## monitor capture start

To start the capture of packet data at a traffic trace point into a buffer, use the **monitor capture start** command in privileged EXEC mode.

**monitor capture** {*capture-name*} **start**

<b>Syntax Description</b>	<i>capture-name</i> The name of the capture to be started.
---------------------------	--

<b>Command Default</b>	The buffer content is not cleared.
------------------------	------------------------------------

<b>Command Modes</b>	Privileged EXEC
----------------------	-----------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.

<b>Usage Guidelines</b>	Use the <b>monitor capture clear</b> command to enable the packet data capture after the capture point is defined. To stop the capture of packet data, use the <b>monitor capture stop</b> command.
-------------------------	---

Ensure that system resources such as CPU and memory are available before starting a capture.

### Example

To start capturing buffer contents:

```
Device# monitor capture mycap start
```

# monitor capture stop

To stop the capture of packet data at a traffic trace point, use the **monitor capture stop** command in privileged EXEC mode.

**monitor capture** { *capture-name* } **stop**

## Syntax Description

*capture-name* The name of the capture to be stopped.

## Command Default

The packet data capture is ongoing.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
	This command was introduced.

## Usage Guidelines

Use the **monitor capture stop** command to stop the capture of packet data that you started using the **monitor capture start** command. You can configure two types of capture buffers: linear and circular. When the linear buffer is full, data capture stops automatically. When the circular buffer is full, data capture starts from the beginning and the data is overwritten.

## Example

To stop capturing buffer contents:

```
Device# monitor capture mycap stop
```

# monitor session

To create a new Ethernet Switched Port Analyzer (SPAN) or a Remote Switched Port Analyzer (RSPAN) session configuration for analyzing traffic between ports or add to an existing session configuration, use the **monitor session** global configuration command. To clear SPAN or RSPAN sessions, use the **no** form of this command.

**monitor session** *session-number* {**destination** | **filter** | **source**}

**no monitor session** {*session-number* [**destination** | **filter** | **source**] | **all** | **local** | **range** *session-range* | **remote**}

Syntax Description		
	<i>session-number</i>	The session number identified with the SPAN or RSPAN session. The range is 1 to 66.
	<b>all</b>	Clears all monitor sessions.
	<b>local</b>	Clears all local monitor sessions.
	<b>range</b> <i>session-range</i>	Clears monitor sessions in the specified range.
	<b>remote</b>	Clears all remote monitor sessions.

**Command Default** No monitor sessions are configured.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You can set a combined maximum of two local SPAN sessions and RSPAN source sessions. You can have a total of 66 SPAN and RSPAN sessions on a switch or switch stack.

You can verify your settings by entering the **show monitor** privileged EXEC command. You can display SPAN, RSPAN, FSPAN, and FRSPAN configuration on the switch by entering the **show running-config** privileged EXEC command. SPAN information appears near the end of the output.

## Example

This example shows how to create a local SPAN session 1 to monitor traffic on Po13 (an EtherChannel port) and limit SPAN traffic in the session only to VLAN 1281. Egress traffic replicates the source; ingress forwarding is not enabled.

```
Device(config)# monitor session 1 source interface Po13
Device(config)# monitor session 1 filter vlan 1281
Device(config)# monitor session 1 destination interface GigabitEthernet2/0/36 encapsulation
replicate
Device(config)# monitor session 1 destination interface GigabitEthernet3/0/36 encapsulation
replicate
```



The following is the output of a **show monitor session all** command after completing these setup instructions:

```
Device# show monitor session all

Session 1
-----
Type                : Local Session
Source Ports        :
  Both              : Po13
Destination Ports   : Gi2/0/36,Gi3/0/36
  Encapsulation     : Replicate
  Ingress           : Disabled
Filter VLANs        : 1281
...
```

## monitor session destination

To start a new Switched Port Analyzer (SPAN) session or Remote SPAN (RSPAN) destination session, to enable ingress traffic on the destination port for a network security device (such as a Cisco IDS Sensor Appliance), and to add or delete interfaces or VLANs to or from an existing SPAN or RSPAN session, use the **monitor session destination** global configuration command. To remove the SPAN or RSPAN session or to remove destination interfaces from the SPAN or RSPAN session, use the **no** form of this command.

```
monitor session session-number destination {interface interface-id [, | -] [encapsulation
{replicate | dot1q} ] {ingress [dot1q | untagged] } | {remote} vlan vlan-id
no monitor session session-number destination {interface interface-id [, | -] [encapsulation
{replicate | dot1q} ] {ingress [dot1q | untagged] } | {remote} vlan vlan-id
```

### Syntax Description

<i>session-number</i>	The session number identified with the SPAN or RSPAN session. The range is 1 to 66.
<b>interface</b> <i>interface-id</i>	Specifies the destination or source interface for a SPAN or RSPAN session. Valid interfaces are physical ports (including type, stack member, module, and port number). For source interface, port channel is also a valid interface type, and the valid range is 1 to 128.
,	(Optional) Specifies a series of interfaces or VLANs, or separates a range of interfaces or VLANs from a previous range. Enter a space before and after the comma.
-	(Optional) Specifies a range of interfaces or VLANs. Enter a space before and after the hyphen.
<b>encapsulation replicate</b>	(Optional) Specifies that the destination interface replicates the source interface encapsulation method. If not selected, the default is to send packets in native form (untagged).  These keywords are valid only for local SPAN. For RSPAN, the RSPAN VLAN ID overwrites the original VLAN ID; therefore, packets are always sent untagged. The <b>encapsulation</b> options are ignored with the <b>no</b> form of the command.
<b>encapsulation dot1q</b>	(Optional) Specifies that the destination interface accepts the source interface incoming packets with IEEE 802.1Q encapsulation.  These keywords are valid only for local SPAN. For RSPAN, the RSPAN VLAN ID overwrites the original VLAN ID; therefore, packets are always sent untagged. The <b>encapsulation</b> options are ignored with the <b>no</b> form of the command.

<b>ingress</b>	Enables ingress traffic forwarding.
<b>dot1q</b>	(Optional) Accepts incoming packets with IEEE 802.1Q encapsulation with the specified VLAN as the default VLAN.
<b>untagged</b>	(Optional) Accepts incoming packets with untagged encapsulation with the specified VLAN as the default VLAN.
<b>isl</b>	Specifies ingress forwarding using ISL encapsulation.
<b>remote</b>	Specifies the remote VLAN for an RSPAN source or destination session. The range is 2 to 1001 and 1006 to 4094.  The RSPAN VLAN cannot be VLAN 1 (the default VLAN) or VLAN IDs 1002 to 1005 (reserved for Token Ring and FDDI VLANs).
<b>vlan <i>vlan-id</i></b>	Sets the default VLAN for ingress traffic when used with only the <b>ingress</b> keyword.

**Command Default**

No monitor sessions are configured.

If **encapsulation replicate** is not specified on a local SPAN destination port, packets are sent in native form with no encapsulation tag.

Ingress forwarding is disabled on destination ports.

You can specify **all**, **local**, **range *session-range***, or **remote** with the **no monitor session** command to clear all SPAN and RSPAN, all local SPAN, a range, or all RSPAN sessions.

**Command Modes**

Global configuration

**Command History**

<b>Release</b>	<b>Modification</b>
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

You can set a combined maximum of 8 local SPAN sessions and RSPAN source sessions. You can have a total of 66 SPAN and RSPAN sessions on a switch or switch stack.

A SPAN or RSPAN destination must be a physical port.

You can have a maximum of 64 destination ports on a switch or a switch stack.

Each session can include multiple ingress or egress source ports or VLANs, but you cannot combine source ports and source VLANs in a single session. Each session can include multiple destination ports.

When you use VLAN-based SPAN (VSPAN) to analyze network traffic in a VLAN or set of VLANs, all active ports in the source VLANs become source ports for the SPAN or RSPAN session. Trunk ports are included as source ports for VSPAN, and only packets with the monitored VLAN ID are sent to the destination port.

You can monitor traffic on a single port or VLAN or on a series or range of ports or VLANs. You select a series or range of interfaces or VLANs by using the [, | -] options.

If you specify a series of VLANs or interfaces, you must enter a space before and after the comma. If you specify a range of VLANs or interfaces, you must enter a space before and after the hyphen (-).

EtherChannel ports can be configured as SPAN or RSPAN destination ports. A physical port that is a member of an EtherChannel group can be used as a destination port, but it cannot participate in the EtherChannel group while it is as a SPAN destination.

A port used as a destination port cannot be a SPAN or RSPAN source, nor can a port be a destination port for more than one session at a time.

You can enable IEEE 802.1x authentication on a port that is a SPAN or RSPAN destination port; however, IEEE 802.1x authentication is disabled until the port is removed as a SPAN destination. If IEEE 802.1x authentication is not available on the port, the switch returns an error message. You can enable IEEE 802.1x authentication on a SPAN or RSPAN source port.

If ingress traffic forwarding is enabled for a network security device, the destination port forwards traffic at Layer 2.

Destination ports can be configured to function in these ways:

- When you enter **monitor session** *session\_number* **destination interface** *interface-id* with no other keywords, egress encapsulation is untagged, and ingress forwarding is not enabled.
- When you enter **monitor session** *session\_number* **destination interface** *interface-id* **ingress**, egress encapsulation is untagged; ingress encapsulation depends on the keywords that follow—**dot1q** or **untagged**.
- When you enter **monitor session** *session\_number* **destination interface** *interface-id* **encapsulation replicate** with no other keywords, egress encapsulation replicates the source interface encapsulation; ingress forwarding is not enabled. (This applies to local SPAN only; RSPAN does not support encapsulation replication.)
- When you enter **monitor session** *session\_number* **destination interface** *interface-id* **encapsulation replicate ingress**, egress encapsulation replicates the source interface encapsulation; ingress encapsulation depends on the keywords that follow—**dot1q** or **untagged**. (This applies to local SPAN only; RSPAN does not support encapsulation replication.)

You can verify your settings by entering the **show monitor** privileged EXEC command. You can display SPAN, RSPAN, FSPAN, and FRSPAN configuration on the switch by entering the **show running-config** privileged EXEC command. SPAN information appears near the end of the output.

## Examples

This example shows how to create a local SPAN session 1 to monitor both sent and received traffic on source port 1 on stack member 1 to destination port 2 on stack member 2:

```
Device(config)# monitor session 1 source interface gigabitethernet1/0/1 both
Device(config)# monitor session 1 destination interface gigabitethernet1/0/2
```

This example shows how to delete a destination port from an existing local SPAN session:

```
Device(config)# no monitor session 2 destination interface gigabitethernet1/0/2
```

This example shows how to configure RSPAN source session 1 to monitor a source interface and to configure the destination RSPAN VLAN 900:

```
Device(config)# monitor session 1 source interface gigabitethernet1/0/1
Device(config)# monitor session 1 destination remote vlan 900
Device(config)# end
```

This example shows how to configure an RSPAN destination session 10 in the switch receiving the monitored traffic:

```
Device(config)# monitor session 10 source remote vlan 900
Device(config)# monitor session 10 destination interface gigabitethernet1/0/2
```

This example shows how to configure the destination port for ingress traffic on VLAN 5 by using a security device that supports IEEE 802.1Q encapsulation. Egress traffic replicates the source; ingress traffic uses IEEE 802.1Q encapsulation.

```
Device(config)# monitor session 2 destination interface gigabitethernet1/0/2 encapsulation
dot1q ingress dot1q vlan 5
```

This example shows how to configure the destination port for ingress traffic on VLAN 5 by using a security device that does not support encapsulation. Egress traffic and ingress traffic are untagged.

```
Device(config)# monitor session 2 destination interface gigabitethernet1/0/2 ingress untagged
vlan 5
```

## monitor session filter

To start a new flow-based SPAN (FSPAN) session or flow-based RSPAN (FRSPAN) source or destination session, or to limit (filter) SPAN source traffic to specific VLANs, use the **monitor session filter** global configuration command. To remove filters from the SPAN or RSPAN session, use the **no** form of this command.

**monitor session** *session-number* **filter** {**vlan** *vlan-id* [, | -] }

**no monitor session** *session-number* **filter** {**vlan** *vlan-id* [, | -] }

Syntax Description		
<i>session-number</i>		The session number identified with the SPAN or RSPAN session. The range is 1 to 66.
<b>vlan</b> <i>vlan-id</i>		Specifies a list of VLANs as filters on trunk source ports to limit SPAN source traffic to specific VLANs. The <i>vlan-id</i> range is 1 to 4094.
,		(Optional) Specifies a series of VLANs, or separates a range of VLANs from a previous range. Enter a space before and after the comma.
-		(Optional) Specifies a range of VLANs. Enter a space before and after the hyphen.

**Command Default** No monitor sessions are configured.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

You can set a combined maximum of two local SPAN sessions and RSPAN source sessions. You can have a total of 66 SPAN and RSPAN sessions on a switch or switch stack.

You can monitor traffic on a single VLAN or on a series or range of ports or VLANs. You select a series or range of VLANs by using the [, | -] options.

If you specify a series of VLANs, you must enter a space before and after the comma. If you specify a range of VLANs, you must enter a space before and after the hyphen (-).

VLAN filtering refers to analyzing network traffic on a selected set of VLANs on trunk source ports. By default, all VLANs are monitored on trunk source ports. You can use the **monitor session** *session\_number* **filter** **vlan** *vlan-id* command to limit SPAN traffic on trunk source ports to only the specified VLANs.

VLAN monitoring and VLAN filtering are mutually exclusive. If a VLAN is a source, VLAN filtering cannot be enabled. If VLAN filtering is configured, a VLAN cannot become a source.

You can verify your settings by entering the **show monitor** privileged EXEC command. You can display SPAN, RSPAN, FSPAN, and FRSPAN configuration on the switch by entering the **show running-config** privileged EXEC command. SPAN information appears near the end of the output.

## Examples

This example shows how to limit SPAN traffic in an existing session only to specific VLANs:

```
Switch(config)# monitor session 1 filter vlan 100 - 110
```

This example shows how to create a local SPAN session 1 to monitor both sent and received traffic on source port 1 on stack member 1 to destination port 2 on stack member 2 and to filter IPv4 traffic using access list number 122 in an FSPAN session:

```
Switch(config)# monitor session 1 source interface gigabitethernet1/0/1 both  
Switch(config)# monitor session 1 destination interface gigabitethernet1/0/2  
Switch(config)# monitor session 1 filter ip access-group 122
```

## monitor session source

To start a new Switched Port Analyzer (SPAN) session or Remote SPAN (RSPAN) source session, or to add or delete interfaces or VLANs to or from an existing SPAN or RSPAN session, use the **monitor session source** global configuration command. To remove the SPAN or RSPAN session or to remove source interfaces from the SPAN or RSPAN session, use the **no** form of this command.

```
monitor session session_number source {interface interface-id [, | -] [both | rx | tx] |
[remote] vlan vlan-id [, | -] [both | rx | tx]}
no monitor session session_number source {interface interface-id [, | -] [both | rx | tx] |
[remote] vlan vlan-id [, | -] [both | rx | tx]}
```

Syntax Description		
<i>session_number</i>		The session number identified with the SPAN or RSPAN session. The range is 1 to 66.
<b>interface</b> <i>interface-id</i>		Specifies the source interface for a SPAN or RSPAN session. Valid interfaces are physical ports (including type, stack member, module, and port number). For source interface, port channel is also a valid interface type, and the valid range is 1 to 48.
,		(Optional) Specifies a series of interfaces or VLANs, or separates a range of interfaces or VLANs from a previous range. Enter a space before and after the comma.
-		(Optional) Specifies a range of interfaces or VLANs. Enter a space before and after the hyphen.
<b>both</b>   <b>rx</b>   <b>tx</b>		(Optional) Specifies the traffic direction to monitor. If you do not specify a traffic direction, the source interface sends both transmitted and received traffic.
<b>remote</b>		(Optional) Specifies the remote VLAN for an RSPAN source or destination session. The range is 2 to 1001 and 1006 to 4094.  The RSPAN VLAN cannot be VLAN 1 (the default VLAN) or VLAN IDs 1002 to 1005 (reserved for Token Ring and FDDI VLANs).
<b>vlan</b> <i>vlan-id</i>		When used with only the <b>ingress</b> keyword, sets default VLAN for ingress traffic.

### Command Default

No monitor sessions are configured.

On a source interface, the default is to monitor both received and transmitted traffic.

On a trunk interface used as a source port, all VLANs are monitored.

### Command Modes

Global configuration



**Command History****Release****Modification**


---

Cisco IOS XE Everest 16.5.1a This command was introduced.

---

**Usage Guidelines**

Traffic that enters or leaves source ports or source VLANs can be monitored by using SPAN or RSPAN. Traffic routed to source ports or source VLANs cannot be monitored.

You can set a combined maximum of two local SPAN sessions and RSPAN source sessions. You can have a total of 66 SPAN and RSPAN sessions on a switch or switch stack.

A source can be a physical port, a port channel, or a VLAN.

Each session can include multiple ingress or egress source ports or VLANs, but you cannot combine source ports and source VLANs in a single session. Each session can include multiple destination ports.

When you use VLAN-based SPAN (VSPAN) to analyze network traffic in a VLAN or set of VLANs, all active ports in the source VLANs become source ports for the SPAN or RSPAN session. Trunk ports are included as source ports for VSPAN, and only packets with the monitored VLAN ID are sent to the destination port.

You can monitor traffic on a single port or VLAN or on a series or range of ports or VLANs. You select a series or range of interfaces or VLANs by using the [, | -] options.

If you specify a series of VLANs or interfaces, you must enter a space before and after the comma. If you specify a range of VLANs or interfaces, you must enter a space before and after the hyphen (-).

You can monitor individual ports while they participate in an EtherChannel, or you can monitor the entire EtherChannel bundle by specifying the **port-channel** number as the RSPAN source interface.

A port used as a destination port cannot be a SPAN or RSPAN source, nor can a port be a destination port for more than one session at a time.

You can enable IEEE 802.1x authentication on a SPAN or RSPAN source port.

You can verify your settings by entering the **show monitor** privileged EXEC command. You can display SPAN, RSPAN, FSPAN, and FRSPAN configuration on the switch by entering the **show running-config** privileged EXEC command. SPAN information appears near the end of the output.

**Examples**

This example shows how to create a local SPAN session 1 to monitor both sent and received traffic on source port 1 on stack member 1 to destination port 2 on stack member 2:

```
Switch(config)# monitor session 1 source interface gigabitethernet1/0/1 both
Switch(config)# monitor session 1 destination interface gigabitethernet1/0/2
```

This example shows how to configure RSPAN source session 1 to monitor multiple source interfaces and to configure the destination RSPAN VLAN 900.

```
Switch(config)# monitor session 1 source interface gigabitethernet1/0/1
Switch(config)# monitor session 1 source interface port-channel 2 tx
Switch(config)# monitor session 1 destination remote vlan 900
Switch(config)# end
```

## monitor session type erspan-source

To configure a local Encapsulated Remote Switched Port Analyzer (ERSPAN) source session, use the **monitor session type erspan-source** command in global configuration mode. To remove the ERSPAN configuration, use the **no** form of this command.

**monitor session** *span-session-number* **type erspan-source**  
**no monitor session** *span-session-number* **type erspan-source**

### Syntax Description

<i>span-session-number</i>	Number of the local ERSPAN session. Valid values are from 1 to 66.
----------------------------	--

### Command Default

ERSPAN source session is not configured.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

### Usage Guidelines

The *span-session-number* and the session type (configured by the *erspan-source* keyword) cannot be changed once configured. Use the **no** form of this command to remove the session and then re-create the session with a new session ID or a new session type.

The ERSPAN source session destination IP address, which must be configured on an interface on the destination switch, is the source of traffic that an ERSPAN destination session sends to the destination ports. You can configure the same address in both the source and destination sessions with the **ip address** command in ERSPAN monitor destination session configuration mode.

The ERSPAN ID differentiates the ERSPAN traffic arriving at the same destination IP address from different ERSPAN source sessions.

The maximum local ERSPAN source session limit is 8.

### Examples

The following example shows how to configure an ERSPAN source session number:

```
Switch(config)# monitor session 55 type erspan-source
Switch(config-mon-erspan-src)#
```

### Related Commands

Command	Description
<b>monitor session type</b>	Creates an ERSPAN source session number or enters the ERSPAN session configuration mode for the session.
<b>show capability feature monitor</b>	Displays information about monitor features.
<b>show monitor session</b>	Displays information about the ERSPAN, SPAN, and RSPAN sessions.

# origin

To configure the IP address used as the source of the Encapsulated Remote Switched Port Analyzer (ERSPAN) traffic, use the **origin** command in ERSPAN monitor destination session configuration mode. To remove the configuration, use the **no** form of this command.

**origin** *ip-address*  
**no origin** *ip-address*

<b>Syntax Description</b>	<i>ip-address</i> Specifies the ERSPAN source session destination IP address.				
<b>Command Default</b>	Source IP address is not configured.				
<b>Command Modes</b>	ERSPAN monitor destination session configuration mode (config-mon-erspan-src-dst)				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Denali 16.3.1</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Denali 16.3.1	This command was introduced.
Release	Modification				
Cisco IOS XE Denali 16.3.1	This command was introduced.				
<b>Usage Guidelines</b>	ERSPAN source session on a switch can use different source IP addresses using the <b>origin</b> command.				

## Examples

The following example shows how to configure an IP address for an ERSPAN source session:

```
Switch(config)# monitor session 2 type erspan-source
Switch(config-mon-erspan-src)# destination
Switch(config-mon-erspan-src-dst)# origin ip-address 203.0.113.2
```

The following sample output from the **show monitor session all** command displays ERSPAN source sessions with different source IP addresses:

```
Session 3
-----
Type : ERSPAN Source Session
Status : Admin Enabled
Source Ports :
Both : Gi1/0/13
Destination IP Address : 10.10.10.10
Origin IP Address : 10.10.10.10

Session 4
-----
Type : ERSPAN Source Session
Status : Admin Enabled
Destination IP Address : 192.0.2.1
Origin IP Address : 203.0.113.2
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>destination</b>	Configures an ERSPAN destination session and specifies destination properties.
<b>monitor session type erspan-source</b>	Configures a local ERSPAN source session.

# show ip sla statistics

To display current or aggregated operational status and statistics of all Cisco IOS IP Service Level Agreement (SLA) operations or a specified operation, use the **show ip sla statistics** command in user EXEC or privileged EXEC mode.

**show ip sla statistics** [*operation-number* [**details**] | **aggregated** [*operation-number* | **details**] | **details**]

Syntax Description		
	<i>operation-number</i>	(Optional) Number of the operation for which operational status and statistics are displayed. Accepted values are from 1 to 2147483647.
	<b>details</b>	(Optional) Specifies detailed output.
	<b>aggregated</b>	(Optional) Specifies the IP SLA aggregated statistics.

**Command Default** Displays output for all running IP SLA operations.

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **show ip sla statistics** to display the current state of IP SLA operations, including how much life the operation has left, whether the operation is active, and the completion time. The output also includes the monitoring data returned for the last (most recently completed) operation. This generated operation ID is displayed when you use the **show ip sla** configuration command for the base multicast operation, and as part of the summary statistics for the entire operation.

Enter the **show** command for a specific operation ID to display details for that one responder.

## Examples

The following is sample output from the **show ip sla statistics** command:

```
Device# show ip sla statistics

Current Operational State
Entry Number: 3
Modification Time: *22:15:43.000 UTC Sun Feb 11 2001
Diagnostics Text:
Last Time this Entry was Reset: Never
Number of Octets in use by this Entry: 1332
Number of Operations Attempted: 2
Current Seconds Left in Life: 3511
Operational State of Entry: active
Latest Completion Time (milliseconds): 544
Latest Operation Start Time: *22:16:43.000 UTC Sun Feb 11 2001
Latest Oper Sense: ok
Latest Sense Description: 200 OK
```

```
Total RTT: 544  
DNS RTT: 12  
TCP Connection RTT: 28  
HTTP Transaction RTT: 504  
HTTP Message Size: 9707
```

# show ip wccp capabilities

To display the WCCP platform capability settings, use the **show ip wccp capabilities** command in user EXEC or privileged EXEC mode.

## show ip wccp capabilities

### Command Default

None

### Command Modes

User EXEC (>)  
Privileged EXEC (#)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

None.

### Example

The following is a sample output from the **show ip wccp capabilities** command:

```
Device# show ip wccp capabilities
WCCP Platform Capability Settings

Capability                               Setting
-----                               -
Supported forwarding methods             GRE & L2
Supported return methods                 GRE & L2
Supported assignment methods             Hash & Mask
Accelerated forwarding methods           L2
Accelerated return methods               L2
Accelerated assignment methods           Mask
Accelerated Mode CLI                     On, CLI Disabled
Supported redirection types               Input & Output
Check Outbound ACL CLI                   Off, CLI Disabled
Check All Services CLI                   CLI Enabled
Closed Service Support                   Supported
VRF Support                               Unsupported
Supported service groups                 8
```

### Related Commands

Command	Description
<b>ip wccp</b>	Enables web cache service and specifies the service number that corresponds to a dynamic service that is defined by the application engine.

# show capability feature monitor

To display information about monitor features, use the **show capability feature monitor** command in privileged EXEC mode.

**show capability feature monitor erspan-destination | erspan-source**

Syntax Description	erspan-destination	erspan-source
	Displays information about the configured Encapsulated Remote Switched Port Analyzer (ERSPAN) source sessions.	Displays all the configured global built-in templates.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.1	This command was introduced.

## Examples

The following is sample output from the **show capability feature monitor erspan-source** command:

```
Switch# show capability feature monitor erspan-source

ERSPAN Source Session Supported: true
No of Rx ERSPAN source session: 8
No of Tx ERSPAN source session: 8
ERSPAN Header Type supported: II
ACL filter Supported: true
Fragmentation Supported: true
Truncation Supported: false
Sequence number Supported: false
QOS Supported: true
```

The following is sample output from the **show capability feature monitor erspan-destination** command:

```
Switch# show capability feature monitor erspan-destination

ERSPAN Destination Session Supported: false
```

## Related Commands

Command	Description
<b>monitor session type erspan-source</b>	Creates an ERSPAN source session number or enters the ERSPAN session configuration mode for the session.



# show monitor

To display information about all Switched Port Analyzer (SPAN) and Remote SPAN (RSPAN) sessions, use the **show monitor** command in EXEC mode.

**show monitor** [**session** {*session\_number* | **all** | **local** | **range** *list* | **remote**} [**detail**]

Syntax Description		
<b>session</b>		(Optional) Displays information about specified SPAN sessions.
<i>session_number</i>		The session number identified with the SPAN or RSPAN session. The range is 1 to 66.
<b>all</b>		(Optional) Displays all SPAN sessions.
<b>local</b>		(Optional) Displays only local SPAN sessions.
<b>range</b> <i>list</i>		(Optional) Displays a range of SPAN sessions, where <i>list</i> is the range of valid sessions. The range is either a single session or a range of sessions described by two numbers, the lower one first, separated by a hyphen. Do not enter any spaces between comma-separated parameters or in hyphen-specified ranges.
	<b>Note</b>	This keyword is available only in privileged EXEC mode.
<b>remote</b>		(Optional) Displays only remote SPAN sessions.
<b>detail</b>		(Optional) Displays detailed information about the specified sessions.

Command Modes	
	User EXEC
	Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

The output is the same for the **show monitor** command and the **show monitor session all** command.

Maximum number of SPAN source sessions: 2 (applies to source and local sessions)

## Examples

This is an example of output for the **show monitor** user EXEC command:

```
Device# show monitor
```

```

Session 1
-----
Type : Local Session
Source Ports :
RX Only : Gi4/0/1
Both : Gi4/0/2-3,Gi4/0/5-6
Destination Ports : Gi4/0/20
Encapsulation : Replicate
Ingress : Disabled
Session 2
-----
Type : Remote Source Session
Source VLANs :
TX Only : 10
Both : 1-9
Dest RSPAN VLAN : 105

```

This is an example of output for the **show monitor** user EXEC command for local SPAN source session 1:

```

Device# show monitor session 1
Session 1
-----
Type : Local Session
Source Ports :
RX Only : Gi4/0/1
Both : Gi4/0/2-3,Gi4/0/5-6
Destination Ports : Gi4/0/20
Encapsulation : Replicate
Ingress : Disabled

```

This is an example of output for the **show monitor session all** user EXEC command when ingress traffic forwarding is enabled:

```

Device# show monitor session all
Session 1
-----
Type : Local Session
Source Ports :
Both : Gi4/0/2
Destination Ports : Gi4/0/3
Encapsulation : Native
Ingress : Enabled, default VLAN = 5
Ingress encap : DOT1Q
Session 2
-----
Type : Local Session
Source Ports :
Both : Gi4/0/8
Destination Ports : Gi4/0/12
Encapsulation : Replicate
Ingress : Enabled, default VLAN = 4
Ingress encap : Untagged

```

# show monitor capture

To display monitor capture (WireShark) content, use the **show monitor capture file** command in privileged EXEC mode.

**show monitor capture** [*capture-name* [ **buffer** ] | **file** *file-location* : *file-name* ][ **brief** | **detailed** | **display-filter** *display-filter-string* ]

Syntax Description	
<i>capture-name</i>	(Optional) Specifies the name of the capture to be displayed.
<b>buffer</b>	(Optional) Specifies that a buffer associated with the named capture is to be displayed.
<b>file</b> <i>file-location</i> : <i>file-name</i>	(Optional) Specifies the file location and name of the capture storage file to be displayed.
<b>brief</b>	(Optional) Specifies the display content in brief.
<b>detailed</b>	(Optional) Specifies detailed display content.
<b>display-filter</b> <i>display-filter-string</i>	Filters the display content according to the <i>display-filter-string</i> .

**Command Default** Displays all capture content.

**Command Modes** Privileged EXEC

Command History	Release	Modification
		This command was introduced.

**Usage Guidelines** none

## Example

To display the capture for a capture called mycap:

```
Device# show monitor capture mycap

Status Information for Capture mycap
  Target Type:
  Interface: CAPWAP,
  Ingress:
  0
  Egress:
  0
  Status : Active
  Filter Details:
    Capture all packets
  Buffer Details:
    Buffer Type: LINEAR (default)
  File Details:
    Associated file name: flash:mycap.pcap
    Size of buffer(in MB): 1
```

```
Limit Details:  
Number of Packets to capture: 0 (no limit)  
Packet Capture duration: 0 (no limit)  
Packet Size to capture: 0 (no limit)  
Packets per second: 0 (no limit)  
Packet sampling rate: 0 (no sampling)
```

# show monitor session

To display information about all Switched Port Analyzer (SPAN) and Remote SPAN (RSPAN) sessions, use the **show monitor session** command in EXEC mode.

**show monitor session** { *session\_number* | **all** | **erspan-source** | **local** | **range list** | **remote** }  
[ **detail** ]

## Syntax Description

<i>session_number</i>	The session number identified with the SPAN or RSPAN session. The range is 1 to 68. However if this switch is stacked with Catalyst 2960-S switches, you are limited to a combined maximum of two local SPAN sessions and RSPAN source sessions, and the range is 1 to 66.
<b>all</b>	Displays all SPAN sessions.
<b>erspan-source</b>	Displays only source ERSPAN sessions.
<b>local</b>	Displays only local SPAN sessions.
<b>range list</b>	Displays a range of SPAN sessions, where <i>list</i> is the range of valid sessions. The range is either a single session or a range of sessions described by two numbers, the lower one first, separated by a hyphen. Do not enter any spaces between comma-separated parameters or in hyphen-specified ranges.  <b>Note</b> This keyword is available only in privileged EXEC mode.
<b>remote</b>	Displays only remote SPAN sessions.
<b>detail</b>	(Optional) Displays detailed information about the specified sessions.

## Command Modes

User EXEC (>)  
Privileged EXEC(#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The maximum local ERSPAN source session limit is 8.

## Examples

The following is sample output from the **show monitor session** command for local SPAN source session 1:

```
Device# show monitor session 1
Session 1
-----
Type : Local Session
Source Ports :
RX Only : Gi4/0/1
Both : Gi4/0/2-3,Gi4/0/5-6
Destination Ports : Gi4/0/20
Encapsulation : Replicate
Ingress : Disabled
```

The following is sample output from the **show monitor session all** command when ingress traffic forwarding is enabled:

```
Device# show monitor session all
Session 1
-----
Type : Local Session
Source Ports :
Both : Gi4/0/2
Destination Ports : Gi4/0/3
Encapsulation : Native
Ingress : Enabled, default VLAN = 5
Ingress encap : DOT1Q
Session 2
-----
Type : Local Session
Source Ports :
Both : Gi4/0/8
Destination Ports : Gi4/0/12
Encapsulation : Replicate
Ingress : Enabled, default VLAN = 4
Ingress encap : Untagged
```

The following is sample output from the **show monitor session erspan-source** command:

```
Switch# show monitor session erspan-source

Type : ERSPAN Source Session
Status : Admin Enabled
Source Ports :
RX Only : Gi1/4/33
Destination IP Address : 20.20.163.20
Destination ERSPAN ID : 110
Origin IP Address : 10.10.10.216
IPv6 Flow Label : None
```

# show platform software fed switch ip wccp

To display platform-dependent Web Cache Communication Protocol (WCCP) information, use the **show platform software fed switch ip wccp** privileged EXEC command.

```
show platform software fed switch switch-number | active | standby ip
wccpcache-engines | interfaces | service-groups
```

## Syntax Description

**switch** { *switch\_num* | **active** | **standby** } The device for which you want to display information.

- *switch\_num*—Enter the switch ID. Displays information for the specified switch.
- **active**—Displays information for the active switch.
- **standby**—Displays information for the standby switch, if available.

<b>cache-engines</b>	Displays WCCP cache engines.
<b>interfaces</b>	Displays WCCP interfaces.
<b>service-groups</b>	Displays WCCP service groups.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use this command only when you are working directly with a technical support representative while troubleshooting a problem. Do not use this command unless a technical support representative asks you to do so.

This command is available only if your is running the IP Services feature set.

The following example displays WCCP interfaces:

```
Device# show platform software fed switch 1 ip wccp interfaces
```

```
WCCP Interface Info
```

```
=====
```

```
**** WCCP Interface: Port-channel13 iif_id: 000000000000007c (#SG:3), VRF: 0 Ingress WCCP
****
```

```
port_handle:0x20000f9
```

```
List of Service Groups on this interface:
```

```
* Service group id:90 vrf_id:0 (ref count:24)
```

```
type: Dynamic      Open service      prot: PROT_TCP      l4_type: Dest ports      priority: 35
Promiscuous mode (no ports).
```

```
* Service group id:70 vrf_id:0 (ref count:24)
type: Dynamic    Open service    prot: PROT_TCP    l4_type: Dest ports    priority: 35
Promiscuous mode (no ports).

* Service group id:60 vrf_id:0 (ref count:24)
type: Dynamic    Open service    prot: PROT_TCP    l4_type: Dest ports    priority: 35
Promiscuous mode (no ports).

**** WCCP Interface: Port-channel14 iif_id: 000000000000007e (#SG:3), VRF: 0 Ingress WCCP
****
port_handle:0x880000fa

List of Service Groups on this interface:
* Service group id:90 vrf_id:0 (ref count:24)
type: Dynamic    Open service    prot: PROT_TCP    l4_type: Dest ports    priority: 35
Promiscuous mode (no ports).

* Service group id:70 vrf_id:0 (ref count:24)
type: Dynamic    Open service    prot: PROT_TCP    l4_type: Dest ports    priority: 35
Promiscuous mode (no ports).
<output truncated>
```



# show platform software swspan

To display switched port analyzer (SPAN) information, use the **show platform software swspan** command in privileged EXEC mode.

**show platform software swspan switch F0 | FP active counters | R0 | RP active destination sess-id session-ID | source sess-id session-ID**

Syntax Description		
<b>switch</b>		Displays information about the switch.
<b>F0</b>		Displays information about the Embedded Service Processor (ESP) slot 0.
<b>FP</b>		Displays information about the ESP.
<b>active</b>		Displays information about the active instance of the ESP or the Route Processor (RP).
<b>counters</b>		Displays the SWSPAN message counters.
<b>R0</b>		Displays information about the RP slot 0.
<b>RP</b>		Displays information the RP.
<b>destination sess-id session-ID</b>		Displays information about the specified destination session.
<b>source sess-id session-ID</b>		Displays information about the specified source session.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Denali 16.1.1	This command was introduced in a release prior to Cisco IOS XE Denali 16.1.1.

**Usage Guidelines** If the session number does not exist or if the SPAN session is a remote destination session, the command output will display the following message "% Error: No Information Available."

## Examples

The following is sample output from the **show platform software swspan FP active source** command:

```
Switch# show platform software swspan FP active source sess-id 0

Showing SPAN source detail info

Session ID : 0
Intf Type : PORT
Port dpidx : 30
PD Sess ID : 1
Session Type : Local
Direction : Ingress
Filter Enabled : No
ACL Configured : No
AOM Object id : 579
AOM Object Status : Done
```

```
Parent AOM object Id : 118
Parent AOM object Status : Done
```

```
Session ID : 9
Intf Type : PORT
Port dpidx : 8
PD Sess ID : 0
Session Type : Local
Direction : Ingress
Filter Enabled : No
ACL Configured : No
AOM Object id : 578
AOM Object Status : Done
Parent AOM object Id : 70
Parent AOM object Status : Done
```

The following is sample output from the **show platform software swspan RP active destination** command:

```
Switch# show platform software swspan RP active destination

Showing SPAN destination table summary info

Sess-id IF-type IF-id Sess-type
-----
1 PORT 19 Remote
```

## shutdown (monitor session)

To disable a configured ERSPAN session, use the **shutdown** command in ERSPAN monitor source session configuration mode. To enable configured ERSPAN session, use the **no** form of this command.

**shutdown**  
**no shutdown**

### Syntax Description

This command has no arguments or keywords.

### Command Default

A newly configured ERSPAN session will be in the shutdown state.

### Command Modes

ERSPAN monitor source session configuration mode (config-mon-erspan-src)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The ERSPAN session remains inactive until the **no shutdown** command is configured.

### Examples

The following example shows how to activate an ERSPAN session using the **no shutdown** command:

```
Device> enable
Device# configure terminal
Device(config)# monitor session 1 type erspan-source
Device(config-mon-erspan-src)# description source1
Device(config-mon-erspan-src)# source interface GigabitEthernet1/0/1 rx
Device(config-mon-erspan-src)# destination
Device(config-mon-erspan-src-dst)# erspan-id 100
Device(config-mon-erspan-src-dst)# origin ip address 10.10.0.1
Device(config-mon-erspan-src-dst)# ip address 10.1.0.2
Device(config-mon-erspan-src-dst)# ip dscp 10
Device(config-mon-erspan-src-dst)# ip ttl 32
Device(config-mon-erspan-src-dst)# mtu 512
Device(config-mon-erspan-src-dst)# vrf monitoring
Device(config-mon-erspan-src-dst)# exit
Device(config-mon-erspan-src)# no shutdown
Device(config-mon-erspan-src)# end
```

### Related Commands

Command	Description
<b>monitor session type</b>	Creates an ERSPAN source and destination session number or enters the ERSPAN session configuration mode for the session.

## snmp ifmib ifindex persist

To globally enable ifIndex values to persist, which will remain constant across reboots, for use by the Simple Network Management Protocol (SNMP), use the **snmp ifmib ifindex persist** command in global configuration mode. To globally disable ifIndex persistence, use the **no** form of this command.

**snmp ifmib ifindex persist**  
**no snmp ifmib ifindex persist**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The ifIndex persistence on a device is disabled.

**Command Modes** Global configuration (config)

**Usage Guidelines** The **snmp ifmib ifindex persist** command does not override an interface-specific configuration. The interface-specific configuration of ifIndex persistence is configured with the **snmp ifindex persist** and **snmp ifindex clear** commands in interface configuration mode.

The **snmp ifmib ifindex persist** command enables ifIndex persistence for all interfaces on a routing device by using the ifDescr and ifIndex entries in the ifIndex table of interface MIB (IF-MIB).

ifIndex persistence means that the ifIndex values in the IF-MIB persist across reboots, allowing for the consistent identification of specific interfaces that use SNMP.

If ifIndex persistence was previously disabled for a specific interface by using the **no snmp ifindex persist** command, ifIndex persistence will remain disabled for that interface.

### Examples

The following example shows how to enable ifIndex persistence for all interfaces:

```
Device(config)# snmp ifmib ifindex persist
```

### Related Commands

Command	Description
<b>snmp ifindex clear</b>	Clears any previously configured <b>snmp ifIndex</b> commands issued in interface configuration mode for a specific interface.
<b>snmp ifindex persist</b>	Enables ifIndex values that persist across reboots (ifIndex persistence) in the IF-MIB.

## snmp-server enable traps

To enable the to send Simple Network Management Protocol (SNMP) notifications for various traps or inform requests to the network management system (NMS), use the **snmp-server enable traps** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps [ auth-framework [ sec-violation ] | bridge | call-home |
config | config-copy | config-ctid | copy-config | cpu | dot1x | energywise | entity
| envmon | errdisable | event-manager | flash | fru-ctrl | license | mac-notification
| port-security | power-ethernet | rep | snmp | stackwise | storm-control | stpx
| syslog | transceiver | tty | vlan-membership | vlancreate | vlandelete | vstack
| vtp ]
```

```
no snmp-server enable traps [ auth-framework [ sec-violation ] | bridge | call-home
| config | config-copy | config-ctid | copy-config | cpu | dot1x | energywise |
entity | envmon | errdisable | event-manager | flash | fru-ctrl | license |
mac-notification | port-security | power-ethernet | rep | snmp | stackwise |
storm-control | stpx | syslog | transceiver | tty | vlan-membership | vlancreate |
vlandelete | vstack | vtp ]
```

Syntax Description	
<b>auth-framework</b>	(Optional) Enables SNMP CISCO-AUTH-FRAMEWORK-MIB traps.
<b>sec-violation</b>	(Optional) Enables SNMP camSecurityViolationNotif notifications.
<b>bridge</b>	(Optional) Enables SNMP STP Bridge MIB traps.*
<b>call-home</b>	(Optional) Enables SNMP CISCO-CALLHOME-MIB traps.*
<b>config</b>	(Optional) Enables SNMP configuration traps.
<b>config-copy</b>	(Optional) Enables SNMP configuration copy traps.
<b>config-ctid</b>	(Optional) Enables SNMP configuration CTID traps.
<b>copy-config</b>	(Optional) Enables SNMP copy-configuration traps.
<b>cpu</b>	(Optional) Enables CPU notification traps.*
<b>dot1x</b>	(Optional) Enables SNMP dot1x traps.*
<b>energywise</b>	(Optional) Enables SNMP energywise traps.*
<b>entity</b>	(Optional) Enables SNMP entity traps.
<b>envmon</b>	(Optional) Enables SNMP environmental monitor traps.*
<b>errdisable</b>	(Optional) Enables SNMP errdisable notification traps.*
<b>event-manager</b>	(Optional) Enables SNMP Embedded Event Manager traps.
<b>flash</b>	(Optional) Enables SNMP FLASH notification traps.*

<b>fru-ctrl</b>	(Optional) Generates entity field-replaceable unit (FRU) control traps. In a stack, this trap refers to the insertion or removal of a in the stack.
<b>license</b>	(Optional) Enables license traps.*
<b>mac-notification</b>	(Optional) Enables SNMP MAC Notification traps.*
<b>port-security</b>	(Optional) Enables SNMP port security traps.*
<b>power-ethernet</b>	(Optional) Enables SNMP power Ethernet traps.*
<b>rep</b>	(Optional) Enables SNMP Resilient Ethernet Protocol traps.
<b>snmp</b>	(Optional) Enables SNMP traps.*
<b>stackwise</b>	(Optional) Enables SNMP stackwise traps.*
<b>storm-control</b>	(Optional) Enables SNMP storm-control trap parameters.*
<b>stp</b>	(Optional) Enables SNMP STP MIB traps.*
<b>syslog</b>	(Optional) Enables SNMP syslog traps.
<b>transceiver</b>	(Optional) Enables SNMP transceiver traps.*
<b>tty</b>	(Optional) Sends TCP connection traps. This is enabled by default.
<b>vlan-membership</b>	(Optional) Enables SNMP VLAN membership traps.
<b>vlancreate</b>	(Optional) Enables SNMP VLAN-created traps.
<b>vlandelete</b>	(Optional) Enables SNMP VLAN-deleted traps.
<b>vstack</b>	(Optional) Enables SNMP Smart Install traps.*
<b>vtp</b>	(Optional) Enables VLAN Trunking Protocol (VTP) traps.

**Command Default** The sending of SNMP traps is disabled.

**Command Modes** Global configuration

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

The command options marked with an asterisk in the table above have subcommands. For more information on these subcommands, see the Related Commands section below.

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.

When supported, use the **snmp-server enable traps** command to enable sending of traps or informs.



---

**Note** Though visible in the command-line help strings, the **fru-ctrl**, **insertion**, and **removal** keywords are not supported on the . The **snmp-server enable informs** global configuration command is not supported. To enable the sending of SNMP inform notifications, use the **snmp-server enable traps** global configuration command combined with the **snmp-server host *host-addr* informs** global configuration command.

---



---

**Note** Informs are not supported in SNMPv1.

---

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

---

### Examples

This example shows how to enable more than one type of SNMP trap:

```
Device(config)# snmp-server enable traps config
Device(config)# snmp-server enable traps vtp
```

# snmp-server enable traps bridge

To generate STP bridge MIB traps, use the **snmp-server enable traps bridge** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps bridge [newroot] [topologychange]
no snmp-server enable traps bridge [newroot] [topologychange]
```

## Syntax Description

**newroot** (Optional) Enables SNMP STP bridge MIB new root traps.

**topologychange** (Optional) Enables SNMP STP bridge MIB topology change traps.

## Command Default

The sending of bridge SNMP traps is disabled.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

## Examples

This example shows how to send bridge new root traps to the NMS:

```
Device(config)# snmp-server enable traps bridge newroot
```



# snmp-server enable traps bulkstat

To enable data-collection-MIB traps, use the **snmp-server enable traps bulkstat** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps bulkstat [collection | transfer]
no snmp-server enable traps bulkstat [collection | transfer]
```

## Syntax Description

**collection** (Optional) Enables data-collection-MIB collection traps.

**transfer** (Optional) Enables data-collection-MIB transfer traps.

## Command Default

The sending of data-collection-MIB traps is disabled.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

## Examples

This example shows how to generate data-collection-MIB collection traps:

```
Device(config)# snmp-server enable traps bulkstat collection
```

## snmp-server enable traps call-home

To enable SNMP CISCO-CALLHOME-MIB traps, use the **snmp-server enable traps call-home** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps call-home [message-send-fail | server-fail]
no snmp-server enable traps call-home [message-send-fail | server-fail]
```

### Syntax Description

**message-send-fail** (Optional) Enables SNMP message-send-fail traps.

**server-fail** (Optional) Enables SNMP server-fail traps.

### Command Default

The sending of SNMP CISCO-CALLHOME-MIB traps is disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to generate SNMP message-send-fail traps:

```
Device(config)# snmp-server enable traps call-home message-send-fail
```

## snmp-server enable traps cef

To enable SNMP Cisco Express Forwarding (CEF) traps, use the **snmp-server enable traps cef** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps cef [inconsistency | peer-fib-state-change | peer-state-change | resource-failure]
no snmp-server enable traps cef [inconsistency | peer-fib-state-change | peer-state-change | resource-failure]
```

### Syntax Description

<b>inconsistency</b>	(Optional) Enables SNMP CEF Inconsistency traps.
<b>peer-fib-state-change</b>	(Optional) Enables SNMP CEF Peer FIB State change traps.
<b>peer-state-change</b>	(Optional) Enables SNMP CEF Peer state change traps.
<b>resource-failure</b>	(Optional) Enables SNMP CEF Resource Failure traps.

### Command Default

The sending of SNMP CEF traps is disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to generate SNMP CEF inconsistency traps:

```
Device(config)# snmp-server enable traps cef inconsistency
```

## snmp-server enable traps cpu

To enable CPU notifications, use the **snmp-server enable traps cpu** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps cpu [threshold]
no snmp-server enable traps cpu [threshold]
```

<b>Syntax Description</b>	<b>threshold</b> (Optional) Enables CPU threshold notification.
---------------------------	---

<b>Command Default</b>	The sending of CPU notifications is disabled.
------------------------	---

<b>Command Modes</b>	Global configuration
----------------------	----------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	Specify the host (NMS) that receives the traps by using the <b>snmp-server host</b> global configuration command. If no trap types are specified, all trap types are sent.
-------------------------	--



<b>Note</b>	Informs are not supported in SNMPv1.
-------------	--------------------------------------

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to generate CPU threshold notifications:

```
Device(config)# snmp-server enable traps cpu threshold
```

## snmp-server enable traps envmon

To enable SNMP environmental traps, use the **snmp-server enable traps envmon** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps envmon [fan] [shutdown] [status] [supply] [temperature]
no snmp-server enable traps envmon [fan] [shutdown] [status] [supply] [temperature]
```

Syntax Description	
<b>fan</b>	(Optional) Enables fan traps.
<b>shutdown</b>	(Optional) Enables environmental monitor shutdown traps.
<b>status</b>	(Optional) Enables SNMP environmental status-change traps.
<b>supply</b>	(Optional) Enables environmental monitor power-supply traps.
<b>temperature</b>	(Optional) Enables environmental monitor temperature traps.

**Command Default** The sending of environmental SNMP traps is disabled.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to generate fan traps:

```
Device(config)# snmp-server enable traps envmon fan
```

## snmp-server enable traps errdisable

To enable SNMP notifications of error-disabling, use the **snmp-server enable traps errdisable** command in global configuration mode. Use the **no** form of this command to return to the default setting.

**snmp-server enable traps errdisable** [**notification-rate** *number-of-notifications*]  
**no snmp-server enable traps errdisable** [**notification-rate** *number-of-notifications*]

<b>Syntax Description</b>	<b>notification-rate</b> <i>number-of-notifications</i>	(Optional) Specifies number of notifications per minute as the notification rate. Accepted values are from 0 to 10000.
<b>Command Default</b>	The sending of SNMP notifications of error-disabling is disabled.	
<b>Command Modes</b>	Global configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	Specify the host (NMS) that receives the traps by using the <b>snmp-server host</b> global configuration command. If no trap types are specified, all trap types are sent.	



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to set the number SNMP notifications of error-disabling to 2:

```
Device(config)# snmp-server enable traps errdisable notification-rate 2
```

# snmp-server enable traps flash

To enable SNMP flash notifications, use the **snmp-server enable traps flash** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps flash [insertion] [removal]
no snmp-server enable traps flash [insertion] [removal]
```

## Syntax Description

**insertion** (Optional) Enables SNMP flash insertion notifications.

**removal** (Optional) Enables SNMP flash removal notifications.

## Command Default

The sending of SNMP flash notifications is disabled.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

## Examples


This example shows how to generate SNMP flash insertion notifications:

```
Device(config)# snmp-server enable traps flash insertion
```

# snmp-server enable traps isis

To enable intermediate system-to-intermediate system (IS-IS) link-state routing protocol traps, use the **snmp-server enable traps isis** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps isis [errors | state-change]
no snmp-server enable traps isis [errors | state-change]
```

<b>Syntax Description</b>	<p><b>errors</b> (Optional) Enables IS-IS error traps.</p> <p><b>state-change</b> (Optional) Enables IS-IS state change traps.</p>				
<b>Command Default</b>	The sending of IS-IS traps is disabled.				
<b>Command Modes</b>	Global configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	Specify the host (NMS) that receives the traps by using the <b>snmp-server host</b> global configuration command. If no trap types are specified, all trap types are sent.				
					
<b>Note</b>	<p>Informs are not supported in SNMPv1.</p> <p>To enable more than one type of trap, you must enter a separate <b>snmp-server enable traps</b> command for each trap type.</p>				
<b>Examples</b>	<p>This example shows how to generate IS-IS error traps:</p> <pre>Device(config)# snmp-server enable traps isis errors</pre>				



# snmp-server enable traps license

To enable license traps, use the **snmp-server enable traps license** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps license [deploy] [error] [usage]
no snmp-server enable traps license [deploy] [error] [usage]
```

## Syntax Description

**deploy** (Optional) Enables license deployment traps.

**error** (Optional) Enables license error traps.

**usage** (Optional) Enables license usage traps.

## Command Default

The sending of license traps is disabled.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

## Examples

This example shows how to generate license deployment traps:

```
Device(config)# snmp-server enable traps license deploy
```

# snmp-server enable traps mac-notification

To enable SNMP MAC notification traps, use the **snmp-server enable traps mac-notification** command in global configuration mode. Use the **no** form of this command to return to the default setting.

**snmp-server enable traps mac-notification** [**change**] [**move**] [**threshold**]  
**no snmp-server enable traps mac-notification** [**change**] [**move**] [**threshold**]

## Syntax Description

**change** (Optional) Enables SNMP MAC change traps.

**move** (Optional) Enables SNMP MAC move traps.

**threshold** (Optional) Enables SNMP MAC threshold traps.

## Command Default

The sending of SNMP MAC notification traps is disabled.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

## Examples

This example shows how to generate SNMP MAC notification change traps:

```
Device(config)# snmp-server enable traps mac-notification change
```

# snmp-server enable traps ospf

To enable SNMP Open Shortest Path First (OSPF) traps, use the **snmp-server enable traps ospf** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps ospf [cisco-specific | errors | lsa | rate-limit rate-limit-time
max-number-of-traps | retransmit | state-change]
no snmp-server enable traps ospf [cisco-specific | errors | lsa | rate-limit rate-limit-time
max-number-of-traps | retransmit | state-change]
```

## Syntax Description

<b>cisco-specific</b>	(Optional) Enables Cisco-specific traps.
<b>errors</b>	(Optional) Enables error traps.
<b>lsa</b>	(Optional) Enables link-state advertisement (LSA) traps.
<b>rate-limit</b>	(Optional) Enables rate-limit traps.
<i>rate-limit-time</i>	(Optional) Specifies window of time in seconds for rate-limit traps. Accepted values are 2 to 60.
<i>max-number-of-traps</i>	(Optional) Specifies maximum number of rate-limit traps to be sent in window time.
<b>retransmit</b>	(Optional) Enables packet-retransmit traps.
<b>state-change</b>	(Optional) Enables state-change traps.

## Command Default

The sending of OSPF SNMP traps is disabled.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

## Examples

This example shows how to enable LSA traps:

```
Device(config)# snmp-server enable traps ospf lsa
```

## snmp-server enable traps pim

To enable SNMP Protocol-Independent Multicast (PIM) traps, use the **snmp-server enable traps pim** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps pim [invalid-pim-message] [neighbor-change] [rp-mapping-change]
no snmp-server enable traps pim [invalid-pim-message] [neighbor-change] [rp-mapping-change]
```

### Syntax Description

**invalid-pim-message** (Optional) Enables invalid PIM message traps.

**neighbor-change** (Optional) Enables PIM neighbor-change traps.

**rp-mapping-change** (Optional) Enables rendezvous point (RP)-mapping change traps.

### Command Default

The sending of PIM SNMP traps is disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



#### Note

Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to enable invalid PIM message traps:

```
Device(config)# snmp-server enable traps pim invalid-pim-message
```

## snmp-server enable traps port-security

To enable SNMP port security traps, use the **snmp-server enable traps port-security** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps port-security [trap-rate value]
no snmp-server enable traps port-security [trap-rate value]
```

<b>Syntax Description</b>	<b>trap-rate</b> <i>value</i>	(Optional) Sets the maximum number of port-security traps sent per second. The range is from 0 to 1000; the default is 0 (no limit imposed; a trap is sent at every occurrence).
<b>Command Default</b>	The sending of port security SNMP traps is disabled.	
<b>Command Modes</b>	Global configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	Specify the host (NMS) that receives the traps by using the <b>snmp-server host</b> global configuration command. If no trap types are specified, all trap types are sent.	



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to enable port-security traps at a rate of 200 per second:

```
Device(config)# snmp-server enable traps port-security trap-rate 200
```

## snmp-server enable traps power-ethernet

To enable SNMP power-over-Ethernet (PoE) traps, use the **snmp-server enable traps power-ethernet** command in global configuration mode. Use the **no** form of this command to return to the default setting.

**snmp-server enable traps power-ethernet group *number* | police**  
**no snmp-server enable traps power-ethernet group *number* | police**

Syntax Description	group <i>number</i>	police
	Enables inline power group-based traps for the specified group number. Accepted values are from 1 to 9.	Enables inline power policing traps.

**Command Default** The sending of power-over-Ethernet SNMP traps is disabled.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to enable power-over-Ethernet traps for group 1:

```
Device(config)# snmp-server enable traps power-over-ethernet group 1
```

## snmp-server enable traps snmp

To enable SNMP traps, use the **snmp-server enable traps snmp** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps snmp [authentication] [coldstart] [linkdown] [linkup] [warmstart]
no snmp-server enable traps snmp [authentication] [coldstart] [linkdown] [linkup]
] [warmstart]
```

Syntax Description	
<b>authentication</b>	(Optional) Enables authentication traps.
<b>coldstart</b>	(Optional) Enables cold start traps.
<b>linkdown</b>	(Optional) Enables linkdown traps.
<b>linkup</b>	(Optional) Enables linkup traps.
<b>warmstart</b>	(Optional) Enables warmstart traps.

**Command Default** The sending of SNMP traps is disabled.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to enable a warmstart SNMP trap:

```
Device(config)# snmp-server enable traps snmp warmstart
```

# snmp-server enable traps storm-control

To enable SNMP storm-control trap parameters, use the **snmp-server enable traps storm-control** command in global configuration mode. Use the **no** form of this command to return to the default setting.

**snmp-server enable traps storm-control** {**trap-rate** *number-of-minutes*}

**no snmp-server enable traps storm-control** {**trap-rate**}

<b>Syntax Description</b>	<b>trap-rate</b> <i>number-of-minutes</i>	(Optional) Specifies the SNMP storm-control trap rate in minutes. Accepted values are from 0 to 1000. The default is 0.  Value 0 indicates that no limit is imposed and a trap is sent at every occurrence. When configured, <b>show run all</b> command output displays <code>no snmp-server enable traps storm-control</code> .
---------------------------	--	---

**Command Default** The sending of SNMP storm-control trap parameters is disabled.

**Command Modes** Global configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

## Examples

This example shows how to set the SNMP storm-control trap rate to 10 traps per minute:

```
Device(config)# snmp-server enable traps storm-control trap-rate 10
```



## snmp-server enable traps stpx

To enable SNMP STPX MIB traps, use the **snmp-server enable traps stpx** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps stpx [inconsistency] [loop-inconsistency] [root-inconsistency]
no snmp-server enable traps stpx [inconsistency] [loop-inconsistency] [root-inconsistency]
```

### Syntax Description

**inconsistency** (Optional) Enables SNMP STPX MIB inconsistency update traps.

**loop-inconsistency** (Optional) Enables SNMP STPX MIB loop inconsistency update traps.

**root-inconsistency** (Optional) Enables SNMP STPX MIB root inconsistency update traps.

### Command Default

The sending of SNMP STPX MIB traps is disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to generate SNMP STPX MIB inconsistency update traps:

```
Device(config)# snmp-server enable traps stpx inconsistency
```

# snmp-server enable traps transceiver

To enable SNMP transceiver traps, use the **snmp-server enable traps transceiver** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps transceiver {all}
no snmp-server enable traps transceiver {all}
```

## Syntax Description

**a** (Optional) Enables all SNMP transceiver traps.

## Command Default

The sending of SNMP transceiver traps is disabled.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



### Note

Inform are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

## Examples

This example shows how to set all SNMP transceiver traps:

```
Device(config)# snmp-server enable traps transceiver all
```

## snmp-server enable traps vrfmib

To allow SNMP vrfmib traps, use the **snmp-server enable traps vrfmib** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps vrfmib [vnet-trunk-down | vnet-trunk-up | vrf-down | vrf-up]
no snmp-server enable traps vrfmib [vnet-trunk-down | vnet-trunk-up | vrf-down | vrf-up]
```

### Syntax Description

**vnet-trunk-down** (Optional) Enables vrfmib trunk down traps.

**vnet-trunk-up** (Optional) Enables vrfmib trunk up traps.

**vrf-down** (Optional) Enables vrfmib vrf down traps.

**vrf-up** (Optional) Enables vrfmib vrf up traps.

### Command Default

The sending of SNMP vrfmib traps is disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



**Note** Informs are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

### Examples

This example shows how to generate vrfmib trunk down traps:

```
Device(config)# snmp-server enable traps vrfmib vnet-trunk-down
```

# snmp-server enable traps vstack

To enable SNMP smart install traps, use the **snmp-server enable traps vstack** command in global configuration mode. Use the **no** form of this command to return to the default setting.

```
snmp-server enable traps vstack [addition] [failure] [lost] [operation]
no snmp-server enable traps vstack [addition] [failure] [lost] [operation]
```

## Syntax Description

<b>addition</b>	(Optional) Enables client added traps.
<b>failure</b>	(Optional) Enables file upload and download failure traps.
<b>lost</b>	(Optional) Enables client lost trap.
<b>operation</b>	(Optional) Enables operation mode change traps.

## Command Default

The sending of SNMP smart install traps is disabled.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Specify the host (NMS) that receives the traps by using the **snmp-server host** global configuration command. If no trap types are specified, all trap types are sent.



### Note

Inform traps are not supported in SNMPv1.

To enable more than one type of trap, you must enter a separate **snmp-server enable traps** command for each trap type.

## Examples

This example shows how to generate SNMP Smart Install client-added traps:

```
Device(config)# snmp-server enable traps vstack addition
```



## snmp-server host

To specify the recipient (host) of a Simple Network Management Protocol (SNMP) notification operation, use the **snmp-server host** global configuration command on the . Use the **no** form of this command to remove the specified host.

```
snmp-server host {host-addr} [vrf vrf-instance] [informs | traps] [version {1 | 2c | 3
{auth | noauth | priv} } ] {community-string [notification-type] }
no snmp-server host {host-addr} [vrf vrf-instance] [informs | traps] [version {1 | 2c |
3 {auth | noauth | priv} } ] {community-string [notification-type] }
```

### Syntax Description

<i>host-addr</i>	Name or Internet address of the host (the targeted recipient).
<b>vrf</b> <i>vrf-instance</i>	(Optional) Specifies the virtual private network (VPN) routing instance and name for this host.
<b>informs</b>   <b>traps</b>	(Optional) Sends SNMP traps or informs to this host.
<b>version</b> <b>1</b>   <b>2c</b>   <b>3</b>	(Optional) Specifies the version of the SNMP used to send the traps. <b>1</b> —SNMPv1. This option is not available with informs. <b>2c</b> —SNMPv2C. <b>3</b> —SNMPv3. One of the authorization keywords (see next table row) must follow the Version 3 keyword.
<b>auth</b>   <b>noauth</b>   <b>priv</b>	<b>auth</b> (Optional)—Enables Message Digest 5 (MD5) and Secure Hash Algorithm (SHA) packet authentication. <b>noauth</b> (Default)—The noAuthNoPriv security level. This is the default if the <b>auth</b>   <b>noauth</b>   <b>priv</b> keyword choice is not specified. <b>priv</b> (Optional)—Enables Data Encryption Standard (DES) packet encryption (also called privacy).
<i>community-string</i>	Password-like community string sent with the notification operation. Though you can set this string by using the <b>snmp-server host</b> command, we recommend that you define this string by using the <b>snmp-server community</b> global configuration command before using the <b>snmp-server host</b> command.
<b>Note</b>	The @ symbol is used for delimiting the context information. Avoid using the @ symbol as part of the SNMP community string when configuring this command.

*notification-type* (Optional) Type of notification to be sent to the host. If no type is specified, all notifications are sent. The notification type can be one or more of the these keywords:

- **auth-framework**—Sends SNMP CISCO-AUTH-FRAMEWORK-MIB traps.
  - **bridge**—Sends SNMP Spanning Tree Protocol (STP) bridge MIB traps.
  - **bulkstat**—Sends Data-Collection-MIB Collection notification traps.
  - **call-home**—Sends SNMP CISCO-CALLHOME-MIB traps.
  - **cef**—Sends SNMP CEF traps.
  - **config**—Sends SNMP configuration traps.
  - **config-copy**—Sends SNMP config-copy traps.
  - **config-ctid**—Sends SNMP config-ctid traps.
  - **copy-config**—Sends SNMP copy configuration traps.
  - **cpu**—Sends CPU notification traps.
  - **cpu threshold**—Sends CPU threshold notification traps.
  - **eigrp**—Sends SNMP EIGRP traps.
  - **entity**—Sends SNMP entity traps.
- 
- **envmon**—Sends environmental monitor traps.
  - **errdisable**—Sends SNMP errdisable notification traps.
  - **event-manager**—Sends SNMP Embedded Event Manager traps.
  - **flash**—Sends SNMP FLASH notifications.
  - **flowmon**—Sends SNMP flowmon notification traps.
  - **ipmulticast**—Sends SNMP IP multicast routing traps.
  - **ipsla**—Sends SNMP IP SLA traps.
  - **isis**—Sends IS-IS traps.
  - **license**—Sends license traps.
  - **local-auth**—Sends SNMP local auth traps.
  - **mac-notification**—Sends SNMP MAC notification traps.
  - **ospf**—Sends Open Shortest Path First (OSPF) traps.
  - **pim**—Sends SNMP Protocol-Independent Multicast (PIM) traps.
  - **port-security**—Sends SNMP port-security traps.
  - **power-ethernet**—Sends SNMP power Ethernet traps.
  - **snmp**—Sends SNMP-type traps.
  - **storm-control**—Sends SNMP storm-control traps.
  - **stpx**—Sends SNMP STP extended MIB traps.
  - **syslog**—Sends SNMP syslog traps.
  - **transceiver**—Sends SNMP transceiver traps.
  - **tty**—Sends TCP connection traps.
  - **vlan-membership**—Sends SNMP VLAN membership traps.
  - **vlancreate**—Sends SNMP VLAN-created traps.
  - **vlandelete**—Sends SNMP VLAN-deleted traps.
  - **vrfmib**—Sends SNMP vrfmib traps.
  - **vstack**—Sends SNMP Smart Install traps.
  - **vtp**—Sends SNMP VLAN Trunking Protocol (VTP) traps.

#### Command Default

This command is disabled by default. No notifications are sent.

If you enter this command with no keywords, the default is to send all trap types to the host. No informs are sent to this host.

If no **version** keyword is present, the default is Version 1.

If Version 3 is selected and no authentication keyword is entered, the default is the **noauth** (noAuthNoPriv) security level.



**Note** Though visible in the command-line help strings, the **fru-ctrl** keyword is not supported.

#### Command Modes

Global configuration

#### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

#### Usage Guidelines

SNMP notifications can be sent as traps or inform requests. Traps are unreliable because the receiver does not send acknowledgments when it receives traps. The sender cannot determine if the traps were received. However, an SNMP entity that receives an inform request acknowledges the message with an SNMP response PDU. If the sender never receives the response, the inform request can be sent again, so that informs are more likely to reach their intended destinations.

However, informs consume more resources in the agent and in the network. Unlike a trap, which is discarded as soon as it is sent, an inform request must be held in memory until a response is received or the request times out. Traps are also sent only once, but an inform might be retried several times. The retries increase traffic and contribute to a higher overhead on the network.

If you do not enter an **snmp-server host** command, no notifications are sent. To configure the to send SNMP notifications, you must enter at least one **snmp-server host** command. If you enter the command with no keywords, all trap types are enabled for the host. To enable multiple hosts, you must enter a separate **snmp-server host** command for each host. You can specify multiple notification types in the command for each host.

If a local user is not associated with a remote host, the does not send informs for the **auth** (authNoPriv) and the **priv** (authPriv) authentication levels.

When multiple **snmp-server host** commands are given for the same host and kind of notification (trap or inform), each succeeding command overwrites the previous command. Only the last **snmp-server host** command is in effect. For example, if you enter an **snmp-server host inform** command for a host and then enter another **snmp-server host inform** command for the same host, the second command replaces the first.

The **snmp-server host** command is used with the **snmp-server enable traps** global configuration command. Use the **snmp-server enable traps** command to specify which SNMP notifications are sent globally. For a host to receive most notifications, at least one **snmp-server enable traps** command and the **snmp-server host** command for that host must be enabled. Some notification types cannot be controlled with the **snmp-server enable traps** command. For example, some notification types are always enabled. Other notification types are enabled by a different command.

The **no snmp-server host** command with no keywords disables traps, but not informs, to the host. To disable informs, use the **no snmp-server host informs** command.



## Examples

This example shows how to configure a unique SNMP community string named comaccess for traps and prevent SNMP polling access with this string through access-list 10:

```
Device(config)# snmp-server community comaccess ro 10
Device(config)# snmp-server host 172.20.2.160 comaccess
Device(config)# access-list 10 deny any
```

This example shows how to send the SNMP traps to the host specified by the name myhost.cisco.com. The community string is defined as comaccess:

```
Device(config)# snmp-server enable traps
Device(config)# snmp-server host myhost.cisco.com comaccess snmp
```

This example shows how to enable the to send all traps to the host myhost.cisco.com by using the community string public:

```
Device(config)# snmp-server enable traps
Device(config)# snmp-server host myhost.cisco.com public
```

You can verify your settings by entering the **show running-config** privileged EXEC command.

## source (ERSPAN)

To configure the Encapsulated Remote Switched Port Analyzer (ERSPAN) source interface or VLAN, and the traffic direction to be monitored, use the **source** command in ERSPAN monitor source session configuration mode. To disable the configuration, use the **no** form of this command.

**source interface** *type number* | **vlan** *vlan-ID*[, | - | **both** | **rx** | **tx**]

### Syntax Description

<b>interface</b> <i>type number</i>	Specifies an interface type and number.
<b>vlan</b> <i>vlan-ID</i>	Associates the ERSPAN source session number with VLANs. Valid values are from 1 to 4094.
,	(Optional) Specifies another interface.
-	(Optional) Specifies a range of interfaces.
<b>both</b>	(Optional) Monitors both received and transmitted ERSPAN traffic.
<b>rx</b>	(Optional) Monitors only received traffic.
<b>tx</b>	(Optional) Monitors only transmitted traffic.

### Command Default

Source interface or VLAN is not configured.

### Command Modes

ERSPAN monitor source session configuration mode (config-mon-erspan-src)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

### Usage Guidelines

You cannot include source VLANs and filter VLANs in the same session.

### Examples

The following example shows how to configure ERSPAN source session properties:

```
Switch(config)# monitor session 2 type erspan-source
Switch(config-mon-erspan-src)# source interface fastethernet 0/1 rx
```

### Related Commands

Command	Description
<b>monitor session type erspan-source</b>	Configures a local ERSPAN source session.

# switchport mode access

To sets the interface as a nontrunking nontagged single-VLAN Ethernet interface , use the **switchport mode access** command in template configuration mode. Use the **no** form of this command to return to the default setting.

```
switchport mode access
no switchport mode access
```

<b>Syntax Description</b>	<b>switchport mode access</b> Sets the interface as a nontrunking nontagged single-VLAN Ethernet interface.				
<b>Command Default</b>	An access port can carry traffic in one VLAN only. By default, an access port carries traffic for VLAN1.				
<b>Command Modes</b>	Template configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td></td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification		This command was introduced.
Release	Modification				
	This command was introduced.				

## Examples

This example shows how to set a single-VLAN interface

```
Device(config-template)# switchport mode access
```

# switchport voice vlan

To specify to forward all voice traffic through the specified VLAN, use the **switchport voice vlan** command in template configuration mode. Use the **no** form of this command to return to the default setting.

```
switchport voice vlan vlan_id
no switchport voice vlan
```

<b>Syntax Description</b>	<b>switchport voice vlan</b> <i>vlan_id</i> Specifies to forward all voice traffic through the specified VLAN.
---------------------------	--

<b>Command Default</b>	You can specify a value from 1 to 4094.
------------------------	---

<b>Command Modes</b>	Template configuration
----------------------	------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Fuji 16.9.1	This command was introduced.

**Examples** This example shows how to specify to forward all voice traffic through the specified VLAN.

```
Device(config-template)# switchport voice vlan 20
```



## Flexible NetFlow Commands

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# cache

To configure a flow cache parameter for a flow monitor, use the **cache** command in flow monitor configuration mode. To remove a flow cache parameter for a flow monitor, use the **no** form of this command.

**cache timeout active | inactive | update seconds | type normal**  
**no cache timeout active | inactive | update | type**

Syntax Description		
<b>timeout</b>		Specifies the flow timeout.
<b>active</b>		Specifies the active flow timeout.
<b>inactive</b>		Specifies the inactive flow timeout.
<b>update</b>		Specifies the update timeout for a permanent flow cache.
<i>seconds</i>		The timeout value in seconds. The range is 30 to 604800 (7 days) for a normal flow cache. For a permanent flow cache the range is 1 to 604800 (7 days).
<b>type</b>		Specifies the type of the flow cache.
<b>normal</b>		Configures a normal cache type. The entries in the flow cache will be aged out according to the <b>timeout active seconds</b> and <b>timeout inactive seconds</b> settings. This is the default cache type.

Command Default	
	The default flow monitor flow cache parameters are used.
	The following flow cache parameters for a flow monitor are enabled:
	<ul style="list-style-type: none"> <li>• Cache type: normal</li> <li>• Active flow timeout: 1800 seconds</li> </ul>

Command Modes	
	Flow monitor configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

Usage Guidelines	
	Each flow monitor has a cache that it uses to store all the flows it monitors. Each cache has various configurable elements, such as the time that a flow is allowed to remain in it. When a flow times out, it is removed from the cache and sent to any exporters that are configured for the corresponding flow monitor.

The **cache timeout active** command controls the aging behavior of the normal type of cache. If a flow has been active for a long time, it is usually desirable to age it out (starting a new flow for any subsequent packets in the flow). This age out process allows the monitoring application that is receiving the exports to remain up to date. By default, this timeout is 1800 seconds (30 minutes), but it can be adjusted according to system requirements. A larger value ensures that long-lived flows are accounted for in a single flow record; a smaller value results in a shorter delay between starting a new long-lived flow and exporting some data for it. When you change the active flow timeout, the new timeout value takes effect immediately.

The **cache timeout inactive** command also controls the aging behavior of the normal type of cache. If a flow has not seen any activity for a specified amount of time, that flow will be aged out. By default, this timeout is 15 seconds, but this value can be adjusted depending on the type of traffic expected. If a large number of short-lived flows is consuming many cache entries, reducing the inactive timeout can reduce this overhead. If a large number of flows frequently get aged out before they have finished collecting their data, increasing this timeout can result in better flow correlation. When you change the inactive flow timeout, the new timeout value takes effect immediately.

The **cache timeout update** command controls the periodic updates sent by the permanent type of cache. This behavior is similar to the active timeout, except that it does not result in the removal of the cache entry from the cache. By default, this timer value is 1800 seconds (30 minutes).

The **cache type normal** command specifies the normal cache type. This is the default cache type. The entries in the cache will be aged out according to the **timeout active** *seconds* and **timeout inactive** *seconds* settings. When a cache entry is aged out, it is removed from the cache and exported via any exporters configured for the monitor associated with the cache.

To return a cache to its default settings, use the **default cache** flow monitor configuration command.




---

**Note** When a cache becomes full, new flows will not be monitored.

---

The following example shows how to configure the active timeout for the flow monitor cache:

```
Device(config)# flow monitor FLOW-MONITOR-1
Device(config-flow-monitor)# cache timeout active 4800
```

The following example shows how to configure the inactive timer for the flow monitor cache:

```
Device(config)# flow monitor FLOW-MONITOR-1
Device(config-flow-monitor)# cache timeout inactive 30
```

The following example shows how to configure the permanent cache update timeout:

```
Device(config)# flow monitor FLOW-MONITOR-1
Device(config-flow-monitor)# cache timeout update 5000
```

The following example shows how to configure a normal cache:

```
Device(config)# flow monitor FLOW-MONITOR-1
Device(config-flow-monitor)# cache type normal
```



# clear flow exporter

To clear the statistics for a Flexible Netflow flow exporter, use the **clear flow exporter** command in privileged EXEC mode.

```
clear flow exporter [[name] exporter-name] statistics
```

Syntax Description	
<b>name</b>	(Optional) Specifies the name of a flow exporter.
<i>exporter-name</i>	(Optional) Name of a flow exporter that was previously configured.
<b>statistics</b>	Clears the flow exporter statistics.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **clear flow exporter** command removes all statistics from the flow exporter. These statistics will not be exported and the data gathered in the cache will be lost.

You can view the flow exporter statistics by using the **show flow exporter statistics** privileged EXEC command.

## Examples

The following example clears the statistics for all of the flow exporters configured on the :

```
Device# clear flow exporter statistics
```

The following example clears the statistics for the flow exporter named FLOW-EXPORTER-1:

```
Device# clear flow exporter FLOW-EXPORTER-1 statistics
```

# clear flow monitor

To clear a flow monitor cache or flow monitor statistics and to force the export of the data in the flow monitor cache, use the **clear flow monitor** command in privileged EXEC mode.

```
clear flow monitor [name] monitor-name [[cache] force-export | statistics]
```

## Syntax Description

<b>name</b>	Specifies the name of a flow monitor.
<i>monitor-name</i>	Name of a flow monitor that was previously configured.
<b>cache</b>	(Optional) Clears the flow monitor cache information.
<b>force-export</b>	(Optional) Forces the export of the flow monitor cache statistics.
<b>statistics</b>	(Optional) Clears the flow monitor statistics.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **clear flow monitor cache** command removes all entries from the flow monitor cache. These entries will not be exported and the data gathered in the cache will be lost.



**Note** The statistics for the cleared cache entries are maintained.

The **clear flow monitor force-export** command removes all entries from the flow monitor cache and exports them using all flow exporters assigned to the flow monitor. This action can result in a short-term increase in CPU usage. Use this command with caution.

The **clear flow monitor statistics** command clears the statistics for this flow monitor.



**Note** The current entries statistic will not be cleared by the **clear flow monitor statistics** command because this is an indicator of how many entries are in the cache and the cache is not cleared with this command.

You can view the flow monitor statistics by using the **show flow monitor statistics** privileged EXEC command.

## Examples

The following example clears the statistics and cache entries for the flow monitor named FLOW-MONITOR-1:

```
Device# clear flow monitor name FLOW-MONITOR-1
```

The following example clears the statistics and cache entries for the flow monitor named FLOW-MONITOR-1 and forces an export:

```
Device# clear flow monitor name FLOW-MONITOR-1 force-export
```

The following example clears the cache for the flow monitor named FLOW-MONITOR-1 and forces an export:

```
Device# clear flow monitor name FLOW-MONITOR-1 cache force-export
```

The following example clears the statistics for the flow monitor named FLOW-MONITOR-1:

```
Device# clear flow monitor name FLOW-MONITOR-1 statistics
```

# collect

To configure non-key fields for the flow monitor record and to enable capturing the values in the fields for the flow created with the record, use the **collect** command in flow record configuration mode.

**collect** **counter** | **interface** | **timestamp** | **transport**

## Syntax Description

<b>counter</b>	Configures the number of bytes or packets in a flow as a non-key field for a flow record. For more information, see <a href="#">collect counter, on page 749</a> .
<b>interface</b>	Configures the input and output interface name as a non-key field for a flow record. For more information, see <a href="#">collect interface, on page 750</a> .
<b>timestamp</b>	Configures the absolute time of the first seen or last seen packet in a flow as a non-key field for a flow record. For more information, see <a href="#">collect timestamp absolute, on page 751</a> .
<b>transport</b>	Enables the collecting of transport TCP flags from a flow record. For more information, see <a href="#">collect transport tcp flags, on page 752</a> .

## Command Default

Non-key fields are not configured for the flow monitor record.

## Command Modes

Flow record configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The values in non-key fields are added to flows to provide additional information about the traffic in the flows. A change in the value of a non-key field does not create a new flow. In most cases, the values for non-key fields are taken from only the first packet in the flow.

The **collect** commands are used to configure non-key fields for the flow monitor record and to enable capturing the values in the fields for the flow created with the record. The values in non-key fields are added to flows to provide additional information about the traffic in the flows. A change in the value of a non-key field does not create a new flow. In most cases the values for non-key fields are taken from only the first packet in the flow.



## Note

Although it is visible in the command-line help string, the **flow username** keyword is not supported.

The following example configures the total number of bytes in the flows as a non-key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# collect counter bytes long
```

# collect counter

To configure the number of bytes or packets in a flow as a non-key field for a flow record, use the **collect counter** command in flow record configuration mode. To disable the use of the number of bytes or packets in a flow (counters) as a non-key field for a flow record, use the **no** form of this command.

**Command Default** The number of bytes or packets in a flow is not configured as a non-key field.

**Command Modes** Flow record configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** To return this command to its default settings, use the **no collect counter** or **default collect counter** flow record configuration command.

The following example configures the total number of bytes in the flows as a non-key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)#collect counter bytes long
```

The following example configures the total number of packets from the flows as a non-key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# collect counter packets long
```

# collect interface

To configure the input interface name as a non-key field for a flow record, use the **collect interface** command in flow record configuration mode. To disable the use of the input interface as a non-key field for a flow record, use the **no** form of this command.

**collect interface input**  
**no collect interface input**

<b>Syntax Description</b>	<b>input</b> Configures the input interface name as a non-key field and enables collecting the input interface from the flows.				
<b>Command Default</b>	The input interface name is not configured as a non-key field.				
<b>Command Modes</b>	Flow record configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	<p>The Flexible NetFlow <b>collect</b> commands are used to configure non-key fields for the flow monitor record and to enable capturing the values in the fields for the flow created with the record. The values in non-key fields are added to flows to provide additional information about the traffic in the flows. A change in the value of a non-key field does not create a new flow. In most cases, the values for non-key fields are taken from only the first packet in the flow.</p> <p>To return this command to its default settings, use the <b>no collect interface</b> or <b>default collect interface</b> flow record configuration command.</p>				

The following example configures the input interface as a non-key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# collect interface input
```

# collect timestamp absolute

To configure the absolute time of the first seen or last seen packet in a flow as a non-key field for a flow record, use the **collect timestamp absolute** command in flow record configuration mode. To disable the use of the first seen or last seen packet in a flow as a non-key field for a flow record, use the **no** form of this command.

```
collect timestamp absolute first | last
no collect timestamp absolute first | last
```

## Syntax Description

**first** Configures the absolute time of the first seen packet in a flow as a non-key field and enables collecting time stamps from the flows.

**last** Configures the absolute time of the last seen packet in a flow as a non-key field and enables collecting time stamps from the flows.

## Command Default

The absolute time field is not configured as a non-key field.

## Command Modes

Flow record configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **collect** commands are used to configure non-key fields for the flow monitor record and to enable capturing the values in the fields for the flow created with the record. The values in non-key fields are added to flows to provide additional information about the traffic in the flows. A change in the value of a non-key field does not create a new flow. In most cases the values for non-key fields are taken from only the first packet in the flow.

The following example configures time stamps based on the absolute time of the first seen packet in a flow as a non-key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# collect timestamp absolute first
```

The following example configures time stamps based on the absolute time of the last seen packet in a flow as a non-key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# collect timestamp absolute last
```

# collect transport tcp flags

To enable the collecting of transport TCP flags from a flow, use the **collect transport tcp flags** command in flow record configuration mode. To disable the collecting of transport TCP flags from the flow, use the **no** form of this command.

**collect transport tcp flags**  
**no collect transport tcp flags**

<b>Syntax Description</b>	This command has no arguments or keywords.				
<b>Command Default</b>	The transport layer fields are not configured as a non-key field.				
<b>Command Modes</b>	Flow record configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines** The values of the transport layer fields are taken from all packets in the flow. You cannot specify which TCP flag to collect. You can only specify to collect transport TCP flags. All TCP flags will be collected with this command. The following transport TCP flags are collected:

- **ack**—TCP acknowledgement flag
- **cwr**—TCP congestion window reduced flag
- **ece**—TCP ECN echo flag
- **fin**—TCP finish flag
- **psh**—TCP push flag
- **rst**—TCP reset flag
- **syn**—TCP synchronize flag
- **urg**—TCP urgent flag

To return this command to its default settings, use the **no collect collect transport tcp flags** or **default collect collect transport tcp flags** flow record configuration command.

The following example collects the TCP flags from a flow:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# collect transport tcp flags
```



# datalink flow monitor

To apply a Flexible NetFlow flow monitor to an interface, use the **datalink flow monitor** command in interface configuration mode. To disable a Flexible NetFlow flow monitor, use the **no** form of this command.

**datalink flow monitor** *monitor-name* **sampler** *sampler-name* **input**  
**no datalink flow monitor** *monitor-name* **sampler** *sampler-name* **input**

Syntax Description		
	<i>monitor-name</i>	Name of the flow monitor to apply to the interface.
	<b>sampler</b> <i>sampler-name</i>	Enables the specified flow sampler for the flow monitor.
	<b>input</b>	Monitors traffic that the switch receives on the interface.

**Command Default** A flow monitor is not enabled.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Before you apply a flow monitor to an interface with the **datalink flow monitor** command, you must have already created the flow monitor using the **flow monitor** global configuration command and the flow sampler using the **sampler** global configuration command.

To enable a flow sampler for the flow monitor, you must have already created the sampler.



**Note** The **datalink flow monitor** command only monitors non-IPv4 and non-IPv6 traffic. To monitor IPv4 traffic, use the **ip flow monitor** command. To monitor IPv6 traffic, use the **ipv6 flow monitor** command.

This example shows how to enable Flexible NetFlow datalink monitoring on an interface:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# datalink flow monitor FLOW-MONITOR-1 sampler FLOW-SAMPLER-1 input
```

# debug flow exporter

To enable debugging output for Flexible Netflow flow exporters, use the **debug flow exporter** command in privileged EXEC mode. To disable debugging output, use the **no** form of this command.

```
debug flow exporter [[name] exporter-name] [error | event | packets number]
no debug flow exporter [[name] exporter-name] [error | event | packets number]
```

## Syntax Description

<b>name</b>	(Optional) Specifies the name of a flow exporter.
<i>exporter-name</i>	(Optional) The name of a flow exporter that was previously configured.
<b>error</b>	(Optional) Enables debugging for flow exporter errors.
<b>event</b>	(Optional) Enables debugging for flow exporter events.
<b>packets</b>	(Optional) Enables packet-level debugging for flow exporters.
<i>number</i>	(Optional) The number of packets to debug for packet-level debugging of flow exporters. The range is 1 to 65535.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following example indicates that a flow exporter packet has been queued for process send:

```
Device# debug flow exporter
May 21 21:29:12.603: FLOW EXP: Packet queued for process send
```

# debug flow monitor

To enable debugging output for Flexible NetFlow flow monitors, use the **debug flow monitor** command in privileged EXEC mode. To disable debugging output, use the **no** form of this command.

```
debug flow monitor [error | [name] monitor-name [cache [error] | error | packets packets]]
no debug flow monitor [error | [name] monitor-name [cache [error] | error | packets packets]]
```

Syntax Description	
<b>error</b>	(Optional) Enables debugging for flow monitor errors for all flow monitors or for the specified flow monitor.
<b>name</b>	(Optional) Specifies the name of a flow monitor.
<i>monitor-name</i>	(Optional) Name of a flow monitor that was previously configured.
<b>cache</b>	(Optional) Enables debugging for the flow monitor cache.
<b>cache error</b>	(Optional) Enables debugging for flow monitor cache errors.
<b>packets</b>	(Optional) Enables packet-level debugging for flow monitors.
<i>packets</i>	(Optional) Number of packets to debug for packet-level debugging of flow monitors. The range is 1 to 65535.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following example shows that the cache for FLOW-MONITOR-1 was deleted:

```
Device# debug flow monitor FLOW-MONITOR-1 cache
May 21 21:53:02.839: FLOW MON: 'FLOW-MONITOR-1' deleted cache
```

# debug flow record

To enable debugging output for Flexible NetFlow flow records, use the **debug flow record** command in privileged EXEC mode. To disable debugging output, use the **no** form of this command.

```
debug flow record [[name] record-name | options sampler-table | [detailed | error]]
no debug flow record [[name] record-name | options sampler-table | [detailed | error]]
```

## Syntax Description

<b>name</b>	(Optional) Specifies the name of a flow record.
<i>record-name</i>	(Optional) Name of a user-defined flow record that was previously configured.
<b>options</b>	(Optional) Includes information on other flow record options.
<b>sampler-table</b>	(Optional) Includes information on the sampler tables.
<b>detailed</b>	(Optional) Displays detailed information.
<b>error</b>	(Optional) Displays errors only.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following example enables debugging for the flow record:

```
Device# debug flow record FLOW-record-1
```

# debug sampler

To enable debugging output for Flexible NetFlow samplers, use the **debug sampler** command in privileged EXEC mode. To disable debugging output, use the **no** form of this command.

```
debug sampler [detailed | error | [name] sampler-name [detailed | error | sampling samples]]
no debug sampler [detailed | error | [name] sampler-name [detailed | error | sampling]]
```

Syntax Description	Parameter	Description
	<b>detailed</b>	(Optional) Enables detailed debugging for sampler elements.
	<b>error</b>	(Optional) Enables debugging for sampler errors.
	<b>name</b>	(Optional) Specifies the name of a sampler.
	<i>sampler-name</i>	(Optional) Name of a sampler that was previously configured.
	<b>sampling</b> <i>samples</i>	(Optional) Enables debugging for sampling and specifies the number of samples to debug.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following sample output shows that the debug process has obtained the ID for the sampler named SAMPLER-1:

```
Device# debug sampler detailed
*May 28 04:14:30.883: Sampler: Sampler(SAMPLER-1: flow monitor FLOW-MONITOR-1 (ip,Et1/0,O)
  get ID succeeded:1
*May 28 04:14:30.971: Sampler: Sampler(SAMPLER-1: flow monitor FLOW-MONITOR-1 (ip,Et0/0,I)
  get ID succeeded:1
```

# description

To configure a description for a flow monitor, flow exporter, or flow record, use the **description** command in the appropriate configuration mode. To remove a description, use the **no** form of this command.

**description** *description*  
**no description** *description*

## Syntax Description

*description* Text string that describes the flow monitor, flow exporter, or flow record.

## Command Default

The default description for a flow sampler, flow monitor, flow exporter, or flow record is "User defined."

## Command Modes

The following command modes are supported:

Flow exporter configuration

Flow monitor configuration

Flow record configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

To return this command to its default setting, use the **no description** or **default description** command in the appropriate configuration mode.

The following example configures a description for a flow monitor:

```
Device(config)# flow monitor FLOW-MONITOR-1
Device(config-flow-monitor)# description Monitors traffic to 172.16.0.1 255.255.0.0
```

# destination

To configure an export destination for a flow exporter, use the **destination** command in flow exporter configuration mode. To remove an export destination for a flow exporter, use the **no** form of this command.

**destination** *hostnameip-address*  
**no destination** *hostnameip-address*

## Syntax Description

*hostname* Hostname of the device to which you want to send the NetFlow information.

*ip-address* IPv4 address of the workstation to which you want to send the NetFlow information.

## Command Default

An export destination is not configured.

## Command Modes

Flow exporter configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Each flow exporter can have only one destination address or hostname.

When you configure a hostname instead of the IP address for the device, the hostname is resolved immediately and the IPv4 address is stored in the running configuration. If the hostname-to-IP-address mapping that was used for the original Domain Name System (DNS) name resolution changes dynamically on the DNS server, the does not detect this, and the exported data continues to be sent to the original IP address, resulting in a loss of data.

To return this command to its default setting, use the **no destination** or **default destination** command in flow exporter configuration mode.

The following example shows how to configure the networking device to export the cache entry to a destination system:

```
Device(config)# flow exporter FLOW-EXPORTER-1
Device(config-flow-exporter)# destination 10.0.0.4
```

# dscp

To configure a differentiated services code point (DSCP) value for flow exporter datagrams, use the **dscp** command in flow exporter configuration mode. To remove a DSCP value for flow exporter datagrams, use the **no** form of this command.

```
dscp dscp
no dscp dscp
```

---

<b>Syntax Description</b>	<i>dscp</i> DSCP to be used in the DSCP field in exported datagrams. The range is 0 to 63. The default is 0.
---------------------------	--

---

<b>Command Default</b>	The differentiated services code point (DSCP) value is 0.
------------------------	---

<b>Command Modes</b>	Flow exporter configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	To return this command to its default setting, use the <b>no dscp</b> or <b>default dscp</b> flow exporter configuration command.
-------------------------	---

The following example sets 22 as the value of the DSCP field in exported datagrams:

```
Device(config)# flow exporter FLOW-EXPORTER-1
Device(config-flow-exporter)# dscp 22
```



## export-protocol netflow-v9

To configure NetFlow Version 9 export as the export protocol for a Flexible NetFlow exporter, use the **export-protocol netflow-v9** command in flow exporter configuration mode.

**export-protocol netflow-v9**

**Syntax Description** This command has no arguments or keywords.

**Command Default** NetFlow Version 9 is enabled.

**Command Modes** Flow exporter configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The `export-protocol netflow-v9` does not support NetFlow v5 export format, only NetFlow v9 export format is supported.

The following example configures NetFlow Version 9 export as the export protocol for a NetFlow exporter:

```
Device(config)# flow exporter FLOW-EXPORTER-1
Device(config-flow-exporter)# export-protocol netflow-v9
```

# export-protocol netflow-v5

To configure NetFlow Version 5 export as the export protocol for a Flexible NetFlow exporter, use the **export-protocol netflow-v5** command in flow exporter configuration mode.

## **export-protocol netflow-v5**

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** NetFlow Version 5 is enabled.

---

**Command Modes** Flow exporter configuration

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

# exporter

To add a flow exporter for a flow monitor, use the **exporter** command in the appropriate configuration mode. To remove a flow exporter for a flow monitor, use the **no** form of this command.

```
exporter exporter-name
no exporter exporter-name
```

<b>Syntax Description</b>	<i>exporter-name</i> Name of a flow exporter that was previously configured.				
<b>Command Default</b>	An exporter is not configured.				
<b>Command Modes</b>	Flow monitor configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	<p>You must have already created a flow exporter by using the <b>flow exporter</b> command before you can apply the flow exporter to a flow monitor with the <b>exporter</b> command.</p> <p>To return this command to its default settings, use the <b>no exporter</b> or <b>default exporter</b> flow monitor configuration command.</p>				

## Examples

The following example configures an exporter for a flow monitor:

```
Device(config)# flow monitor FLOW-MONITOR-1
Device(config-flow-monitor)# exporter EXPORTER-1
```

# flow exporter

To create a flow exporter, or to modify an existing flow exporter, and enter flow exporter configuration mode, use the **flow exporter** command in global configuration mode. To remove a flow exporter, use the **no** form of this command.

**flow exporter** *exporter-name*  
**no flow exporter** *exporter-name*

<b>Syntax Description</b>	<i>exporter-name</i> Name of the flow exporter that is being created or modified.
---------------------------	---

<b>Command Default</b>	flow exporters are not present in the configuration.
------------------------	--

<b>Command Modes</b>	Global configuration
----------------------	----------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	Flow exporters export the data in the flow monitor cache to a remote system, such as a server running NetFlow collector, for analysis and storage. Flow exporters are created as separate entities in the configuration. Flow exporters are assigned to flow monitors to provide data export capability for the flow monitors. You can create several flow exporters and assign them to one or more flow monitors to provide several export destinations. You can create one flow exporter and apply it to several flow monitors.
-------------------------	---

<b>Examples</b>	The following example creates a flow exporter named FLOW-EXPORTER-1 and enters flow exporter configuration mode:
-----------------	--

```
Device(config)# flow exporter FLOW-EXPORTER-1
Device(config-flow-exporter)#
```

# flow monitor

To create a flow monitor, or to modify an existing flow monitor, and enter flow monitor configuration mode, use the **flow monitor** command in global configuration mode. To remove a flow monitor, use the **no** form of this command.

**flow monitor** *monitor-name*  
**no flow monitor** *monitor-name*

<b>Syntax Description</b>	<i>monitor-name</i> Name of the flow monitor that is being created or modified.
---------------------------	---

<b>Command Default</b>	flow monitors are not present in the configuration.
------------------------	---

<b>Command Modes</b>	Global configuration
----------------------	----------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	Flow monitors are the component that is applied to interfaces to perform network traffic monitoring. Flow monitors consist of a flow record and a cache. You add the record to the flow monitor after you create the flow monitor. The flow monitor cache is automatically created at the time the flow monitor is applied to the first interface. Flow data is collected from the network traffic during the monitoring process based on the key and nonkey fields in the flow monitor's record and stored in the flow monitor cache.
-------------------------	--

<b>Examples</b>	The following example creates a flow monitor named FLOW-MONITOR-1 and enters flow monitor configuration mode:
-----------------	---

```
Device(config)# flow monitor FLOW-MONITOR-1
Device(config-flow-monitor)#
```

# flow record

To create a flow record, or to modify an existing flow record, and enter flow record configuration mode, use the **flow record** command in global configuration mode. To remove a record, use the **no** form of this command.

**flow record** *record-name*  
**no flow record** *record-name*

<b>Syntax Description</b>	<i>record-name</i> Name of the flow record that is being created or modified.
---------------------------	---

<b>Command Default</b>	A flow record is not configured.
------------------------	----------------------------------

<b>Command Modes</b>	Global configuration
----------------------	----------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	A flow record defines the keys that uses to identify packets in the flow, as well as other fields of interest that gathers for the flow. You can define a flow record with any combination of keys and fields of interest. The supports a rich set of keys. A flow record also defines the types of counters gathered per flow. You can configure 64-bit packet or byte counters.
-------------------------	---

<b>Examples</b>	The following example creates a flow record named FLOW-RECORD-1, and enters flow record configuration mode:
-----------------	---

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)#
```

# ip flow monitor

To enable a Flexible NetFlow flow monitor for IPv4 traffic that the is receiving, use the **ip flow monitor** command in interface configuration mode. To disable a flow monitor, use the **no** form of this command.

```
ip flow monitor monitor-name [sampler sampler-name] input
no ip flow monitor monitor-name [sampler sampler-name] input
```

Syntax Description	
	<i>monitor-name</i> Name of the flow monitor to apply to the interface.
	<b>sampler</b> <i>sampler-name</i> (Optional) Enables the specified flow sampler for the flow monitor.
	<b>input</b> Monitors IPv4 traffic that the receives on the interface.

**Command Default** A flow monitor is not enabled.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Before you can apply a flow monitor to an interface with the **ip flow monitor** command, you must have already created the flow monitor using the **flow monitor** global configuration command.

When you add a sampler to a flow monitor, only packets that are selected by the named sampler will be entered into the cache to form flows. Each use of a sampler causes separate statistics to be stored for that usage.

You cannot add a sampler to a flow monitor after the flow monitor has been enabled on the interface. You must first remove the flow monitor from the interface and then enable the same flow monitor with a sampler.



**Note** The statistics for each flow must be scaled to give the expected true usage. For example, with a 1 in 100 sampler it is expected that the packet and byte counters will have to be multiplied by 100.

The following example enables a flow monitor for monitoring input traffic:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ip flow monitor FLOW-MONITOR-1 input
```

The following example enables a flow monitor for monitoring input traffic, with a sampler to limit the input packets that are sampled:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ip flow monitor FLOW-MONITOR-1 sampler SAMPLER-1 input
```

The following example shows what happens when you try to add a sampler to a flow monitor that has already been enabled on an interface without a sampler:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ip flow monitor FLOW-MONITOR-1 sampler SAMPLER-2 input
% Flow Monitor: Flow Monitor 'FLOW-MONITOR-1' is already on in full mode and cannot be
enabled with a sampler.
```

The following example shows how to remove a flow monitor from an interface so that it can be enabled with the sampler:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# no ip flow monitor FLOW-MONITOR-1 input
Device(config-if)# ip flow monitor FLOW-MONITOR-1 sampler SAMPLER-2 input
```



# ipv6 flow monitor

To enable a flow monitor for IPv6 traffic that the interface is receiving, use the **ipv6 flow monitor** command in interface configuration mode. To disable a flow monitor, use the **no** form of this command.

```
ipv6 flow monitor monitor-name [sampler sampler-name] input
no ipv6 flow monitor monitor-name [sampler sampler-name] input
```

## Syntax Description

<i>monitor-name</i>	Name of the flow monitor to apply to the interface.
<b>sampler</b> <i>sampler-name</i>	(Optional) Enables the specified flow sampler for the flow monitor.
<b>input</b>	Monitors IPv6 traffic that the interface receives on the interface.

## Command Default

A flow monitor is not enabled.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Before you can apply a flow monitor to the interface with the **ipv6 flow monitor** command, you must have already created the flow monitor using the **flow monitor** global configuration command.

When you add a sampler to a flow monitor, only packets that are selected by the named sampler will be entered into the cache to form flows. Each use of a sampler causes separate statistics to be stored for that usage.

You cannot add a sampler to a flow monitor after the flow monitor has been enabled on the interface. You must first remove the flow monitor from the interface and then enable the same flow monitor with a sampler.



**Note** The statistics for each flow must be scaled to give the expected true usage. For example, with a 1 in 100 sampler it is expected that the packet and byte counters will have to be multiplied by 100.

The following example enables a flow monitor for monitoring input traffic:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ipv6 flow monitor FLOW-MONITOR-1 input
```

The following example enables a flow monitor for monitoring input traffic, with a sampler to limit the input packets that are sampled:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ipv6 flow monitor FLOW-MONITOR-1 sampler SAMPLER-1 input
```

The following example shows what happens when you try to add a sampler to a flow monitor that has already been enabled on an interface without a sampler:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ipv6 flow monitor FLOW-MONITOR-1 sampler SAMPLER-2 input
% Flow Monitor: Flow Monitor 'FLOW-MONITOR-1' is already on in full mode and cannot be
enabled with a sampler.
```

The following example shows how to remove a flow monitor from an interface so that it can be enabled with the sampler:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# no ipv6 flow monitor FLOW-MONITOR-1 input
Device(config-if)# ipv6 flow monitor FLOW-MONITOR-1 sampler SAMPLER-2 input
```

# match datalink ethertype

To configure the EtherType of the packet as a key field for a flow record, use the **match datalink ethertype** command in flow record configuration mode. To disable the EtherType of the packet as a key field for a flow record, use the **no** form of this command.

**match datalink ethertype**  
**no match datalink ethertype**

<b>Syntax Description</b>	This command has no arguments or keywords.	
<b>Command Default</b>	The EtherType of the packet is not configured as a key field.	
<b>Command Modes</b>	Flow record configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

When you configure the EtherType of the packet as a key field for a flow record using the **match datalink ethertype** command, the traffic flow that is created is based on the type of flow monitor that is assigned to the interface:

- When a datalink flow monitor is assigned to an interface using the **datalink flow monitor** interface configuration command, it creates unique flows for different Layer 2 protocols.
- When an IP flow monitor is assigned to an interface using the **ip flow monitor** interface configuration command, it creates unique flows for different IPv4 protocols.
- When an IPv6 flow monitor is assigned to an interface using the **ipv6 flow monitor** interface configuration command, it creates unique flows for different IPv6 protocols.

To return this command to its default settings, use the **no match datalink ethertype** or **default match datalink ethertype** flow record configuration command.

The following example configures the EtherType of the packet as a key field for a flow record:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match datalink ethertype
```

# match datalink mac

To configure the use of MAC addresses as a key field for a flow record, use the **match datalink mac** command in flow record configuration mode. To disable the use of MAC addresses as a key field for a flow record, use the **no** form of this command.

**match datalink mac destination address input | source address input**  
**no match datalink mac destination address input | source address input**

<b>Syntax Description</b>	<b>destination address</b>	Configures the use of the destination MAC address as a key field.
	<b>input</b>	Specifies the MAC address of input packets.
	<b>source address</b>	Configures the use of the source MAC address as a key field.
<b>Command Default</b>	MAC addresses are not configured as a key field.	
<b>Command Modes</b>	Flow record configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

The **input** keyword is used to specify the observation point that is used by the **match datalink mac** command to create flows based on the unique MAC addresses in the network traffic.



**Note** When a datalink flow monitor is assigned to an interface or VLAN record, it creates flows only for non-IPv6 or non-IPv4 traffic.

To return this command to its default settings, use the **no match datalink mac** or **default match datalink mac** flow record configuration command.

The following example configures the use of the destination MAC address of packets that are received by the as a key field for a flow record:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match datalink mac destination address input
```

## match datalink vlan

To configure the VLAN ID as a key field for a flow record, use the **match datalink vlan** command in flow record configuration mode. To disable the use of the VLAN ID value as a key field for a flow record, use the **no** form of this command.

```
match datalink vlan input
no match datalink vlan input
```

<b>Syntax Description</b>	<b>input</b> Configures the VLAN ID of traffic being received by the as a key field.				
<b>Command Default</b>	The VLAN ID is not configured as a key field.				
<b>Command Modes</b>	Flow record configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	<p>A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the <b>match</b> command.</p> <p>The <b>input</b> keyword is used to specify the observation point that is used by the <b>match datalink vlan</b> command to create flows based on the unique VLAN IDs in the network traffic.</p> <p>The following example configures the VLAN ID of traffic being received by the as a key field for a flow record:</p> <pre>Device(config)# flow record FLOW-RECORD-1 Device(config-flow-record)# match datalink vlan input</pre>				

# match flow cts

To configure CTS source group tag and destination group tag for a flow record, use the **match flow cts** command in flow record configuration mode. To disable the group tag as key field for a flow record, use the **no** form of this command.

**match flow cts source | destination group-tag**  
**no match flow cts source | destination group-tag**

<b>Syntax Description</b>	<b>cts destination group-tag</b>	Configures the CTS destination field group as a key field.
	<b>cts source group-tag</b>	Configures the CTS source field group as a key field.
<b>Command Default</b>	The CTS destination or source field group, flow direction and the flow sampler ID are not configured as key fields.	
<b>Command Modes</b>	Flexible NetFlow flow record configuration (config-flow-record) Policy inline configuration (config-if-policy-inline)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.
		This command was reintroduced. This command was not supported in
<b>Usage Guidelines</b>	A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the <b>match</b> command.	

The following example configures the source group-tag as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match flow cts source group-tag
```

## match flow direction

To configure the flow direction as key fields for a flow record, use the **match flow direction** command in flow record configuration mode. To disable the use of the flow direction as key fields for a flow record, use the **no** form of this command.

**match flow direction**  
**no match flow direction**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The flow direction is not configured as key fields.

**Command Modes** Flow record configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

The **match flow direction** command captures the direction of the flow as a key field. This feature is most useful when a single flow monitor is configured for input and output flows. It can be used to find and eliminate flows that are being monitored twice, once on input and once on output. This command can help to match up pairs of flows in the exported data when the two flows are flowing in opposite directions.

The following example configures the direction the flow was monitored in as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match flow direction
```

# match interface

To configure the input and output interfaces as key fields for a flow record, use the **match interface** command in flow record configuration mode. To disable the use of the input and output interfaces as key fields for a flow record, use the **no** form of this command.

**match interface input | output**  
**no match interface input | output**

## Syntax Description

**input** Configures the input interface as a key field.

**output** Configures the output interface as a key field.

## Command Default

The input and output interfaces are not configured as key fields.

## Command Modes

Flow record configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

The following example configures the input interface as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match interface input
```

The following example configures the output interface as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match interface output
```



# match ipv4

To configure one or more of the IPv4 fields as a key field for a flow record, use the **match ipv4** command in flow record configuration mode. To disable the use of one or more of the IPv4 fields as a key field for a flow record, use the **no** form of this command.

**match ipv4 destination address | protocol | source address | tos | version**  
**no match ipv4 destination address | protocol | source address | tos | version**

Syntax Description	
<b>destination address</b>	Configures the IPv4 destination address as a key field. For more information see <a href="#">match ipv4 destination address, on page 778</a> .
<b>protocol</b>	Configures the IPv4 protocol as a key field.
<b>source address</b>	Configures the IPv4 destination address as a key field. For more information see <a href="#">match ipv4 source address, on page 779</a> .
<b>tos</b>	Configures the IPv4 ToS as a key field.
<b>version</b>	Configures the IP version from IPv4 header as a key field.

**Command Default** The use of one or more of the IPv4 fields as a key field for a user-defined flow record is not enabled.

**Command Modes** Flow record configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

The following example configures the IPv4 protocol as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match ipv4 protocol
```

# match ipv4 destination address

To configure the IPv4 destination address as a key field for a flow record, use the **match ipv4 destination address** command in flow record configuration mode. To disable the IPv4 destination address as a key field for a flow record, use the **no** form of this command.

**match ipv4 destination address**  
**no match ipv4 destination address**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The IPv4 destination address is not configured as a key field.

**Command Modes** Flow record configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

To return this command to its default settings, use the **no match ipv4 destination address** or **default match ipv4 destination address** flow record configuration command.

The following example configures the IPv4 destination address as a key field for a flow record:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match ipv4 destination address
```

# match ipv4 source address

To configure the IPv4 source address as a key field for a flow record, use the **match ipv4 source address** command in flow record configuration mode. To disable the use of the IPv4 source address as a key field for a flow record, use the **no** form of this command.

**match ipv4 source address**  
**no match ipv4 source address**

---

**Syntax Description**

This command has no arguments or keywords.

---

**Command Default**

The IPv4 source address is not configured as a key field.

---

**Command Modes**

Flow record configuration

---

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

**Usage Guidelines**

A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

To return this command to its default settings, use the **no match ipv4 source address** or **default match ipv4 source address** flow record configuration command.

The following example configures the IPv4 source address as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match ipv4 source address
```

# match ipv4 ttl

To configure the IPv4 time-to-live (TTL) field as a key field for a flow record, use the **match ipv4 ttl** command in flow record configuration mode. To disable the use of the IPv4 TTL field as a key field for a flow record, use the **no** form of this command.

**match ipv4 ttl**  
**no match ipv4 ttl**

<b>Syntax Description</b>	This command has no arguments or keywords.				
<b>Command Default</b>	The IPv4 time-to-live (TTL) field is not configured as a key field.				
<b>Command Modes</b>	Flow record configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines** A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match ipv4 ttl** command.

The following example configures IPv4 TTL as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match ipv4 ttl
```

## match ipv6

To configure one or more of the IPv6 fields as a key field for a flow record, use the **match ipv6** command in flow record configuration mode. To disable the use of one or more of the IPv6 fields as a key field for a flow record, use the **no** form of this command.

**match ipv6 destination address | protocol | source address | traffic-class | version**  
**no match ipv6 destination address | protocol | source address | traffic-class | version**

<b>Syntax Description</b>	<b>destination address</b>	Configures the IPv4 destination address as a key field. For more information see <a href="#">match ipv6 destination address, on page 782</a> .
	<b>protocol</b>	Configures the IPv6 protocol as a key field.
	<b>source address</b>	Configures the IPv4 destination address as a key field. For more information see <a href="#">match ipv6 source address, on page 784</a> .
<b>Command Default</b>	The IPv6 fields are not configured as a key field.	
<b>Command Modes</b>	Flow record configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the <b>match</b> command.	

The following example configures the IPv6 protocol field as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match ipv6 protocol
```

## match ipv6 destination address

To configure the IPv6 destination address as a key field for a flow record, use the **match ipv6 destination address** command in flow record configuration mode. To disable the IPv6 destination address as a key field for a flow record, use the **no** form of this command.

**match ipv6 destination address**  
**no match ipv6 destination address**

<b>Syntax Description</b>	This command has no arguments or keywords.	
<b>Command Default</b>	The IPv6 destination address is not configured as a key field.	
<b>Command Modes</b>	Flow record configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

To return this command to its default settings, use the **no match ipv6 destination address** or **default match ipv6 destination address** flow record configuration command.

The following example configures the IPv6 destination address as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match ipv6 destination address
```

# match ipv6 hop-limit

To configure the IPv6 hop limit as a key field for a flow record, use the **match ipv6 hop-limit** command in flow record configuration mode. To disable the use of a section of an IPv6 packet as a key field for a flow record, use the **no** form of this command.

**match ipv6 hop-limit**  
**no match ipv6 hop-limit**

<b>Syntax Description</b>	This command has no arguments or keywords.				
<b>Command Default</b>	The use of the IPv6 hop limit as a key field for a user-defined flow record is not enabled by default.				
<b>Command Modes</b>	Flow record configuration				
<b>Command History</b>	<table><thead><tr><th>Release</th><th>Modification</th></tr></thead><tbody><tr><td>Cisco IOS XE Everest 16.5.1a</td><td>This command was introduced.</td></tr></tbody></table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	<p>A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the <b>match</b> command.</p> <p>The following example configures the hop limit of the packets in the flow as a key field:</p> <pre>Device(config)# flow record FLOW-RECORD-1 Device(config-flow-record)# match ipv6 hop-limit</pre>				

# match ipv6 source address

To configure the IPv6 source address as a key field for a flow record, use the **match ipv6 source address** command in flow record configuration mode. To disable the use of the IPv6 source address as a key field for a flow record, use the **no** form of this command.

**match ipv6 source address**  
**no match ipv6 source address**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The IPv6 source address is not configured as a key field.

**Command Modes** Flow record configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

To return this command to its default settings, use the **no match ipv6 source address** or **default match ipv6 source address** flow record configuration command.

The following example configures a IPv6 source address as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match ipv6 source address
```



# match transport

To configure one or more of the transport fields as a key field for a flow record, use the **match transport** command in flow record configuration mode. To disable the use of one or more of the transport fields as a key field for a flow record, use the **no** form of this command.

## Syntax Description

**destination-port** Configures the transport destination port as a key field.

**source-port** Configures the transport source port as a key field.

## Command Default

The transport fields are not configured as a key field.

## Command Modes

Flow record configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

The following example configures the destination port as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match transport destination-port
```

The following example configures the source port as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match transport source-port
```

# match transport icmp ipv4

To configure the ICMP IPv4 type field and the code field as key fields for a flow record, use the **match transport icmp ipv4** command in flow record configuration mode. To disable the use of the ICMP IPv4 type field and code field as key fields for a flow record, use the **no** form of this command.

**match transport icmp ipv4 code | type**  
**no match transport icmp ipv4 code | type**

<b>Syntax Description</b>	<b>code</b> Configures the IPv4 ICMP code as a key field.				
	<b>type</b> Configures the IPv4 ICMP type as a key field.				
<b>Command Default</b>	The ICMP IPv4 type field and the code field are not configured as key fields.				
<b>Command Modes</b>	Flow record configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines** A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

The following example configures the IPv4 ICMP code field as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match transport icmp ipv4 code
```

The following example configures the IPv4 ICMP type field as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match transport icmp ipv4 type
```

# match transport icmp ipv6

To configure the ICMP IPv6 type field and the code field as key fields for a flow record, use the **match transport icmp ipv6** command in flow record configuration mode. To disable the use of the ICMP IPv6 type field and code field as key fields for a flow record, use the **no** form of this command.

```
match transport icmp ipv6 code | type
no match transport icmp ipv6 code | type
```

## Syntax Description

**code** Configures the IPv6 ICMP code as a key field.

**type** Configures the IPv6 ICMP type as a key field.

## Command Default

The ICMP IPv6 type field and the code field are not configured as key fields.

## Command Modes

Flow record configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

A flow record requires at least one key field before it can be used in a flow monitor. The key fields distinguish flows, with each flow having a unique set of values for the key fields. The key fields are defined using the **match** command.

The following example configures the IPv6 ICMP code field as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match transport icmp ipv6 code
```

The following example configures the IPv6 ICMP type field as a key field:

```
Device(config)# flow record FLOW-RECORD-1
Device(config-flow-record)# match transport icmp ipv6 type
```

## mode random 1 out-of

To enable random sampling and to specify the packet interval for a sampler, use the **mode random 1 out-of** command in sampler configuration mode. To remove the packet interval information for a sampler, use the **no** form of this command.

**mode random 1 out-of** *window-size*  
**no mode**

<b>Syntax Description</b>	<i>window-size</i> Specifies the window size from which to select packets. The range is 2 to 1024.
---------------------------	--

<b>Command Default</b>	The mode and the packet interval for a sampler are not configured.
------------------------	--

<b>Command Modes</b>	Sampler configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		Cisco IOS XE Everest 16.5.1a

<b>Usage Guidelines</b>	A total of four unique samplers are supported on the . Packets are chosen in a manner that should eliminate any bias from traffic patterns and counter any attempt by users to avoid monitoring.
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<b>Note</b>	The <b>deterministic</b> keyword is not supported, even though it is visible in the command-line help string.
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### Examples

The following example enables random sampling with a window size of 1000:

```
Device(config)# sampler SAMPLER-1
Device(config-sampler)# mode random 1 out-of 1000
```

# option

To configure optional data parameters for a flow exporter for , use the **option** command in flow exporter configuration mode. To remove optional data parameters for a flow exporter, use the **no** form of this command.

**option exporter-stats | interface-table | sampler-table [timeout seconds]**  
**no option exporter-stats | interface-table | sampler-table**

Syntax Description	exporter-stats	Configures the exporter statistics option for flow exporters.
	<b>interface-table</b>	Configures the interface table option for flow exporters.
	<b>sampler-table</b>	Configures the export sampler table option for flow exporters.
	<b>timeout seconds</b>	(Optional) Configures the option resend time in seconds for flow exporters. The range is 1 to 86400. The default is 600.

**Command Default** The timeout is 600 seconds. All other optional data parameters are not configured.

**Command Modes** Flow exporter configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **option exporter-stats** command causes the periodic sending of the exporter statistics, including the number of records, bytes, and packets sent. This command allows the collector to estimate packet loss for the export records it receives. The optional timeout alters the frequency at which the reports are sent.

The **option interface-table** command causes the periodic sending of an options table, which allows the collector to map the interface SNMP indexes provided in the flow records to interface names. The optional timeout can alter the frequency at which the reports are sent.

The **option sampler-table** command causes the periodic sending of an options table, which details the configuration of each sampler and allows the collector to map the sampler ID provided in any flow record to a configuration that it can use to scale up the flow statistics. The optional timeout can alter the frequency at which the reports are sent.

To return this command to its default settings, use the **no option** or **default option** flow exporter configuration command.

The following example shows how to enable the periodic sending of the sampler option table, which allows the collector to map the sampler ID to the sampler type and rate:

```
Device(config)# flow exporter FLOW-EXPORTER-1
Device(config-flow-exporter)# option sampler-table
```

The following example shows how to enable the periodic sending of the exporter statistics, including the number of records, bytes, and packets sent:

```
Device(config)# flow exporter FLOW-EXPORTER-1
Device(config-flow-exporter)# option exporter-stats
```

The following example shows how to enable the periodic sending of an options table, which allows the collector to map the interface SNMP indexes provided in the flow records to interface names:

```
Device(config)# flow exporter FLOW-EXPORTER-1  
Device(config-flow-exporter)# option interface-table
```

# record

To add a flow record for a flow monitor, use the **record** command in flow monitor configuration mode. To remove a flow record for a flow monitor, use the **no** form of this command.

**record** *record-name*  
**no record**

## Syntax Description

*record-name* Name of a user-defined flow record that was previously configured.

## Command Default

A flow record is not configured.

## Command Modes

Flow monitor configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Each flow monitor requires a record to define the contents and layout of its cache entries. The flow monitor can use one of the wide range of predefined record formats, or advanced users may create their own record formats.



### Note

You must use the **no ip flow monitor** command to remove a flow monitor from all of the interfaces to which you have applied it before you can modify the parameters for the **record** command for the flow monitor.

## Examples

The following example configures the flow monitor to use FLOW-RECORD-1:

```
Device(config)# flow monitor FLOW-MONITOR-1
Device(config-flow-monitor)# record FLOW-RECORD-1
```

# sampler

To create a flow sampler, or to modify an existing flow sampler, and to enter sampler configuration mode, use the **sampler** command in global configuration mode. To remove a sampler, use the **no** form of this command.

**sampler** *sampler-name*

**no sampler** *sampler-name*

<b>Syntax Description</b>	<i>sampler-name</i> Name of the flow sampler that is being created or modified.
---------------------------	---

<b>Command Default</b>	flow samplers are not configured.
------------------------	-----------------------------------

<b>Command Modes</b>	Global configuration
----------------------	----------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	Flow samplers are used to reduce the load placed by on the networking device to monitor traffic by limiting the number of packets that are analyzed. You configure a rate of sampling that is 1 out of a range of packets. Flow samplers are applied to interfaces in conjunction with a flow monitor to implement sampled .
-------------------------	--

To enable flow sampling, you configure the record that you want to use for traffic analysis and assign it to a flow monitor. When you apply a flow monitor with a sampler to an interface, the sampled packets are analyzed at the rate specified by the sampler and compared with the flow record associated with the flow monitor. If the analyzed packets meet the criteria specified by the flow record, they are added to the flow monitor cache.

## Examples

The following example creates a flow sampler name SAMPLER-1:

```
Device(config)# sampler SAMPLER-1
Device(config-sampler)#
```



# show flow exporter

To display flow exporter status and statistics, use the **show flow exporter** command in privileged EXEC mode.

```
show flow exporter [export-ids netflow-v9] [name] exporter-name [statistics | templates] | statistics | templates]
```

Syntax Description	
<b>export-ids netflow-v9</b>	(Optional) Displays the NetFlow Version 9 export fields that can be exported and their IDs.
<b>name</b>	(Optional) Specifies the name of a flow exporter.
<i>exporter-name</i>	(Optional) Name of a flow exporter that was previously configured.
<b>statistics</b>	(Optional) Displays statistics for all flow exporters or for the specified flow exporter.
<b>templates</b>	(Optional) Displays template information for all flow exporters or for the specified flow exporter.

**Command Default** None

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

The following example displays the status and statistics for all of the flow exporters configured on a :

```
Device# show flow exporter
Flow Exporter FLOW-EXPORTER-1:
  Description:           Exports to the datacenter
  Export protocol:       NetFlow Version 9
  Transport Configuration:
    Destination IP address: 192.168.0.1
    Source IP address:     192.168.0.2
    Transport Protocol:    UDP
    Destination Port:      9995
    Source Port:           55864
    DSCP:                  0x0
    TTL:                   255
    Output Features:       Used
```

This table describes the significant fields shown in the display:

**Table 102: show flow exporter Field Descriptions**

Field	Description
Flow Exporter	The name of the flow exporter that you configured.

Field	Description
Description	The description that you configured for the exporter, or the default description User defined.
Transport Configuration	The transport configuration fields for this exporter.
Destination IP address	The IP address of the destination host.
Source IP address	The source IP address used by the exported packets.
Transport Protocol	The transport layer protocol used by the exported packets.
Destination Port	The destination UDP port to which the exported packets are sent.
Source Port	The source UDP port from which the exported packets are sent.
DSCP	The differentiated services code point (DSCP) value.
TTL	The time-to-live value.
Output Features	Specifies whether the <b>output-features</b> command, which causes the output features to be run on Flexible NetFlow export packets, has been used or not.

The following example displays the status and statistics for all of the flow exporters configured on a :

```
Device# show flow exporter name FLOW-EXPORTER-1 statistics
Flow Exporter FLOW-EXPORTER-1:
  Packet send statistics (last cleared 2w6d ago):
    Successfully sent:      0                (0 bytes)
```

# show flow interface

To display the configuration and status for an interface, use the **show flow interface** command in privileged EXEC mode.

**show flow interface** [*type number*]

## Syntax Description

*type* (Optional) The type of interface on which you want to display accounting configuration information.

*number* (Optional) The number of the interface on which you want to display accounting configuration information.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following example displays the accounting configuration on Ethernet interfaces 0/0 and 0/1:

```
Device# show flow interface gigabitethernet1/0/1

Interface Ethernet1/0
  monitor:          FLOW-MONITOR-1
  direction:       Output
  traffic(ip):      on
Device# show flow interface gigabitethernet1/0/2
Interface Ethernet0/0
  monitor:          FLOW-MONITOR-1
  direction:       Input
  traffic(ip):      sampler SAMPLER-2#
```

The table below describes the significant fields shown in the display.

**Table 103: show flow interface Field Descriptions**

Field	Description
Interface	The interface to which the information applies.
monitor	The name of the flow monitor that is configured on the interface.
direction:	The direction of traffic that is being monitored by the flow monitor. The possible values are: <ul style="list-style-type: none"> <li>• Input—Traffic is being received by the interface.</li> <li>• Output—Traffic is being transmitted by the interface.</li> </ul>

Field	Description
traffic(ip)	<p>Indicates if the flow monitor is in normal mode or sampler mode.</p> <p>The possible values are:</p> <ul style="list-style-type: none"><li>• on—The flow monitor is in normal mode.</li><li>• sampler—The flow monitor is in sampler mode (the name of the sampler will be included in the display).</li></ul>

# show flow monitor

To display the status and statistics for a flow monitor, use the **show flow monitor** command in privileged EXEC mode.

Syntax Description	name	(Optional) Specifies the name of a flow monitor.
	<i>monitor-name</i>	(Optional) Name of a flow monitor that was previously configured.
	<b>cache</b>	(Optional) Displays the contents of the cache for the flow monitor.
	<b>format</b>	(Optional) Specifies the use of one of the format options for formatting the display output.
	<b>csv</b>	(Optional) Displays the flow monitor cache contents in comma-separated variables (CSV) format.
	<b>record</b>	(Optional) Displays the flow monitor cache contents in record format.
	<b>table</b>	(Optional) Displays the flow monitor cache contents in table format.
	<b>statistics</b>	(Optional) Displays the statistics for the flow monitor.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **cache** keyword uses the record format by default.

The uppercase field names in the display output of the **show flowmonitor monitor-name cache** command are key fields that uses to differentiate flows. The lowercase field names in the display output of the **show flow monitor monitor-name cache** command are nonkey fields from which collects values as additional data for the cache.

## Examples

The following example displays the status for a flow monitor:

```
Device# show flow monitor FLOW-MONITOR-1

Flow Monitor FLOW-MONITOR-1:
  Description:      Used for basic traffic analysis
  Flow Record:     flow-record-1
  Flow Exporter:   flow-exporter-1
                  flow-exporter-2

Cache:
  Type:            normal
  Status:         allocated
  Size:           4096 entries / 311316 bytes
  Inactive Timeout: 15 secs
  Active Timeout: 1800 secs
```

This table describes the significant fields shown in the display.

**Table 104: show flow monitor monitor-name Field Descriptions**

Field	Description
Flow Monitor	Name of the flow monitor that you configured.
Description	Description that you configured or the monitor, or the default description User defined.
Flow Record	Flow record assigned to the flow monitor.
Flow Exporter	Exporters that are assigned to the flow monitor.
Cache	Information about the cache for the flow monitor.
Type	Flow monitor cache type. The value is always normal, as it is the only supported cache type.
Status	Status of the flow monitor cache. The possible values are: <ul style="list-style-type: none"> <li>• allocated—The cache is allocated.</li> <li>• being deleted—The cache is being deleted.</li> <li>• not allocated—The cache is not allocated.</li> </ul>
Size	Current cache size.
Inactive Timeout	Current value for the inactive timeout in seconds.
Active Timeout	Current value for the active timeout in seconds.

The following example displays the status, statistics, and data for the flow monitor named FLOW-MONITOR-1:

This table describes the significant fields shown in the display.

The following example displays the status, statistics, and data for the flow monitor named FLOW-MONITOR-1 in a table format:

The following example displays the status, statistics, and data for the flow monitor named FLOW-MONITOR-IPv6 (the cache contains IPv6 data) in record format:

The following example displays the status and statistics for a flow monitor:

# show flow record

To display the status and statistics for a flow record, use the **show flow record** command in privileged EXEC mode.

```
show flow record [[name] record-name]
```

<b>Syntax Description</b>	<b>name</b> (Optional) Specifies the name of a flow record.
	<b>record-name</b> (Optional) Name of a user-defined flow record that was previously configured.
<b>Command Default</b>	None
<b>Command Modes</b>	Privileged EXEC
<b>Command History</b>	<b>Release</b>
	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a This command was introduced.

The following example displays the status and statistics for FLOW-RECORD-1:

```
Device# show flow record FLOW-RECORD-1
flow record FLOW-RECORD-1:
  Description:      User defined
  No. of users:    0
  Total field space: 24 bytes
  Fields:
    match ipv6 destination address
    match transport source-port
    collect interface input
```

# show sampler

To display the status and statistics for a sampler, use the **show sampler** command in privileged EXEC mode.

**show sampler** *[[name] sampler-name]*

<b>Syntax Description</b>	<b>name</b> (Optional) Specifies the name of a sampler.
	<i>sampler-name</i> (Optional) Name of a sampler that was previously configured.
<b>Command Default</b>	None
<b>Command Modes</b>	Privileged EXEC
<b>Command History</b>	<b>Release</b>
	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a This command was introduced.

The following example displays the status and statistics for all of the flow samplers configured:

```
Device# show sampler
Sampler SAMPLER-1:
  ID:                2083940135
  export ID:         0
  Description:       User defined
  Type:              Invalid (not in use)
  Rate:              1 out of 32
  Samples:           0
  Requests:          0
  Users (0):
  Users (0):

Sampler SAMPLER-2:
  ID:                3800923489
  export ID:         1
  Description:       User defined
  Type:              random
  Rate:              1 out of 100
  Samples:           1
  Requests:          124
  Users (1):
  Users (1):
    flow monitor FLOW-MONITOR-1 (datalink,vlan1) 0 out of 0
```

This table describes the significant fields shown in the display.

**Table 105: show sampler Field Descriptions**

Field	Description
ID	ID number of the flow sampler.
Export ID	ID of the flow sampler export.



Field	Description
Description	Description that you configured for the flow sampler, or the default description User defined.
Type	Sampling mode that you configured for the flow sampler.
Rate	Window size (for packet selection) that you configured for the flow sampler. The range is 2 to 32768.
Samples	Number of packets sampled since the flow sampler was configured or the was restarted. This is equivalent to the number of times a positive response was received when the sampler was queried to determine if the traffic needed to be sampled. See the explanation of the Requests field in this table.
Requests	Number of times the flow sampler was queried to determine if the traffic needed to be sampled.
Users	Interfaces on which the flow sampler is configured.

## source

To configure the source IP address interface for all of the packets sent by a flow exporter, use the **source** command in flow exporter configuration mode. To remove the source IP address interface for all of the packets sent by a flow exporter, use the **no source** form of this command.

**source** *interface-type interface-number*  
**no source**

<b>Syntax Description</b>	<i>interface-type</i> Type of interface whose IP address you want to use for the source IP address of the packets sent by a flow exporter.				
	<i>interface-number</i> Interface number whose IP address you want to use for the source IP address of the packets sent by a flow exporter.				
<b>Command Default</b>	The IP address of the interface over which the datagram is transmitted is used as the source IP address.				
<b>Command Modes</b>	Flow exporter configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines** The benefits of using a consistent IP source address for the datagrams that sends include the following:

- The source IP address of the datagrams exported by is used by the destination system to determine from which the data is arriving. If your network has two or more paths that can be used to send datagrams from the to the destination system and you do not specify the source interface from which the source IP address is to be obtained, the uses the IP address of the interface over which the datagram is transmitted as the source IP address of the datagram. In this situation the destination system might receive datagrams from the same , but with different source IP addresses. When the destination system receives datagrams from the same with different source IP addresses, the destination system treats the datagrams as if they were being sent from different . To avoid having the destination system treat the datagrams as if they were being sent from different , you must configure the destination system to aggregate the datagrams it receives from all of the possible source IP addresses in the into a single flow.
- If your has multiple interfaces that can be used to transmit datagrams to the destination system, and you do not configure the **source** command, you will have to add an entry for the IP address of each interface into any access lists that you create for permitting traffic. Creating and maintaining access lists for permitting traffic from known sources and blocking it from unknown sources is easier when you limit the source IP address for datagrams to a single IP address for each that is exporting traffic.



**Caution** The interface that you configure as the **source** interface must have an IP address configured, and it must be up.



---

**Tip** When a transient outage occurs on the interface that you configured with the **source** command, the exporter reverts to the default behavior of using the IP address of the interface over which the datagrams are being transmitted as the source IP address for the datagrams. To avoid this problem, use a loopback interface as the source interface because loopback interfaces are not subject to the transient outages that can occur on physical interfaces.

---

To return this command to its default settings, use the **no source** or **default source** flow exporter configuration command.

---

## Examples

The following example shows how to configure to use a loopback interface as the source interface for NetFlow traffic:

```
Device(config)# flow exporter FLOW-EXPORTER-1
Device(config-flow-exporter)# source loopback 0
```

# template data timeout

To specify a timeout period for resending flow exporter template data, use the **template data timeout** command in flow exporter configuration mode. To remove the template resend timeout for a flow exporter, use the **no** form of this command.

**template data timeout** *seconds*  
**no template data timeout** *seconds*

<b>Syntax Description</b>	<i>seconds</i> Timeout value in seconds. The range is 1 to 86400. The default is 600.
---------------------------	---

<b>Command Default</b>	The default template resend timeout for a flow exporter is 600 seconds.
------------------------	---

<b>Command Modes</b>	Flow exporter configuration
----------------------	-----------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	<p>Flow exporter template data describes the exported data records. Data records cannot be decoded without the corresponding template. The <b>template data timeout</b> command controls how often those templates are exported.</p> <p>To return this command to its default settings, use the <b>no template data timeout</b> or <b>default template data timeout</b> flow record exporter command.</p>
-------------------------	---

The following example configures resending templates based on a timeout of 1000 seconds:

```
Device(config)# flow exporter FLOW-EXPORTER-1
Device(config-flow-exporter)# template data timeout 1000
```

# transport

To configure the transport protocol for a flow exporter for , use the **transport** command in flow exporter configuration mode. To remove the transport protocol for a flow exporter, use the **no** form of this command.

```
transport udp udp-port
no transport udp udp-port
```

<b>Syntax Description</b>	<b>udp</b> <i>udp-port</i> Specifies User Datagram Protocol (UDP) as the transport protocol and the UDP port number.				
<b>Command Default</b>	Flow exporters use UDP on port 9995.				
<b>Command Modes</b>	Flow exporter configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	<p>To return this command to its default settings, use the <b>no transport</b> or <b>default transport flow exporter</b> configuration command.</p> <p>The following example configures UDP as the transport protocol and a UDP port number of 250:</p> <pre>Device(config)# <b>flow exporter</b> FLOW-EXPORTER-1 Device(config-flow-exporter)# <b>transport udp</b> 250</pre>				

## ttl

To configure the time-to-live (TTL) value, use the **ttl** command in flow exporter configuration mode. To remove the TTL value, use the **no** form of this command.

```
ttl ttl
no ttl ttl
```

<b>Syntax Description</b>	<i>ttl</i> Time-to-live (TTL) value for exported datagrams. The range is 1 to 255. The default is 255.
---------------------------	--

<b>Command Default</b>	Flow exporters use a TTL of 255.
------------------------	----------------------------------

<b>Command Modes</b>	Flow exporter configuration
----------------------	-----------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	To return this command to its default settings, use the <b>no ttl</b> or <b>default ttl</b> flow exporter configuration command.
-------------------------	--

The following example specifies a TTL of 15:

```
Device(config)# flow exporter FLOW-EXPORTER-1
Device(config-flow-exporter)# ttl 15
```



# PART IX

## QoS

- [Auto QoS Commands, on page 809](#)
- [QoS Commands, on page 847](#)







## Auto QoS Commands

---

- [auto qos classify](#), on page 810
- [auto qos trust](#), on page 812
- [auto qos video](#), on page 819
- [auto qos voip](#) , on page 829
- [debug auto qos](#), on page 843
- [show auto qos](#) , on page 844

# auto qos classify

To automatically configure quality of service (QoS) classification for untrusted devices within a QoS domain, use the **auto qos classify** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

**auto qos classify** [**police**]  
**no auto qos classify** [**police**]

<b>Syntax Description</b>	<b>police</b> (Optional) Configure QoS policing for untrusted devices.
---------------------------	--

<b>Command Default</b>	Auto-QoS classify is disabled on the port.
------------------------	--

<b>Command Modes</b>	Interface configuration
----------------------	-------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	Use this command to configure the QoS for trusted interfaces within the QoS domain. The QoS domain includes the device, the network interior, and edge devices that can classify incoming traffic for QoS.
-------------------------	--

When auto-QoS is enabled, it uses the ingress packet label to categorize traffic, to assign packet labels, and to configure the ingress and egress queues.

Auto-QoS configures the device for connectivity with a trusted interface. The QoS labels of incoming packets are trusted. For nonrouted ports, the CoS value of the incoming packets is trusted. For routed ports, the DSCP value of the incoming packet is trusted.

To take advantage of the auto-QoS defaults, you should enable auto-QoS before you configure other QoS commands. You can fine-tune the auto-QoS configuration *after* you enable auto-QoS.



<b>Note</b>	The device applies the auto-QoS-generated commands as if the commands were entered from the command-line interface (CLI). An existing user configuration can cause the application of the generated commands to fail or to be overridden by the generated commands. These actions occur without warning. If all the generated commands are successfully applied, any user-entered configuration that was not overridden remains in the running configuration. Any user-entered configuration that was overridden can be retrieved by reloading the device without saving the current configuration to memory. If the generated commands fail to be applied, the previous running configuration is restored.
-------------	---

After auto-QoS is enabled, do not modify a policy map or aggregate policer that includes *AutoQoS* in its name. If you need to modify the policy map or aggregate policer, make a copy of it, and change the copied policy map or policer. To use the new policy map instead of the generated one, remove the generated policy map from the interface, and apply the new policy map.

To display the QoS configuration that is automatically generated when auto-QoS is enabled, enable debugging before you enable auto-QoS. Use the **debug auto qos** privileged EXEC command to enable auto-QoS debugging.

The following policy maps and class maps are created and applied when running the **auto qos classify** and **auto qos classify police** commands:

Policy maps (For the **auto qos classify police** command):

- AutoQos-4.0-Classify-Police-Input-Policy
- AutoQos-4.0-Output-Policy

Class maps:

- AutoQos-4.0-Multimedia-Conf-Class (match-any)
- AutoQos-4.0-Bulk-Data-Class (match-any)
- AutoQos-4.0-Transaction-Class (match-any)
- AutoQos-4.0-Scavenger-Class (match-any)
- AutoQos-4.0-Signaling-Class (match-any)
- AutoQos-4.0-Default-Class (match-any)
- class-default (match-any)
- AutoQos-4.0-Output-Priority-Queue (match-any)
- AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
- AutoQos-4.0-Output-Trans-Data-Queue (match-any)
- AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
- AutoQos-4.0-Output-Scavenger-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)

To disable auto-QoS on a port, use the **no auto qos classify** interface configuration command. Only the auto-QoS-generated interface configuration commands for this port are removed. If this is the last port on which auto-QoS is enabled and you enter the **no auto qos classify** command, auto-QoS is considered disabled even though the auto-QoS-generated global configuration commands remain (to avoid disrupting traffic on other ports affected by the global configuration).

## Examples

This example shows how to enable auto-QoS classification of an untrusted device and police traffic:

You can verify your settings by entering the **show auto qos interface *interface-id*** privileged EXEC command.

## auto qos trust

To automatically configure quality of service (QoS) for trusted interfaces within a QoS domain, use the **auto qos trust** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

```
auto qos trust cos | dscp
no auto qos trust cos | dscp
```

<b>Syntax Description</b>	<b>cos</b> Trusts the CoS packet classification.				
	<b>dscp</b> Trusts the DSCP packet classification.				
<b>Command Default</b>	Auto-QoS trust is disabled on the port.				
<b>Command Modes</b>	Interface configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines** Use this command to configure the QoS for trusted interfaces within the QoS domain. The QoS domain includes the device, the network interior, and edge devices that can classify incoming traffic for QoS. When auto-QoS is enabled, it uses the ingress packet label to categorize traffic, to assign packet labels, and to configure the ingress and egress queues.

*Table 106: Traffic Types, Packet Labels, and Queues*

	VOIP Data Traffic	VOIP Control Traffic	Routing Protocol Traffic	STP <sup>1</sup> BPDU <sup>2</sup> Traffic	Real-Time Video Traffic	All Other Traffic
DSCP <sup>3</sup>	46	24, 26	48	56	34	–
CoS <sup>4</sup>	5	3	6	7	3	–

<sup>1</sup> STP = Spanning Tree Protocol

<sup>2</sup> BPDU = bridge protocol data unit

<sup>3</sup> DSCP = Differentiated Services Code Point

<sup>4</sup> CoS = class of service



**Note** The device applies the auto-QoS-generated commands as if the commands were entered from the command-line interface (CLI). An existing user configuration can cause the application of the generated commands to fail or to be overridden by the generated commands. These actions occur without warning. If all the generated commands are successfully applied, any user-entered configuration that was not overridden remains in the running configuration. Any user-entered configuration that was overridden can be retrieved by reloading the device without saving the current configuration to memory. If the generated commands fail to be applied, the previous running configuration is restored.

After auto-QoS is enabled, do not modify a policy map or aggregate policer that includes *AutoQoS* in its name. If you need to modify the policy map or aggregate policer, make a copy of it, and change the copied policy map or policer. To use the new policy map instead of the generated one, remove the generated policy map from the interface, and apply the new policy map.

To display the QoS configuration that is automatically generated when auto-QoS is enabled, enable debugging before you enable auto-QoS. Use the **debug auto qos** privileged EXEC command to enable auto-QoS debugging.

The following policy maps and class maps are created and applied when running the **auto qos trust cos** command.

Policy maps:

- AutoQos-4.0-Trust-Cos-Input-Policy
- AutoQos-4.0-Output-Policy

Class maps:

- class-default (match-any)
- AutoQos-4.0-Output-Priority-Queue (match-any)
- AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
- AutoQos-4.0-Output-Trans-Data-Queue (match-any)
- AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
- AutoQos-4.0-Output-Scavenger-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)

The following policy maps and class maps are created and applied when running the **auto qos trust dscp** command:

Policy maps:

- AutoQos-4.0-Trust-Dscp-Input-Policy
- AutoQos-4.0-Output-Policy

Class maps:

- class-default (match-any)

- AutoQos-4.0-Output-Priority-Queue (match-any)
- AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
- AutoQos-4.0-Output-Trans-Data-Queue (match-any)
- AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
- AutoQos-4.0-Output-Scavenger-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)

To disable auto-QoS on a port, use the **no auto qos trust** interface configuration command. Only the auto-QoS-generated interface configuration commands for this port are removed. If this is the last port on which auto-QoS is enabled and you enter the **no auto qos trust** command, auto-QoS is considered disabled even though the auto-QoS-generated global configuration commands remain (to avoid disrupting traffic on other ports affected by the global configuration).

## Examples

This example shows how to enable auto-QoS for a trusted interface with specific CoS classification.

```
Device(config)# interface hundredgigabitethernet1/0/17
Device(config-if)# auto qos trust cos
Device(config-if)# end
Device# show policy-map interface hundredgigabitethernet1/0/17
```

### Hundredgigabitethernet1/0/17

```
Service-policy input: AutoQos-4.0-Trust-Cos-Input-Policy
```

```
Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    cos cos table AutoQos-4.0-Trust-Cos-Table
```

```
Service-policy output: AutoQos-4.0-Output-Policy
```

```
queue stats for all priority classes:
```

```
Queueing
  priority level 1
```

```
(total drops) 0
(bytes output) 0
```

```
Class-map: AutoQos-4.0-Output-Priority-Queue (match-any)
  0 packets
  Match: dscp cs4 (32) cs5 (40) ef (46)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 5
    0 packets, 0 bytes
    5 minute rate 0 bps
  Priority: 30% (300000 kbps), burst bytes 7500000,
  Priority Level: 1
```

```
Class-map: AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
  0 packets
  Match: dscp cs2 (16) cs3 (24) cs6 (48) cs7 (56)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 3
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing
  queue-limit dscp 16 percent 80
  queue-limit dscp 24 percent 90
  queue-limit dscp 48 percent 100
  queue-limit dscp 56 percent 100

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%

  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
  0 packets
  Match: dscp af41 (34) af42 (36) af43 (38)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 4
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Trans-Data-Queue (match-any)
  0 packets
  Match: dscp af21 (18) af22 (20) af23 (22)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 2
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
  0 packets
  Match: dscp af11 (10) af12 (12) af13 (14)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 1
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 4%
  queue-buffers ratio 10
```

```

Class-map: AutoQos-4.0-Output-Scavenger-Queue (match-any)
  0 packets
  Match: dscp cs1 (8)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 1%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)
  0 packets
  Match: dscp af31 (26) af32 (28) af33 (30)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%
  queue-buffers ratio 10

Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 25%
  queue-buffers ratio 25

```

This example shows how to enable auto-QoS for a trusted interface with specific DSCP classification.

```

Device(config)# interface hundredgigabitethernet1/0/19
Device(config-if)# auto qos trust dscp
Device(config-if)# end
Device#show policy-map interface hundredgigabitethernet1/0/19
Hundredgigabitethernet1/0/19

Service-policy input: AutoQos-4.0-Trust-Dscp-Input-Policy

Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp dscp table AutoQos-4.0-Trust-Dscp-Table

Service-policy output: AutoQos-4.0-Output-Policy

queue stats for all priority classes:
  Queueing
  priority level 1

  (total drops) 0

```



```
(bytes output) 0

Class-map: AutoQos-4.0-Output-Priority-Queue (match-any)
 0 packets
 Match: dscp cs4 (32) cs5 (40) ef (46)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 5
   0 packets, 0 bytes
   5 minute rate 0 bps
 Priority: 30% (300000 kbps), burst bytes 7500000,

 Priority Level: 1

Class-map: AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
 0 packets
 Match: dscp cs2 (16) cs3 (24) cs6 (48) cs7 (56)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 3
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing
 queue-limit dscp 16 percent 80
 queue-limit dscp 24 percent 90
 queue-limit dscp 48 percent 100
 queue-limit dscp 56 percent 100

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%

 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
 0 packets
 Match: dscp af41 (34) af42 (36) af43 (38)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 4
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%
 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Trans-Data-Queue (match-any)
 0 packets
 Match: dscp af21 (18) af22 (20) af23 (22)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 2
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%
 queue-buffers ratio 10
```

```

Class-map: AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
  0 packets
  Match: dscp af11 (10) af12 (12) af13 (14)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 1
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 4%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Scavenger-Queue (match-any)
  0 packets
  Match: dscp cs1 (8)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 1%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)
  0 packets
  Match: dscp af31 (26) af32 (28) af33 (30)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%
  queue-buffers ratio 10

Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 25%
  queue-buffers ratio 25

```

You can verify your settings by entering the **show auto qos interface *interface-id*** privileged EXEC command.

# auto qos video

To automatically configure quality of service (QoS) for video within a QoS domain, use the **auto qos video** command in interface configuration mode. Use the **no** form of this command to return to the default setting.

```
auto qos video { cts | ip-camera | media-player }
no auto qos video { cts | ip-camera | media-player }
```

Syntax Description	Parameter	Description
	<b>cts</b>	Specifies a port connected to a Cisco TelePresence System and automatically configures QoS for video.
	<b>ip-camera</b>	Specifies a port connected to a Cisco IP camera and automatically configures QoS for video.
	<b>media-player</b>	Specifies a port connected to a CDP-capable Cisco digital media player and automatically configures QoS for video.

**Command Default** Auto-QoS video is disabled on the port.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use this command to configure the QoS appropriate for video traffic within the QoS domain. The QoS domain includes the device, the network interior, and edge devices that can classify incoming traffic for QoS. When auto-QoS is enabled, it uses the ingress packet label to categorize traffic, to assign packet labels, and to configure the ingress and egress queues. For more information, see the queue tables at the end of this section.

Auto-QoS configures the device for video connectivity to a Cisco TelePresence system, a Cisco IP camera, or a Cisco digital media player.

To take advantage of the auto-QoS defaults, you should enable auto-QoS before you configure other QoS commands. You can fine-tune the auto-QoS configuration *after* you enable auto-QoS.

The device applies the auto-QoS-generated commands as if the commands were entered from the command-line interface (CLI). An existing user configuration can cause the application of the generated commands to fail or to be overridden by the generated commands. These actions occur without warning. If all the generated commands are successfully applied, any user-entered configuration that was not overridden remains in the running configuration. Any user-entered configuration that was overridden can be retrieved by reloading the device without saving the current configuration to memory. If the generated commands fail to be applied, the previous running configuration is restored.

If this is the first port on which you have enabled auto-QoS, the auto-QoS-generated global configuration commands are executed followed by the interface configuration commands. If you enable auto-QoS on another port, only the auto-QoS-generated interface configuration commands for that port are executed.

After auto-QoS is enabled, do not modify a policy map or aggregate policer that includes *AutoQoS* in its name. If you need to modify the policy map or aggregate policer, make a copy of it, and change the copied policy

map or policer. To use the new policy map instead of the generated one, remove the generated policy map from the interface, and apply the new policy map.

To display the QoS configuration that is automatically generated when auto-QoS is enabled, enable debugging before you enable auto-QoS. Use the **debug auto qos** privileged EXEC command to enable auto-QoS debugging.

The following policy maps and class maps are created and applied when running the **auto qos video cts** command:

Policy maps:

- AutoQos-4.0-Trust-Cos-Input-Policy
- AutoQos-4.0-Output-Policy

Class maps

- class-default (match-any)
- AutoQos-4.0-Output-Priority-Queue (match-any)
- AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
- AutoQos-4.0-Output-Trans-Data-Queue (match-any)
- AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
- AutoQos-4.0-Output-Scavenger-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)

The following policy maps and class maps are created and applied when running the **auto qos video ip-camera** command:

Policy maps:

- AutoQos-4.0-Trust-Dscp-Input-Policy
- AutoQos-4.0-Output-Policy

Class maps:

- class-default (match-any)
- AutoQos-4.0-Output-Priority-Queue (match-any)
- AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
- AutoQos-4.0-Output-Trans-Data-Queue (match-any)
- AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
- AutoQos-4.0-Output-Scavenger-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)

The following policy maps and class maps are created and applied when running the **auto qos video media-player** command:

Policy maps:

- AutoQos-4.0-Trust-Dscp-Input-Policy
- AutoQos-4.0-Output-Policy

Class maps:

- class-default (match-any)
- AutoQos-4.0-Output-Priority-Queue (match-any)
- AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
- AutoQos-4.0-Output-Trans-Data-Queue (match-any)
- AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
- AutoQos-4.0-Output-Scavenger-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)

To disable auto-QoS on a port, use the **no auto qos video** interface configuration command. Only the auto-QoS-generated interface configuration commands for this port are removed. If this is the last port on which auto-QoS is enabled, and you enter the **no auto qos video** command, auto-QoS is considered disabled even though the auto-QoS-generated global configuration commands remain (to avoid disrupting traffic on other ports affected by the global configuration).

**Table 107: Traffic Types, Packet Labels, and Queues**

	VOIP Data Traffic	VOIP Control Traffic	Routing Protocol Traffic	STP <sup>5</sup> BPDUs <sup>6</sup> Traffic	Real-Time Video Traffic	All Other Traffic
DSCP <sup>7</sup>	46	24, 26	48	56	34	–
CoS <sup>8</sup>	5	3	6	7	3	–

<sup>5</sup> STP = Spanning Tree Protocol

<sup>6</sup> BPDUs = bridge protocol data unit

<sup>7</sup> DSCP = Differentiated Services Code Point

<sup>8</sup> CoS = class of service

## Examples

The following is an example of the **auto qos video cts** command and the applied policies and class maps:

```
Device(config)# interface hundredgigabitethernet1/0/13
Device(config-if)# auto qos video cts
Device(config-if)# end
Device# show policy-map interface hundredgigabitethernet1/0/13
Hundredgigabitethernet1/0/13
```

Service-policy input: AutoQos-4.0-Trust-Cos-Input-Policy

```
Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    cos cos table AutoQos-4.0-Trust-Cos-Table
```

Service-policy output: AutoQos-4.0-Output-Policy

queue stats for all priority classes:

```
Queueing
  priority level 1
```

```
(total drops) 0
(bytes output) 0
```

Class-map: AutoQos-4.0-Output-Priority-Queue (match-any)

```
  0 packets
  Match: dscp cs4 (32) cs5 (40) ef (46)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 5
    0 packets, 0 bytes
    5 minute rate 0 bps
  Priority: 30% (300000 kbps), burst bytes 7500000,
```

```
  Priority Level: 1
```

Class-map: AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)

```
  0 packets
  Match: dscp cs2 (16) cs3 (24) cs6 (48) cs7 (56)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 3
    0 packets, 0 bytes
    5 minute rate 0 bps
```

```
Queueing
  queue-limit dscp 16 percent 80
  queue-limit dscp 24 percent 90
  queue-limit dscp 48 percent 100
  queue-limit dscp 56 percent 100
```

```
(total drops) 0
(bytes output) 0
bandwidth remaining 10%
```

```
queue-buffers ratio 10
```

Class-map: AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)

```
  0 packets
  Match: dscp af41 (34) af42 (36) af43 (38)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 4
    0 packets, 0 bytes
    5 minute rate 0 bps
```

```
Queueing
```

```
(total drops) 0
(bytes output) 0
bandwidth remaining 10%
```

```
queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Trans-Data-Queue (match-any)
 0 packets
 Match: dscp af21 (18) af22 (20) af23 (22)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 2
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%
 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
 0 packets
 Match: dscp af11 (10) af12 (12) af13 (14)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 1
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 4%
 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Scavenger-Queue (match-any)
 0 packets
 Match: dscp cs1 (8)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 1%
 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)
 0 packets
 Match: dscp af31 (26) af32 (28) af33 (30)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%
 queue-buffers ratio 10

Class-map: class-default (match-any)
 0 packets
 Match: any
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
```

```
(bytes output) 0
bandwidth remaining 25%
queue-buffers ratio 25
```

The following is an example of the **auto qos video ip-camera** command and the applied policies and class maps:

```
Device(config)# interface hundredgigabitethernet1/0/9
Device(config-if)# auto qos video ip-camera
Device(config-if)# end
Device# show policy-map interface hundredgigabitethernet1/0/9
```

#### Hundredgigabitethernet1/0/9

```
Service-policy input: AutoQos-4.0-Trust-Dscp-Input-Policy
```

```
Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp dscp table AutoQos-4.0-Trust-Dscp-Table
```

```
Service-policy output: AutoQos-4.0-Output-Policy
```

```
queue stats for all priority classes:
```

```
Queueing
priority level 1
```

```
(total drops) 0
(bytes output) 0
```

```
Class-map: AutoQos-4.0-Output-Priority-Queue (match-any)
  0 packets
  Match: dscp cs4 (32) cs5 (40) ef (46)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 5
    0 packets, 0 bytes
    5 minute rate 0 bps
  Priority: 30% (300000 kbps), burst bytes 7500000,
```

```
Priority Level: 1
```

```
Class-map: AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
  0 packets
  Match: dscp cs2 (16) cs3 (24) cs6 (48) cs7 (56)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 3
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing
  queue-limit dscp 16 percent 80
  queue-limit dscp 24 percent 90
  queue-limit dscp 48 percent 100
  queue-limit dscp 56 percent 100
```

```
(total drops) 0
(bytes output) 0
```



```
bandwidth remaining 10%

queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
  0 packets
  Match: dscp af41 (34) af42 (36) af43 (38)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 4
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Trans-Data-Queue (match-any)
  0 packets
  Match: dscp af21 (18) af22 (20) af23 (22)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 2
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
  0 packets
  Match: dscp af11 (10) af12 (12) af13 (14)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 1
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 4%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Scavenger-Queue (match-any)
  0 packets
  Match: dscp cs1 (8)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 1%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)
  0 packets
  Match: dscp af31 (26) af32 (28) af33 (30)
```

```

    0 packets, 0 bytes
    5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 10%
queue-buffers ratio 10

Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 25%
queue-buffers ratio 25

```

The following is an example of the **auto qos video media-player** command and the applied policies and class maps.

```

Device(config)# interface hundredgigabitethernet1/0/7
Device(config-if)# auto qos video media-player
Device(config-if)# end
Device# show policy-map interface hundredgigabitethernet1/0/7

interface hundredgigabitethernet1/0/7

Service-policy input: AutoQos-4.0-Trust-Dscp-Input-Policy

Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp dscp table AutoQos-4.0-Trust-Dscp-Table

Service-policy output: AutoQos-4.0-Output-Policy

queue stats for all priority classes:
Queueing
priority level 1

(total drops) 0
(bytes output) 0

Class-map: AutoQos-4.0-Output-Priority-Queue (match-any)
  0 packets
  Match: dscp cs4 (32) cs5 (40) ef (46)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 5
    0 packets, 0 bytes
    5 minute rate 0 bps
  Priority: 30% (300000 kbps), burst bytes 7500000,

Priority Level: 1

```

```
Class-map: AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
 0 packets
 Match: dscp cs2 (16) cs3 (24) cs6 (48) cs7 (56)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 3
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing
 queue-limit dscp 16 percent 80
 queue-limit dscp 24 percent 90
 queue-limit dscp 48 percent 100
 queue-limit dscp 56 percent 100

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%

 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
 0 packets
 Match: dscp af41 (34) af42 (36) af43 (38)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 4
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%
 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Trans-Data-Queue (match-any)
 0 packets
 Match: dscp af21 (18) af22 (20) af23 (22)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 2
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%
 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
 0 packets
 Match: dscp af11 (10) af12 (12) af13 (14)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 1
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 4%
```

```
queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Scavenger-Queue (match-any)
 0 packets
 Match: dscp cs1 (8)
       0 packets, 0 bytes
       5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 1%
 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)
 0 packets
 Match: dscp af31 (26) af32 (28) af33 (30)
       0 packets, 0 bytes
       5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%
 queue-buffers ratio 10

Class-map: class-default (match-any)
 0 packets
 Match: any
       0 packets, 0 bytes
       5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 25%
 queue-buffers ratio 25
```

You can verify your settings by entering the **show auto qos video interface *interface-id*** privileged EXEC command.

## auto qos voip

To automatically configure quality of service (QoS) for voice over IP (VoIP) within a QoS domain, use the **auto qos voip** command in interface configuration mode. Use the **no** form of this command to return to the default setting.

```
auto qos voip {cisco-phone | cisco-softphone | trust}
no auto qos voip {cisco-phone | cisco-softphone | trust}
```

Syntax Description	
<b>cisco-phone</b>	Specifies a port connected to a Cisco IP phone, and automatically configures QoS for VoIP. The QoS labels of incoming packets are trusted only when the telephone is detected.
<b>cisco-softphone</b>	Specifies a port connected to a device running the Cisco SoftPhone, and automatically configures QoS for VoIP.
<b>trust</b>	Specifies a port connected to a trusted device, and automatically configures QoS for VoIP. The QoS labels of incoming packets are trusted. For nonrouted ports, the CoS value of the incoming packet is trusted. For routed ports, the DSCP value of the incoming packet is trusted.

Command Default	
	Auto-QoS is disabled on the port.
	When auto-QoS is enabled, it uses the ingress packet label to categorize traffic, to assign packet labels, and to configure the ingress and egress queues.

Command Default	
	Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

Usage Guidelines	
	Use this command to configure the QoS appropriate for VoIP traffic within the QoS domain. The QoS domain includes the device, the network interior, and edge devices that can classify incoming traffic for QoS.

Auto-QoS configures the device for VoIP with Cisco IP phones on device and routed ports and for devices running the Cisco SoftPhone application. These releases support only Cisco IP SoftPhone Version 1.3(3) or later. Connected devices must use Cisco Call Manager Version 4 or later.

To take advantage of the auto-QoS defaults, you should enable auto-QoS before you configure other QoS commands. You can fine-tune the auto-QoS configuration *after* you enable auto-QoS.



**Note** The device applies the auto-QoS-generated commands as if the commands were entered from the command-line interface (CLI). An existing user configuration can cause the application of the generated commands to fail or to be overridden by the generated commands. These actions occur without warning. If all the generated commands are successfully applied, any user-entered configuration that was not overridden remains in the running configuration. Any user-entered configuration that was overridden can be retrieved by reloading the device without saving the current configuration to memory. If the generated commands fail to be applied, the previous running configuration is restored.

If this is the first port on which you have enabled auto-QoS, the auto-QoS-generated global configuration commands are executed followed by the interface configuration commands. If you enable auto-QoS on another port, only the auto-QoS-generated interface configuration commands for that port are executed.

When you enter the **auto qos voip cisco-phone** interface configuration command on a port at the edge of the network that is connected to a Cisco IP phone, the device enables the trusted boundary feature. The device uses the Cisco Discovery Protocol (CDP) to detect the presence of a Cisco IP phone. When a Cisco IP phone is detected, the ingress classification on the port is set to trust the QoS label received in the packet. The device also uses policing to determine whether a packet is in or out of profile and to specify the action on the packet. If the packet does not have a DSCP value of 24, 26, or 46 or is out of profile, the device changes the DSCP value to 0. When a Cisco IP phone is absent, the ingress classification is set to not trust the QoS label in the packet. The policing is applied to those traffic matching the policy-map classification before the device enables the trust boundary feature.

- When you enter the **auto qos voip cisco-softphone** interface configuration command on a port at the edge of the network that is connected to a device running the Cisco SoftPhone, the device uses policing to decide whether a packet is in or out of profile and to specify the action on the packet. If the packet does not have a DSCP value of 24, 26, or 46 or is out of profile, the device changes the DSCP value to 0.
- When you enter the **auto qos voip trust** interface configuration command on a port connected to the network interior, the device trusts the CoS value for nonrouted ports or the DSCP value for routed ports in ingress packets (the assumption is that traffic has already been classified by other edge devices).

You can enable auto-QoS on static, dynamic-access, and voice VLAN access, and trunk ports. When enabling auto-QoS with a Cisco IP phone on a routed port, you must assign a static IP address to the IP phone.



**Note** When a device running Cisco SoftPhone is connected to a device or routed port, the device supports only one Cisco SoftPhone application per port.

After auto-QoS is enabled, do not modify a policy map or aggregate policer that includes *AutoQoS* in its name. If you need to modify the policy map or aggregate policer, make a copy of it, and change the copied policy map or policer. To use the new policy map instead of the generated one, remove the generated policy map from the interface, and apply the new policy map.

To display the QoS configuration that is automatically generated when auto-QoS is enabled, enable debugging before you enable auto-QoS. Use the **debug auto qos** privileged EXEC command to enable auto-QoS debugging.

The following policy maps and class maps are created and applied when running the **auto qos voip trust** command:

Policy maps:

- AutoQos-4.0-Trust-Cos-Input-Policy
- AutoQos-4.0-Output-Policy

Class maps:

- class-default (match-any)
- AutoQos-4.0-Output-Priority-Queue (match-any)
- AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
- AutoQos-4.0-Output-Trans-Data-Queue (match-any)
- AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
- AutoQos-4.0-Output-Scavenger-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)

The following policy maps and class maps are created and applied when running the **auto qos voip cisco-softphone** command:

Policy maps:

- AutoQos-4.0-CiscoSoftPhone-Input-Policy
- AutoQos-4.0-Output-Policy

Class maps:

- AutoQos-4.0-Voip-Data-Class (match-any)
- AutoQos-4.0-Voip-Signal-Class (match-any)
- AutoQos-4.0-Multimedia-Conf-Class (match-any)
- AutoQos-4.0-Bulk-Data-Class (match-any)
- AutoQos-4.0-Transaction-Class (match-any)
- AutoQos-4.0-Scavenger-Class (match-any)
- AutoQos-4.0-Signaling-Class (match-any)
- AutoQos-4.0-Default-Class (match-any)
- class-default (match-any)
- AutoQos-4.0-Output-Priority-Queue (match-any)
- AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
- AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
- AutoQos-4.0-Output-Trans-Data-Queue (match-any)
- AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
- AutoQos-4.0-Output-Scavenger-Queue (match-any)

- AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)

The following policy maps and class maps are created and applied when running the **auto qos voip cisco-phone** command:

Policy maps:

- service-policy input AutoQos-4.0-CiscoPhone-Input-Policy
- service-policy output AutoQos-4.0-Output-Policy

Class maps:

- class AutoQos-4.0-Voip-Data-CiscoPhone-Class
- class AutoQos-4.0-Voip-Signal-CiscoPhone-Class
- class AutoQos-4.0-Default-Class

To disable auto-QoS on a port, use the **no auto qos voip** interface configuration command. Only the auto-QoS-generated interface configuration commands for this port are removed. If this is the last port on which auto-QoS is enabled and you enter the **no auto qos voip** command, auto-QoS is considered disabled even though the auto-QoS-generated global configuration commands remain (to avoid disrupting traffic on other ports affected by the global configuration).

The device configures egress queues on the port according to the settings in this table.

**Table 108: Auto-QoS Configuration for the Egress Queues**

Egress Queue	Queue Number	CoS-to-Queue Map	Queue Weight (Bandwidth)	Queue (Buffer) Size for Gigabit-Capable Ports	Queue (Buffer) Size for 10/100 Ethernet Ports
Priority (shaped)	1	4, 5	Up to 100 percent	25 percent	15 percent
SRR shared	2	2, 3, 6, 7	10 percent	25 percent	25 percent
SRR shared	3	0	60 percent	25 percent	40 percent
SRR shared	4	1	20 percent	25 percent	20 percent

## Examples

The following is an example of the **auto qos voip trust** command and the applied policies and class maps:

```
Device(config)# interface hundredgigabitethernet1/0/31
Device(config-if)# auto qos voip trust
Device(config-if)# end
Device# show policy-map interface hundredgigabitethernet1/0/31

Hundredgigabitethernet1/0/31

  Service-policy input: AutoQos-4.0-Trust-Cos-Input-Policy

    Class-map: class-default (match-any)
      0 packets
```



```
Match: any
  0 packets, 0 bytes
  5 minute rate 0 bps
QoS Set
  cos cos table AutoQos-4.0-Trust-Cos-Table

Service-policy output: AutoQos-4.0-Output-Policy

queue stats for all priority classes:
  Queueing
  priority level 1

  (total drops) 0
  (bytes output) 0

Class-map: AutoQos-4.0-Output-Priority-Queue (match-any)
  0 packets
  Match: dscp cs4 (32) cs5 (40) ef (46)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 5
    0 packets, 0 bytes
    5 minute rate 0 bps
  Priority: 30% (300000 kbps), burst bytes 7500000,

  Priority Level: 1

Class-map: AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
  0 packets
  Match: dscp cs2 (16) cs3 (24) cs6 (48) cs7 (56)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 3
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing
  queue-limit dscp 16 percent 80
  queue-limit dscp 24 percent 90
  queue-limit dscp 48 percent 100
  queue-limit dscp 56 percent 100

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%

  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
  0 packets
  Match: dscp af41 (34) af42 (36) af43 (38)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 4
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Trans-Data-Queue (match-any)
  0 packets
```

```

Match: dscp af21 (18) af22 (20) af23 (22)
      0 packets, 0 bytes
      5 minute rate 0 bps
Match: cos 2
      0 packets, 0 bytes
      5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 10%
queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
0 packets
Match: dscp af11 (10) af12 (12) af13 (14)
      0 packets, 0 bytes
      5 minute rate 0 bps
Match: cos 1
      0 packets, 0 bytes
      5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 4%
queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Scavenger-Queue (match-any)
0 packets
Match: dscp cs1 (8)
      0 packets, 0 bytes
      5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 1%
queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)
0 packets
Match: dscp af31 (26) af32 (28) af33 (30)
      0 packets, 0 bytes
      5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 10%
queue-buffers ratio 10

Class-map: class-default (match-any)
0 packets
Match: any
      0 packets, 0 bytes
      5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 25%
queue-buffers ratio 25

```

The following is an example of the **auto qos voip cisco-phone** command and the applied policies and class maps:

```

Device(config)# interface hundredgigabitethernet1/0/5
Device(config-if)# auto qos voip cisco-phone
Device(config-if)# end
Device# show policy-map interface hundredgigabitethernet1/0/5

Hundredgigabitethernet1/0/5

Service-policy input: AutoQos-4.0-CiscoPhone-Input-Policy

Class-map: AutoQos-4.0-Voip-Data-CiscoPhone-Class (match-any)
  0 packets
  Match: cos 5
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp ef
  police:
    cir 128000 bps, bc 8000 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      set-dscp-transmit dscp table policed-dscp
    conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Voip-Signal-CiscoPhone-Class (match-any)
  0 packets
  Match: cos 3
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp cs3
  police:
    cir 32000 bps, bc 8000 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      set-dscp-transmit dscp table policed-dscp
    conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Default-Class (match-any)
  0 packets
  Match: access-group name AutoQos-4.0-Acl-Default
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp default

Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps

Service-policy output: AutoQos-4.0-Output-Policy

queue stats for all priority classes:
  Queueing
  priority level 1

  (total drops) 0

```

```

(bytes output) 0

Class-map: AutoQos-4.0-Output-Priority-Queue (match-any)
 0 packets
 Match: dscp cs4 (32) cs5 (40) ef (46)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 5
   0 packets, 0 bytes
   5 minute rate 0 bps
 Priority: 30% (300000 kbps), burst bytes 7500000,

 Priority Level: 1

Class-map: AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
 0 packets
 Match: dscp cs2 (16) cs3 (24) cs6 (48) cs7 (56)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 3
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing
 queue-limit dscp 16 percent 80
 queue-limit dscp 24 percent 90
 queue-limit dscp 48 percent 100
 queue-limit dscp 56 percent 100

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%

 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
 0 packets
 Match: dscp af41 (34) af42 (36) af43 (38)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 4
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%
 queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Trans-Data-Queue (match-any)
 0 packets
 Match: dscp af21 (18) af22 (20) af23 (22)
   0 packets, 0 bytes
   5 minute rate 0 bps
 Match: cos 2
   0 packets, 0 bytes
   5 minute rate 0 bps
 Queueing

 (total drops) 0
 (bytes output) 0
 bandwidth remaining 10%
 queue-buffers ratio 10

```

```

Class-map: AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
  0 packets
  Match: dscp af11 (10) af12 (12) af13 (14)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 1
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 4%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Scavenger-Queue (match-any)
  0 packets
  Match: dscp cs1 (8)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 1%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)
  0 packets
  Match: dscp af31 (26) af32 (28) af33 (30)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%
  queue-buffers ratio 10

Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 25%
  queue-buffers ratio 25

```

The following is an example of the **auto qos voip cisco-softphone** command and the applied policies and class maps:

```

Device(config)# interface hundredgigabitethernet1/0/21
Device(config-if)# auto qos voip cisco-softphone
Device(config-if)# end
Device# show policy-map interface hundredgigabitethernet1/0/21

Hundredgigabitethernet1/0/21

Service-policy input: AutoQos-4.0-CiscoSoftPhone-Input-Policy

```

```

Class-map: AutoQos-4.0-Voip-Data-Class (match-any)
  0 packets
  Match: dscp ef (46)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 5
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp ef
  police:
    cir 128000 bps, bc 8000 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      set-dscp-transmit dscp table policed-dscp
    conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Voip-Signal-Class (match-any)
  0 packets
  Match: dscp cs3 (24)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 3
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp cs3
  police:
    cir 32000 bps, bc 8000 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      set-dscp-transmit dscp table policed-dscp
    conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Multimedia-Conf-Class (match-any)
  0 packets
  Match: access-group name AutoQos-4.0-Acl-MultiEnhanced-Conf
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp af41
  police:
    cir 5000000 bps, bc 156250 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      drop
    conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Bulk-Data-Class (match-any)
  0 packets
  Match: access-group name AutoQos-4.0-Acl-Bulk-Data
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp af11
  police:
    cir 10000000 bps, bc 312500 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:

```

```
        set-dscp-transmit dscp table policed-dscp
        conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Transaction-Class (match-any)
  0 packets
  Match: access-group name AutoQos-4.0-Acl-Transactional-Data
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp af21
  police:
    cir 10000000 bps, bc 312500 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      set-dscp-transmit dscp table policed-dscp
      conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Scavanger-Class (match-any)
  0 packets
  Match: access-group name AutoQos-4.0-Acl-Scavanger
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp cs1
  police:
    cir 10000000 bps, bc 312500 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      drop
    conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Signaling-Class (match-any)
  0 packets
  Match: access-group name AutoQos-4.0-Acl-Signaling
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp cs3
  police:
    cir 32000 bps, bc 8000 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      drop
    conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Default-Class (match-any)
  0 packets
  Match: access-group name AutoQos-4.0-Acl-Default
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp default
  police:
    cir 10000000 bps, bc 312500 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      set-dscp-transmit dscp table policed-dscp
      conformed 0000 bps, exceed 0000 bps

Class-map: class-default (match-any)
```

```

0 packets
Match: any
  0 packets, 0 bytes
  5 minute rate 0 bps

```

Service-policy output: AutoQos-4.0-Output-Policy

queue stats for all priority classes:

```

Queueing
priority level 1

```

```

(total drops) 0
(bytes output) 0

```

Class-map: AutoQos-4.0-Output-Priority-Queue (match-any)

```

0 packets
Match: dscp cs4 (32) cs5 (40) ef (46)
  0 packets, 0 bytes
  5 minute rate 0 bps
Match: cos 5
  0 packets, 0 bytes
  5 minute rate 0 bps
Priority: 30% (300000 kbps), burst bytes 7500000,

```

Priority Level: 1

Class-map: AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)

```

0 packets
Match: dscp cs2 (16) cs3 (24) cs6 (48) cs7 (56)
  0 packets, 0 bytes
  5 minute rate 0 bps
Match: cos 3
  0 packets, 0 bytes
  5 minute rate 0 bps
Queueing
queue-limit dscp 16 percent 80
queue-limit dscp 24 percent 90
queue-limit dscp 48 percent 100
queue-limit dscp 56 percent 100

```

```

(total drops) 0
(bytes output) 0
bandwidth remaining 10%

```

queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)

```

0 packets
Match: dscp af41 (34) af42 (36) af43 (38)
  0 packets, 0 bytes
  5 minute rate 0 bps
Match: cos 4
  0 packets, 0 bytes
  5 minute rate 0 bps
Queueing

```

```

(total drops) 0
(bytes output) 0
bandwidth remaining 10%
queue-buffers ratio 10

```

Class-map: AutoQos-4.0-Output-Trans-Data-Queue (match-any)

```

0 packets
Match: dscp af21 (18) af22 (20) af23 (22)

```



```
    0 packets, 0 bytes
    5 minute rate 0 bps
Match: cos 2
    0 packets, 0 bytes
    5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 10%
queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
  0 packets
  Match: dscp af11 (10) af12 (12) af13 (14)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Match: cos 1
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 4%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Scavenger-Queue (match-any)
  0 packets
  Match: dscp cs1 (8)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 1%
  queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)
  0 packets
  Match: dscp af31 (26) af32 (28) af33 (30)
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 10%
  queue-buffers ratio 10

Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps
  Queueing

  (total drops) 0
  (bytes output) 0
  bandwidth remaining 25%
  queue-buffers ratio 25
```

You can verify your settings by entering the **show auto qos interface *interface-id*** privileged EXEC command.

# debug auto qos

To enable debugging of the automatic quality of service (auto-QoS) feature, use the **debug auto qos** command in privileged EXEC mode. Use the **no** form of this command to disable debugging.

**debug auto qos**  
**no debug auto qos**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Auto-QoS debugging is disabled.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** To display the QoS configuration that is automatically generated when auto-QoS is enabled, enable debugging before you enable auto-QoS. You enable debugging by entering the **debug auto qos** privileged EXEC command.

The **undebug auto qos** command is the same as the **no debug auto qos** command.

When you enable debugging on a stack, it is enabled only on the active . To enable debugging on a stack member, you can start a session from the active by using the **session switch-number** privileged EXEC command. Then enter the **debug** command at the command-line prompt of the stack member. You also can use the **remote command stack-member-number LINE** privileged EXEC command on the active to enable debugging on a member without first starting a session.

## Examples

This example shows how to display the QoS configuration that is automatically generated when auto-QoS is enabled:

```
Device# debug auto qos
AutoQoS debugging is on
Device# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Device(config)# interface gigabitethernet2/0/1
Device(config-if)# auto qos voip cisco-phone
```

# show auto qos

To display the quality of service (QoS) commands entered on the interfaces on which automatic QoS (auto-QoS) is enabled, use the **show auto qos** command in privileged EXEC mode.

```
show auto qos [interface [interface-id]]
```

<b>Syntax Description</b>	<b>interface</b> [interface-id]	(Optional) Displays auto-QoS information for the specified port or for all ports. Valid interfaces include physical ports.
<b>Command Modes</b>	User EXEC Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	The <b>show auto qos</b> command output shows only the <b>auto qos</b> command entered on each interface. The <b>show auto qos interface interface-id</b> command output shows the <b>auto qos</b> command entered on a specific interface. Use the <b>show running-config</b> privileged EXEC command to display the auto-QoS configuration and the user modifications.	

## Examples

This is an example of output from the **show auto qos** command after the **auto qos voip cisco-phone** and the **auto qos voip cisco-softphone** interface configuration commands are entered:

```
Device# show auto qos
Hundredgigabitethernet 1/0/3
auto qos voip cisco-softphone

Hundredgigabitethernet 1/0/5
auto qos voip cisco-phone

Hundredgigabitethernet 1/0/7
auto qos voip cisco-phone
```

This is an example of output from the **show auto qos interface interface-id** command when the **auto qos voip cisco-phone** interface configuration command is entered:

```
Device# show auto qos interface Hundredgigabitethernet 1/0/5
Hundredgigabitethernet 1/0/5
auto qos voip cisco-phone
```

These are examples of output from the **show auto qos interface interface-id** command when auto-QoS is disabled on an interface:

```
Device# show auto qos interface Hundredgigabitethernet 1/0/11
```

```
AutoQoS is disabled
```





## QoS Commands

---

- [class](#), on page 848
- [class-map](#), on page 850
- [match \(class-map configuration\)](#), on page 852
- [policy-map](#), on page 856
- [priority](#), on page 858
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- [random-detect cos](#), on page 863
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- [service-policy \(Wired\)](#), on page 871
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# class

To define a traffic classification match criteria for the specified class-map name, use the **class** command in policy-map configuration mode. Use the **no** form of this command to delete an existing class map.

**class** *class-map-name* | **class-default**  
**no class** *class-map-name* | **class-default**

## Syntax Description

*class-map-name* The class map name.

**class-default** Refers to a system default class that matches unclassified packets.

## Command Default

No policy map class-maps are defined.

## Command Modes

Policy-map configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Before using the **class** command, you must use the **policy-map** global configuration command to identify the policy map and enter policy-map configuration mode. After specifying a policy map, you can configure a policy for new classes or modify a policy for any existing classes in that policy map. You attach the policy map to a port by using the **service-policy** interface configuration command.

After entering the **class** command, you enter the policy-map class configuration mode. These configuration commands are available:

- **admit**—Admits a request for Call Admission Control (CAC)
- **bandwidth**—Specifies the bandwidth allocated to the class.
- **exit**—Exits the policy-map class configuration mode and returns to policy-map configuration mode.
- **no**—Returns a command to its default setting.
- **police**—Defines a policer or aggregate policer for the classified traffic. The policer specifies the bandwidth limitations and the action to take when the limits are exceeded. For more information about this command, see *Cisco IOS Quality of Service Solutions Command Reference* available on Cisco.com.
- **priority**—Assigns scheduling priority to a class of traffic belonging to a policy map.
- **queue-buffers**—Configures the queue buffer for the class.
- **queue-limit**—Specifies the maximum number of packets the queue can hold for a class policy configured in a policy map.
- **service-policy**—Configures a QoS service policy.
- **set**—Specifies a value to be assigned to the classified traffic. For more information, see the *set* command.
- **shape**—Specifies average or peak rate traffic shaping. For more information about this command, see *Cisco IOS Quality of Service Solutions Command Reference* available on Cisco.com.



To return to policy-map configuration mode, use the **exit** command. To return to privileged EXEC mode, use the **end** command.

The **class** command performs the same function as the **class-map** global configuration command. Use the **class** command when a new classification, which is not shared with any other ports, is needed. Use the **class-map** command when the map is shared among many ports.

You can configure a default class by using the **class class-default** policy-map configuration command. Unclassified traffic (traffic that does not meet the match criteria specified in the traffic classes) is treated as default traffic.

You can verify your settings by entering the **show policy-map** privileged EXEC command.

## Examples

This example shows how to create a policy map called policy1. When attached to the ingress direction, it matches all the incoming traffic defined in class1 and polices the traffic at an average rate of 1 Mb/s and bursts at 1000 bytes, marking down exceeding traffic via a table-map.

```
Device(config)# policy-map policy1
Device(config-pmap)# class class1
Device(config-pmap-c)# police cir 1000000 bc 1000 conform-action
transmit exceed-action set-dscp-transmit dscp table EXEC_TABLE
Device(config-pmap-c)# exit
```

This example shows how to configure a default traffic class to a policy map. It also shows how the default traffic class is automatically placed at the end of policy-map pm3 even though **class-default** was configured first:

```
Device# configure terminal
Device(config)# class-map cm-3
Device(config-cmap)# match ip dscp 30
Device(config-cmap)# exit

Device(config)# class-map cm-4
Device(config-cmap)# match ip dscp 40
Device(config-cmap)# exit

Device(config)# policy-map pm3
Device(config-pmap)# class class-default
Device(config-pmap-c)# set dscp 10
Device(config-pmap-c)# exit

Device(config-pmap)# class cm-3
Device(config-pmap-c)# set dscp 4
Device(config-pmap-c)# exit

Device(config-pmap)# class cm-4
Device(config-pmap-c)# set precedence 5
Device(config-pmap-c)# exit
Device(config-pmap)# exit

Device# show policy-map pm3
Policy Map pm3
  Class cm-3
    set dscp 4
  Class cm-4
    set precedence 5
  Class class-default
    set dscp af11
```

# class-map

To create a class map to be used for matching packets to the class whose name you specify and to enter class-map configuration mode, use the **class-map** command in global configuration mode. Use the **no** form of this command to delete an existing class map and to return to global or policy map configuration mode.

```
class-map class-map name {match-any | match-all}
no class-map class-map name {match-any | match-all}
```

Syntax Description	
<b>match-any</b>	(Optional) Perform a logical-OR of the matching statements under this class map. One or more criteria must be matched.
<b>match-all</b>	(Optional) Performs a logical-AND of the matching statements under this class map. All criterias must match.
<i>class-map-name</i>	The class map name.

**Command Default** No class maps are defined.

**Command Modes** Global configuration  
Policy map configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use this command to specify the name of the class for which you want to create or modify class-map match criteria and to enter class-map configuration mode.

The **class-map** command and its subcommands are used to define packet classification, marking, and aggregate policing as part of a globally named service policy applied on a per-port basis.

After you are in quality of service (QoS) class-map configuration mode, these configuration commands are available:

- **description**—Describes the class map (up to 200 characters). The **show class-map** privileged EXEC command displays the description and the name of the class map.
- **exit**—Exits from QoS class-map configuration mode.
- **match**—Configures classification criteria.
- **no**—Removes a match statement from a class map.

If you enter the **match-any** keyword, you can only use it to specify an extended named access control list (ACL) with the **match access-group** class-map configuration command.

To define packet classification on a physical-port basis, only one **match** command per class map is supported.

The ACL can have multiple access control entries (ACEs).



---

**Note** You cannot configure IPv4 and IPv6 classification criteria simultaneously in the same class-map. However, they can be configured in different class-maps in the same policy.

---

### Examples

This example shows how to configure the class map called class1 with one match criterion, which is an access list called 103:

```
Device(config)# access-list 103 permit ip any any dscp 10
Device(config)# class-map class1
Device(config-cmap)# match access-group 103
Device(config-cmap)# exit
```

This example shows how to delete the class map class1:

```
Device(config)# no class-map class1
```

You can verify your settings by entering the **show class-map** privileged EXEC command.

# match (class-map configuration)

To define the match criteria to classify traffic, use the **match** command in class-map configuration mode. Use the **no** form of this command to remove the match criteria.

## Cisco IOS XE Everest 16.5.x and Earlier Releases

```
match access-group name acl-name acl-index | class-map class-map-name | cos cos-value | dscp dscp-value
| [ip] dscp dscp-list | [ip] precedence ip-precedence-list | precedence precedence-value1...value4 |
qos-group qos-group-value | vlan vlan-id
no match access-group name acl-name acl-index | class-map class-map-name | cos cos-value | dscp
dscp-value | [ip] dscp dscp-list | [ip] precedence ip-precedence-list | precedence
precedence-value1...value4 | qos-group qos-group-value | vlan vlan-id
```

## Cisco IOS XE Everest 16.6.x and Later Releases

```
match access-group name acl-name acl-index | cos cos-value | dscp dscp-value | [ip] dscp dscp-list |
[ip] precedence ip-precedence-list | mpls experimental-value | non-client-nrt | precedence
precedence-value1...value4 | protocol protocol-name | qos-group qos-group-value | vlan vlan-id | wlan
wlan-id
no match access-group name acl-name acl-index | cos cos-value | dscp dscp-value | [ip] dscp dscp-list |
[ip] precedence ip-precedence-list | mpls experimental-value | non-client-nrt | precedence
precedence-value1...value4 | protocol protocol-name | qos-group qos-group-value | vlan vlan-id | wlan
wlan-id
```

### Syntax Description

<b>access-group</b>	Specifies an access group.
<b>name</b> <i>acl-name</i>	Specifies the name of an IP standard or extended access control list (ACL) or MAC ACL.
<i>acl-index</i>	Specifies the number of an IP standard or extended access control list (ACL) or MAC ACL. For an IP standard ACL, the ACL index range is 1 to 99 and 1300 to 1999. For an IP extended ACL, the ACL index range is 100 to 199 and 2000 to 2699.
<b>class-map</b> <i>class-map-name</i>	Uses a traffic class as a classification policy and specifies a traffic class name to use as the match criterion.
<b>cos</b> <i>cos-value</i>	Matches a packet on the basis of a Layer 2 class of service (CoS)/Inter-Switch Link (ISL) marking. The cos-value is from 0 to 7. You can specify up to four CoS values in one <b>match cos</b> statement, separated by a space.
<b>dscp</b> <i>dscp-value</i>	Specifies the parameters for each DSCP value. You can specify a value in the range 0 to 63 specifying the differentiated services code point value.

<b>ip dscp</b> <i>dscp-list</i>	Specifies a list of up to eight IP Differentiated Services Code Point (DSCP) values to match against incoming packets. Separate each value with a space. The range is 0 to 63. You also can enter a mnemonic name for a commonly used value.
<b>ip precedence</b> <i>ip-precedence-list</i>	Specifies a list of up to eight IP-precedence values to match against incoming packets. Separate each value with a space. The range is 0 to 7. You also can enter a mnemonic name for a commonly used value.
<b>precedence</b> <i>precedence-value1...value4</i>	Assigns an IP precedence value to the classified traffic. The range is 0 to 7. You also can enter a mnemonic name for a commonly used value.
<b>qos-group</b> <i>qos-group-value</i>	Identifies a specific QoS group value as a match criterion. The range is 0 to 31.
<b>vlan</b> <i>vlan-id</i>	Identifies a specific VLAN as a match criterion. The range is 1 to 4094.
<b>mpls</b> <i>experimental-value</i>	Specifies Multi Protocol Label Switching specific values.
<b>non-client-nrt</b>	Matches a non-client NRT (non-real-time).
<b>protocol</b> <i>protocol-name</i>	Specifies the type of protocol.
<b>wlan</b> <i>wlan-id</i>	Identifies 802.11 specific values.

**Command Default** No match criteria are defined.

**Command Modes** Class-map configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
	Cisco IOS XE Everest 16.6.1	The <b>class-map</b> <i>class-map-name</i> keyword is removed. The <b>mpls</b> <i>experimental-value</i> , <b>non-client-nrt</b> , <b>protocol</b> <i>protocol-name</i> , and <b>wlan</b> <i>wlan-id</i> keywords are added.

**Usage Guidelines** The **match** command is used to specify which fields in the incoming packets are examined to classify the packets. Only the IP access group or the MAC access group matching to the Ether Type/Len are supported. If you enter the **class-map match-any***class-map-name* global configuration command, you can enter the following **match** commands:

- **match access-group name** *acl-name*




---

**Note** The ACL must be an extended named ACL.

This is not applicable to Cisco Catalyst 9500 Series High Performance Switches.

---

- **match ip dscp** *dscp-list*
- **match ip precedence** *ip-precedence-list*

The **match access-group** *acl-index* command is not supported.

To define packet classification on a physical-port basis, only one **match** command per class map is supported. In this situation, the **match-any** keyword is equivalent.

For the **match ip dscp** *dscp-list* or the **match ip precedence** *ip-precedence-list* command, you can enter a mnemonic name for a commonly used value. For example, you can enter the **match ip dscp af11** command, which is the same as entering the **match ip dscp 10** command. You can enter the **match ip precedence critical** command, which is the same as entering the **match ip precedence 5** command. For a list of supported mnemonics, enter the **match ip dscp ?** or the **match ip precedence ?** command to see the command-line help strings.

Use the **input-interface** *interface-id-list* keyword when you are configuring an interface-level class map in a hierarchical policy map. For the *interface-id-list*, you can specify up to six entries.

## Examples

This example shows how to create a class map called class2, which matches all the incoming traffic with DSCP values of 10, 11, and 12:

```
Device(config)# class-map class2
Device(config-cmap)# match ip dscp 10 11 12
Device(config-cmap)# exit
```

This example shows how to create a class map called class3, which matches all the incoming traffic with IP-precedence values of 5, 6, and 7:

```
Device(config)# class-map class3
Device(config-cmap)# match ip precedence 5 6 7
Device(config-cmap)# exit
```

This example shows how to delete the IP-precedence match criteria and to classify traffic using acl1:

```
Device(config)# class-map class2
Device(config-cmap)# match ip precedence 5 6 7
Device(config-cmap)# no match ip precedence
Device(config-cmap)# match access-group acl1
Device(config-cmap)# exit
```

This example shows how to specify a list of physical ports to which an interface-level class map in a hierarchical policy map applies:

```
Device(config)# class-map match-any class4
Device(config-cmap)# match cos 4
Device(config-cmap)# exit
```

This example shows how to specify a range of physical ports to which an interface-level class map in a hierarchical policy map applies:

```
Device(config)# class-map match-any class4  
Device(config-cmap)# match cos 4  
Device(config-cmap)# exit
```

You can verify your settings by entering the **show class-map** privileged EXEC command.

# policy-map

To create or modify a policy map that can be attached to multiple physical ports or switch virtual interfaces (SVIs) and to enter policy-map configuration mode, use the **policy-map** command in global configuration mode. Use the **no** form of this command to delete an existing policy map and to return to global configuration mode.

**policy-map** *policy-map-name*  
**no policy-map** *policy-map-name*

## Syntax Description

*policy-map-name* Name of the policy map.

## Command Default

No policy maps are defined.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

After entering the **policy-map** command, you enter policy-map configuration mode, and these configuration commands are available:

- **class**—Defines the classification match criteria for the specified class map.
- **description**—Describes the policy map (up to 200 characters).
- **exit**—Exits policy-map configuration mode and returns you to global configuration mode.
- **no**—Removes a previously defined policy map.
- **sequence-interval**—Enables sequence number capability.

To return to global configuration mode, use the **exit** command. To return to privileged EXEC mode, use the **end** command.

Before configuring policies for classes whose match criteria are defined in a class map, use the **policy-map** command to specify the name of the policy map to be created, added to, or modified. Entering the **policy-map** command also enables the policy-map configuration mode in which you can configure or modify the class policies for that policy map.

You can configure class policies in a policy map only if the classes have match criteria defined for them. To configure the match criteria for a class, use the **class-map** global configuration and **match** class-map configuration commands. You define packet classification on a physical-port basis.

Only one policy map per ingress port is supported. You can apply the same policy map to multiple physical ports.

You can apply a nonhierarchical policy maps to physical ports. A nonhierarchical policy map is the same as the port-based policy maps in the .

A hierarchical policy map has two levels in the format of a parent-child policy. The parent policy cannot be modified but the child policy (port-child policy) can be modified to suit the QoS configuration.



In VLAN-based QoS, a service policy is applied to an SVI interface.



**Note** Not all MQC QoS combinations are supported for wired ports. For information about these restrictions, see chapters "Restrictions for QoS on Wired Targets" in the QoS configuration guide.

## Examples

This example shows how to create a policy map called `policy1`. When attached to the ingress port, it matches all the incoming traffic defined in `class1`, sets the IP DSCP to 10, and polices the traffic at an average rate of 1 Mb/s and bursts at 20 KB. Traffic less than the profile is sent.

```
Device(config)# policy-map policy1
Device(config-pmap)# class class1
Device(config-pmap-c)# set dscp 10
Device(config-pmap-c)# police 1000000 20000 conform-action transmit
Device(config-pmap-c)# exit
```

This example show you how to configure hierarchical polices:

```
Device# configure terminal
Device(config)# class-map c1
Device(config-cmap)# exit

Device(config)# class-map c2
Device(config-cmap)# exit

Device(config)# policy-map child
Device(config-pmap)# class c1
Device(config-pmap-c)# priority level 1
Device(config-pmap-c)# police rate percent 20 conform-action transmit exceed action drop
Device(config-pmap-c-police)# exit
Device(config-pmap-c)# exit

Device(config-pmap)# class c2
Device(config-pmap-c)# bandwidth 20000
Device(config-pmap-c)# exit

Device(config-pmap)# class class-default
Device(config-pmap-c)# bandwidth 20000
Device(config-pmap-c)# exit
Device(config-pmap)# exit

Device(config)# policy-map parent
Device(config-pmap)# class class-default
Device(config-pmap-c)# shape average 1000000
Device(config-pmap-c)# service-policy child
Device(config-pmap-c)# end
```

This example shows how to delete a policy map:

```
Device(config)# no policy-map policymap2
```

You can verify your settings by entering the **show policy-map** privileged EXEC command.

# priority

To assign priority to a class of traffic belonging to a policy map, use the **priority** command in policy-map class configuration mode. To remove a previously specified priority for a class, use the **no** form of this command.

```
priority [Kbps [burst -in-bytes] ] | level level-value [Kbps [burst -in-bytes] ] | percent
percentage [Kb/s [burst -in-bytes] ] ]
no priority [Kb/s [burst -in-bytes] ] | level level value [Kb/s [burst -in-bytes] ] | percent
percentage [Kb/s [burst -in-bytes] ] ]
```

Syntax Description		
	<i>Kb/s</i>	(Optional) Guaranteed allowed bandwidth, in kilobits per second (kbps), for the priority traffic. The amount of guaranteed bandwidth varies according to the interface and platform in use. Beyond the guaranteed bandwidth, the priority traffic will be dropped in the event of congestion to ensure that the nonpriority traffic is not starved. The value must be between 1 and 2,000,000 kbps.
	<i>burst -in-bytes</i>	(Optional) Burst size in bytes. The burst size configures the network to accommodate temporary bursts of traffic. The default burst value, which is computed as 200 milliseconds of traffic at the configured bandwidth rate, is used when the burst argument is not specified. The range of the burst is from 32 to 2000000 bytes.
	<b>level</b> <i>level-value</i>	(Optional) Assigns priority level. Available values for <i>level-value</i> are 1 and 2. Level 1 is a higher priority than Level 2. Level 1 reserves bandwidth and goes first, so latency is very low.
	<b>percent</b> <i>percentage</i>	(Optional) Specifies the amount of guaranteed bandwidth to be specified by the percent of available bandwidth.

**Command Default** No priority is set.

**Command Modes** Policy-map class configuration (config-pmap-c)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The bandwidth and priority commands cannot be used in the same class, within the same policy map. However, these commands can be used together in the same policy map.

When the policy map containing class policy configurations is attached to the interface to stipulate the service policy for that interface, available bandwidth is assessed. If a policy map cannot be attached to a particular interface because of insufficient interface bandwidth, the policy is removed from all interfaces to which it was successfully attached.

### Example

The following example shows how to configure the priority of the class in policy map policy1:

```
Device(config)# class-map cm1
Device(config-cmap)#match precedence 2
Device(config-cmap)#exit

Device(config)#class-map cm2
Device(config-cmap)#match dscp 30
Device(config-cmap)#exit

Device(config)# policy-map policy1
Device(config-pmap)# class cm1
Device(config-pmap-c)# priority level 1
Device(config-pmap-c)# police 1m
Device(config-pmap-c-police)#exit
Device(config-pmap-c)#exit
Device(config-pmap)#exit

Device(config)#policy-map policy1
Device(config-pmap)#class cm2
Device(config-pmap-c)#priority level 2
Device(config-pmap-c)#police 1m
```

# queue-buffers ratio

To configure the queue buffer for the class, use the **queue-buffers ratio** command in policy-map class configuration mode. Use the **no** form of this command to remove the ratio limit.

**queue-buffers ratio** *ratio limit*  
**no queue-buffers ratio** *ratio limit*

<b>Syntax Description</b>	<i>ratio limit</i> (Optional) Configures the queue buffer for the class. Enter the queue buffers ratio limit (0-100).				
<b>Command Default</b>	No queue buffer for the class is defined.				
<b>Command Modes</b>	Policy-map class configuration (config-pmap-c)				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	<p>Either the <b>bandwidth</b>, <b>shape</b>, or <b>priority</b> command must be used before using this command. For more information about these commands, see <i>Cisco IOS Quality of Service Solutions Command Reference</i> available on Cisco.com</p> <p>The <b>queue-buffers ratio</b> allows you to allocate buffers to queues. If buffers are not allocated, then they are divided equally amongst all queues. You can use the queue-buffer ratio to divide it in a particular ratio. The buffers are soft buffers because Dynamic Threshold and Scaling (DTS) is active on all queues by default.</p>				

## Example

The following example sets the queue buffers ratio to 10 percent:

```
Device(config)# policy-map policy_queuebuf01
Device(config-pmap)# class-map class_queuebuf01
Device(config-cmap)# exit
Device(config)# policy policy_queuebuf01
Device(config-pmap)# class class_queuebuf01
Device(config-pmap-c)# bandwidth percent 80
Device(config-pmap-c)# queue-buffers ratio 10
Device(config-pmap)# end
```

You can verify your settings by entering the **show policy-map** privileged EXEC command.

# queue-limit

To specify or modify the maximum number of packets the queue can hold for a class policy configured in a policy map, use the **queue-limit** policy-map class configuration command. To remove the queue packet limit from a class, use the **no** form of this command.

**queue-limit** *queue-limit-size* [**packets**] **cos** *cos-value* | **dscp** *dscp-value* **percent** *percentage-of-packets*  
**no queue-limit** *queue-limit-size* [**packets**] **cos** *cos-value* | **dscp** *dscp-value* **percent** *percentage-of-packets*

Syntax Description		
<i>queue-limit-size</i>		The maximum size of the queue. The maximum varies according to the optional unit of measure keyword specified ( bytes, ms, us, or packets).
<b>cos</b> <i>cos-value</i>		Specifies parameters for each cos value. CoS values are from 0 to 7.
<b>dscp</b> <i>dscp-value</i>		Specifies parameters for each DSCP value.  You can specify a value in the range 0 to 63 specifying the differentiated services code point value for the type of queue limit .
<b>percent</b> <i>percentage-of-packets</i>		A percentage in the range 1 to 100 specifying the maximum percentage of packets that the queue for this class can accumulate.

**Command Default** None

**Command Modes** Policy-map class configuration (policy-map-c)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Although visible in the command line help-strings, the **packets** unit of measure is not supported; use the **percent** unit of measure.



**Note** This command is supported only on wired ports in the egress direction.

Weighted fair queuing (WFQ) creates a queue for every class for which a class map is defined. Packets satisfying the match criteria for a class accumulate in the queue reserved for the class until they are sent, which occurs when the queue is serviced by the fair queuing process. When the maximum packet threshold you defined for the class is reached, queuing of any further packets to the class queue causes tail drop.

You use queue limits to configure Weighted Tail Drop (WTD). WTD ensures the configuration of more than one threshold per queue. Each class of service is dropped at a different threshold value to provide for QoS differentiation.

You can configure the maximum queue thresholds for the different subclasses of traffic, that is, DSCP and CoS and configure the maximum queue thresholds for each subclass.

### Example

The following example configures a policy map called port-queue to contain policy for a class called dscp-1. The policy for this class is set so that the queue reserved for it has a maximum packet limit of 20 percent:

```
Device(config)# policy-map policy11
Device(config-pmap)# class dscp-1
Device(config-pmap-c)# bandwidth percent 20
Device(config-pmap-c)# queue-limit dscp 1 percent 20
```

## random-detect cos

To change the minimum and maximum packet thresholds for the Class of service (CoS) value, use the **random-detect cos** command in QoS policy-map class configuration mode. To return the minimum and maximum packet thresholds to the default for the CoS value, use the **no** form of this command.

```
random-detect cos cos-value percent min-threshold max-threshold
no random-detect cos cos-value percent min-threshold max-threshold
```

Syntax Description	
<i>cos-value</i>	The CoS value, which is IEEE 802.1Q/ISL class of service/user priority value. The CoS value can be a number from 0 to 7.
percent	Specifies that the minimum and threshold values are in percentage.
<i>min-threshold</i>	Minimum threshold in number of packets. The value range of this argument is from 1 to 512000000. When the average queue length reaches the minimum threshold, Weighted Random Early Detection (WRED) randomly drop some packets with the specified CoS value.
<i>max-threshold</i>	Maximum threshold in number of packets. The value range of this argument is from the value of the <i>min-threshold</i> argument to 512000000. When the average queue length exceeds the maximum threshold, WRED or dWRED drop all packets with the specified CoS value.

### Command Modes

QoS policy-map class configuration (config-pmap-c)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **random-detect cos** command in conjunction with the **random-detect** command in QoS policy-map class configuration mode.

The **random-detect cos** command is available only if you have specified the *cos-based* argument when using the **random-detect** command in interface configuration mode.

### Examples

The following example enables WRED to use the CoS value 8. The minimum threshold for the CoS value 8 is 20, the maximum threshold is 40.

```
random-detect cos-based
random-detect cos percent 5 20 40
```

### Related Commands

Command	Description
<b>random-detect</b>	Enables WRED

# random-detect cos-based

To enable weighted random early detection (WRED) on the basis of the class of service (CoS) value of a packet, use the **random-detect cos-based** command in policy-map class configuration mode. To disable WRED, use the **no** form of this command.

**random-detect cos-based**  
**no random-detect cos-based**

## Command Default

When WRED is configured, the default minimum and maximum thresholds are determined on the basis of output buffering capacity and the transmission speed for the interface.

## Command Modes

Policy-map class configuration (config-pmap-c)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

In the following example, WRED is configured on the basis of the CoS value.

```
Switch> enable
Switch# configure terminal
Switch(config)# policy-map policymap1
Switch(config-pmap)# class class1
Switch(config-pmap-c)# random-detect cos-based
Switch(config-pmap-c)#

end
```

## Related Commands

Command	Description
<b>random-detect cos</b>	Specifies the CoS value of a packet, the minimum and maximum thresholds, and the maximum probability denominator used for enabling WRED.
<b>show policy-map</b>	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
<b>show policy-map interface</b>	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific PVC on the interface.



## random-detect dscp

To change the minimum and maximum packet thresholds for the differentiated services code point (DSCP) value, use the **random-detect dscp** command in QoS policy-map class configuration mode. To return the minimum and maximum packet thresholds to the default for the DSCP value, use the **no** form of this command.

```
random-detect dscp dscp-value percent min-threshold max-threshold
no random-detect dscp dscp-value percent min-threshold max-threshold
```

Syntax Description	
<i>dscp-value</i>	The DSCP value. The DSCP value can be a number from 0 to 63, or it can be one of the following keywords: <b>af11</b> , <b>af12</b> , <b>af13</b> , <b>af21</b> , <b>af22</b> , <b>af23</b> , <b>af31</b> , <b>af32</b> , <b>af33</b> , <b>af41</b> , <b>af42</b> , <b>af43</b> , <b>cs1</b> , <b>cs2</b> , <b>cs3</b> , <b>cs4</b> , <b>cs5</b> , <b>cs7</b> , <b>ef</b> , or <b>rsvp</b> .
percent	Specifies that the minimum and threshold values are in percentage.
<i>min-threshold</i>	Minimum threshold in number of packets. The value range of this argument is from 1 to 512000000. When the average queue length reaches the minimum threshold, Weighted Random Early Detection (WRED) randomly drop some packets with the specified DSCP value.
<i>max-threshold</i>	Maximum threshold in number of packets. The value range of this argument is from the value of the <i>min-threshold</i> argument to 512000000. When the average queue length exceeds the maximum threshold, WRED or dWRED drop all packets with the specified DSCP value.

### Command Modes

QoS policy-map class configuration (config-pmap-c)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **random-detect dscp** command in conjunction with the **random-detect** command in QoS policy-map class configuration mode.

The **random-detect dscp** command is available only if you specified the *dscp-based* argument when using the **random-detect** command in interface configuration mode.

### Specifying the DSCP Value

The **random-detect dscp** command allows you to specify the DSCP value per traffic class. The DSCP value can be a number from 0 to 63, or it can be one of the following keywords: **af11**, **af12**, **af13**, **af21**, **af22**, **af23**, **af31**, **af32**, **af33**, **af41**, **af42**, **af43**, **cs1**, **cs2**, **cs3**, **cs4**, **cs5**, **cs7**, **ef**, or **rsvp**.

On a particular traffic class, eight DSCP values can be configured per traffic class. Overall, 29 values can be configured on a traffic class: 8 precedence values, 12 Assured Forwarding (AF) code points, 1 Expedited Forwarding code point, and 8 user-defined DSCP values.

### Assured Forwarding Code Points

The AF code points provide a means for a domain to offer four different levels (four different AF classes) of forwarding assurances for IP packets received from other (such as customer) domains. Each one of the four AF classes is allocated a certain amount of forwarding services (buffer space and bandwidth).

Within each AF class, IP packets are marked with one of three possible drop precedence values (binary 2{010}, 4{100}, or 6{110}), which exist as the three lowest bits in the DSCP header. In congested network environments, the drop precedence value of the packet determines the importance of the packet within the AF class. Packets with higher drop precedence values are discarded before packets with lower drop precedence values.

The upper three bits of the DSCP value determine the AF class; the lower three values determine the drop probability.

### Examples

The following example enables WRED to use the DSCP value 8. The minimum threshold for the DSCP value 8 is 20, the maximum threshold is 40, and the mark probability is 1/10.

```
random-detect dscp percent 8 20 40
```

### Related Commands

Command	Description
<b>random-detect</b>	Enables WRED

## random-detect dscp-based

To base weighted random early detection (WRED) on the Differentiated Services Code Point (dscp) value of a packet, use the **random-detectdscp-based** command in policy-map class configuration mode. To disable this feature, use the **no** form of this command.

**random-detect dscp-based**  
**no random-detect dscp-based**

**Syntax Description** This command has no arguments or keywords.

**Command Default** WRED is disabled by default.

**Command Modes** Policy-map class configuration (config-pmap-c)

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** With the **random-detectdscp-based** command, WRED is based on the dscp value of the packet. Use the **random-detectdscp-based** command before configuring the **random-detectdscp** command.

**Examples** The following example shows that random detect is based on the precedence value of a packet:

```
Switch> enable
Switch# configure terminal
Switch(config)#

policy-map policy1
Switch(config-pmap)# class class1
Switch(config-pmap-c)# bandwidth percent 80
Switch(config-pmap-c)# random-detect dscp-based
Switch(config-pmap-c)# random-detect dscp 2 percent 10 40
Switch(config-pmap-c)# exit
```

Command	Description
<b>random-detect</b>	Enables WRED.
<b>random-detect dscp</b>	Configures the WRED parameters for a particular DSCP value for a class policy in a policy map.

## random-detect precedence

To configure Weighted Random Early Detection (WRED) parameters for a particular IP precedence for a class policy in a policy map, use the **random-detect precedence** command in QoS policy-map class configuration mode. To return the values to the default for the precedence, use the **no** form of this command.

**random-detect precedence** *precedence percent min-threshold max-threshold*  
**no random-detect precedence**

### Syntax Description

<i>precedence</i>	IP precedence number. The value range is from 0 to 7; see Table 1 in the “Usage Guidelines” section.
<b>percent</b>	Indicates that the threshold values are in percentage.
<i>min-threshold</i>	Minimum threshold in number of packets. The value range of this argument is from 1 to 512000000. When the average queue length reaches the minimum threshold, WRED randomly drops some packets with the specified IP precedence.
<i>max-threshold</i>	Maximum threshold in number of packets. The value range of this argument is from the value of the <i>min-threshold</i> argument to 512000000. When the average queue length exceeds the maximum threshold, WRED or dWRED drop all packets with the specified IP precedence.

### Command Default

The default *min-threshold* value depends on the precedence. The *min-threshold* value for IP precedence 0 corresponds to half of the *max-threshold* value. The values for the remaining precedences fall between half the *max-threshold* value and the *max-threshold* value at evenly spaced intervals. See the table in the “Usage Guidelines” section of this command for a list of the default minimum threshold values for each IP precedence.

### Command Modes

Interface configuration (config-if)  
 QoS policy-map class configuration (config-pmap-c)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

WRED is a congestion avoidance mechanism that slows traffic by randomly dropping packets when congestion exists.

When you configure the **random-detect** command on an interface, packets are given preferential treatment based on the IP precedence of the packet. Use the **random-detect precedence** command to adjust the treatment for different precedences.

If you want WRED to ignore the precedence when determining which packets to drop, enter this command with the same parameters for each precedence. Remember to use appropriate values for the minimum and maximum thresholds.

Note that if you use the **random-detect precedence** command to adjust the treatment for different precedences within class policy, you must ensure that WRED is not configured for the interface to which you attach that service policy.



**Note** Although the range of values for the *min-threshold* and *max-threshold* arguments is from 1 to 512000000, the actual values that you can specify depend on the type of random detect you are configuring. For example, the maximum threshold value cannot exceed the queue limit.

### Examples

The following example shows the configuration to enable WRED on the interface and to specify parameters for the different IP precedences:

```
interface FortyGigE1/0/1
 description 45Mbps to R1
 ip address 10.200.14.250 255.255.255.252
 random-detect
 random-detect precedence 7 percent 20 50
```

### Related Commands

Command	Description
<b>bandwidth (policy-map class)</b>	Specifies or modifies the bandwidth allocated for a class belonging to a policy map.
<b>random-detect dscp</b>	Changes the minimum and maximum packet thresholds for the DSCP value.
<b>show policy-map interface</b>	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.
<b>show queuing</b>	Lists all or selected configured queuing strategies.

# random-detect precedence-based

To base weighted random early detection (WRED) on the precedence value of a packet, use the **random-detect precedence-based** command in policy-map class configuration mode. To disable this feature, use the **no** form of this command.

**random-detect precedence-based**  
**no random-detect precedence-based**

**Syntax Description** This command has no arguments or keywords.

**Command Default** WRED is disabled by default.

**Command Modes** Policy-map class configuration (config-pmap-c)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

With the **random-detect precedence-based** command, WRED is based on the IP precedence value of the packet.

Use the **random-detect precedence-based** command before configuring the **random-detect precedence-based** command.

## Examples

The following example shows that random detect is based on the precedence value of a packet:

```
Device> enable
Device# configure terminal
Device(config)#

policy-map policy1
Device(config-pmap)# class class1
Device(config-pmap-c)# bandwidth percent 80
Device(config-pmap-c)# random-detect precedence-based
Device(config-pmap-c)# random-detect precedence 2 percent 30 50
Device(config-pmap-c)# exit
```

## Related Commands

Command	Description
<b>random-detect</b>	Enables WRED.
<b>random-detect precedence</b>	Configures the WRED parameters for a particular IP precedence for a class policy in a policy map.

## service-policy (Wired)

To apply a policy map to a physical port or a switch virtual interface (SVI), use the **service-policy** command in interface configuration mode. Use the **no** form of this command to remove the policy map and port association.

```
service-policy {input | output} policy-map-name
no service-policy {input | output} policy-map-name
```

<b>Syntax Description</b>	<b>input</b> <i>policy-map-name</i> Apply the specified policy map to the input of a physical port or an SVI.
	<b>output</b> <i>policy-map-name</i> Apply the specified policy map to the output of a physical port or an SVI.

<b>Command Default</b>	No policy maps are attached to the port.
------------------------	--

<b>Command Modes</b>	WLAN interface configuration
----------------------	------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

A policy map is defined by the **policy map** command.

Only one policy map is supported per port, per direction. In other words, only one input policy and one output policy is allowed on any one port.

You can apply a policy map to incoming traffic on a physical port or on an SVI.

**Examples**

This example shows how to apply plcmap1 to an physical ingress port:

```
Device(config)# interface hundredgigabitethernet 1/0/3
Device(config-if)# service-policy input plcmap1
```

This example shows how to remove plcmap2 from a physical port:

```
Device(config)# interface hundredgigabitethernet 1/0/5
Device(config-if)# no service-policy input plcmap2
```

The following example displays a VLAN policer configuration. At the end of this configuration, the VLAN policy map is applied to an interface for QoS:

```
Device# configure terminal
Device(config)# class-map vlan100
Device(config-cmap)# match vlan 100
Device(config-cmap)# exit
Device(config)# policy-map vlan100
Device(config-pmap)# policy-map class vlan100
Device(config-pmap-c)# police 100000 bc conform-action transmit exceed-action drop
Device(config-pmap-c-police)# end
Device# configure terminal
```

```
Device(config)# interface hundredgigabitethernet 1/0/5  
Device(config-if)# service-policy input vlan100
```

You can verify your settings by entering the **show running-config** privileged EXEC command.



## set

To classify IP traffic by setting a Differentiated Services Code Point (DSCP) or an IP-precedence value in the packet, use the **set** command in policy-map class configuration mode. Use the **no** form of this command to remove traffic classification.

**set**

**cos | dscp | precedence | ip | qos-group**

**set cos**

*cos-value* | **cos | dscp | precedence | qos-group** [**table** *table-map-name*]

**set dscp**

*dscp-value* | **cos | dscp | precedence | qos-group** [**table** *table-map-name*]

**set ip dscp | precedence**

**set precedence** *precedence-value* | **cos | dscp | precedence | qos-group** [**table** *table-map-name*]

**set qos-group**

*qos-group-value* | **dscp** [**table** *table-map-name*] | **precedence** [**table** *table-map-name*]

---

**Syntax Description****cos**

Sets the Layer 2 class of service (CoS) value or user priority of an outgoing packet. You can specify these values:

- *cos-value*—CoS value from 0 to 7. You also can enter a mnemonic name for a commonly used value.
- Specify a packet-marking category to set the CoS value of the packet. If you also configure a table map for mapping and converting packet-marking values, this establishes the "map from" packet-marking category. Packet-marking category keywords:
  - **cos**—Sets a value from the CoS value or user priority.
  - **dscp**—Sets a value from packet differentiated services code point (DSCP).
  - **precedence**—Sets a value from packet precedence.
  - **qos-group**—Sets a value from the QoS group.

- (Optional) **table** *table-map-name*—Indicates that the values set in a specified table map are used to set the CoS value. Enter the name of the table map used to specify the CoS value. The table map name can be a maximum of 64 alphanumeric characters.

If you specify a packet-marking category but do not specify the table map, the default action is to copy the value associated with the packet-marking category as the CoS value. For example, if you enter the **set cos precedence** command, the precedence (packet-marking category) value is copied and used as the CoS value.

---

---

**dscp**

Sets the differentiated services code point (DSCP) value to mark IP(v4) and IPv6 packets. You can specify these values:

- **cos-value**—Number that sets the DSCP value. The range is from 0 to 63. You also can enter a mnemonic name for a commonly used value.
- Specify a packet-marking category to set the DSCP value of the packet. If you also configure a table map for mapping and converting packet-marking values, this establishes the "map from" packet-marking category. Packet-marking category keywords:
  - **cos**—Sets a value from the CoS value or user priority.
  - **dscp**—Sets a value from packet differentiated services code point (DSCP).
  - **precedence**—Sets a value from packet precedence.
  - **qos-group**—Sets a value from the QoS group.
- (Optional)**table** *table-map-name*—Indicates that the values set in a specified table map will be used to set the DSCP value. Enter the name of the table map used to specify the DSCP value. The table map name can be a maximum of 64 alphanumeric characters.

If you specify a packet-marking category but do not specify the table map, the default action is to copy the value associated with the packet-marking category as the DSCP value. For example, if you enter the **set dscp cos** command, the CoS value (packet-marking category) is copied and used as the DSCP value.

---

**ip**

Sets IP values to the classified traffic. You can specify these values:

- **dscp**—Specify an IP DSCP value from 0 to 63 or a packet marking category.
  - **precedence**—Specify a precedence-bit value in the IP header; valid values are from 0 to 7 or specify a packet marking category.
-

---

**precedence**

Sets the precedence value in the packet header. You can specify these values:

- *precedence-value*— Sets the precedence bit in the packet header; valid values are from 0 to 7. You also can enter a mnemonic name for a commonly used value.
- Specify a packet marking category to set the precedence value of the packet.
  - **cos**—Sets a value from the CoS or user priority.
  - **dscp**—Sets a value from packet differentiated services code point (DSCP).
  - **precedence**—Sets a value from packet precedence.
  - **qos-group**—Sets a value from the QoS group.
- (Optional) **table** *table-map-name*—Indicates that the values set in a specified table map will be used to set the precedence value. Enter the name of the table map used to specify the precedence value. The table map name can be a maximum of 64 alphanumeric characters.

If you specify a packet-marking category but do not specify the table map, the default action is to copy the value associated with the packet-marking category as the precedence value. For example, if you enter the **set precedence cos** command, the CoS value (packet-marking category) is copied and used as the precedence value.

---

<b>qos-group</b>	<p>Assigns a QoS group identifier that can be used later to classify packets.</p> <ul style="list-style-type: none"> <li>• <i>qos-group-value</i>—Sets a QoS value to the classified traffic. The range is 0 to 31. You also can enter a mnemonic name for a commonly used value.</li> <li>• <b>dscp</b>—Sets the original DSCP field value of the packet as the QoS group value.</li> <li>• <b>precedence</b>—Sets the original precedence field value of the packet as the QoS group value.</li> <li>• (Optional)<b>table</b> <i>table-map-name</i>—Indicates that the values set in a specified table map will be used to set the DSCP or precedence value. Enter the name of the table map used to specify the value. The table map name can be a maximum of 64 alphanumeric characters.</li> </ul> <p>If you specify a packet-marking category (<b>dscp</b> or <b>precedence</b>) but do not specify the table map, the default action is to copy the value associated with the packet-marking category as the QoS group value. For example, if you enter the <b>set qos-group precedence</b> command, the precedence value (packet-marking category) is copied and used as the QoS group value.</p>
------------------	---

**Command Default** No traffic classification is defined.

**Command Modes** Policy-map class configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
		The <b>cos</b> , <b>dscp</b> , <b>qos-group</b> , <b>wlantable</b> <i>table-map-name</i> , keywords were added.

**Usage Guidelines** For the **set dscp** *dscp-value* command, the **set cos** *cos-value* command, and the **set ip precedence** *precedence-value* command, you can enter a mnemonic name for a commonly used value. For example, you can enter the **set dscp af11** command, which is the same as entering the **set dscp 10** command. You can enter the **set ip precedence critical** command, which is the same as entering the **set ip precedence 5** command. For a list of supported mnemonics, enter the **set dscp ?** or the **set ip precedence ?** command to see the command-line help strings.

When you configure the **set dscp cos** command, note the following: The CoS value is a 3-bit field, and the DSCP value is a 6-bit field. Only the three bits of the CoS field are used.

When you configure the **set dscp qos-group** command, note the following:

- The valid range for the DSCP value is a number from 0 to 63. The valid value range for the QoS group is a number from 0 to 99.

- If a QoS group value falls within both value ranges (for example, 44), the packet-marking value is copied and the packets is marked.
- If QoS group value exceeds the DSCP range (for example, 77), the packet-marking value is not be copied and the packet is not marked. No action is taken.

The **set qos-group** command cannot be applied until you create a service policy in policy-map configuration mode and then attach the service policy to an interface or ATM virtual circuit (VC).

To return to policy-map configuration mode, use the **exit** command. To return to privileged EXEC mode, use the **end** command.

## Examples

This example shows how to assign DSCP 10 to all FTP traffic without any policers:

```
Device(config)# policy-map policy_ftp
Device(config-pmap)# class-map ftp_class
Device(config-cmap)# exit
Device(config)# policy policy_ftp
Device(config-pmap)# class ftp_class
Device(config-pmap-c)# set dscp 10
Device(config-pmap)# exit
```

You can verify your settings by entering the **show policy-map** privileged EXEC command.

## show class-map

To display quality of service (QoS) class maps, which define the match criteria to classify traffic, use the **show class-map** command in EXEC mode.

```
show class-map [class-map-name | type control subscriber {all | class-map-name}]
```

Syntax Description	
<i>class-map-name</i>	(Optional) Class map name.
<b>type control subscriber</b>	(Optional) Displays information about control class maps.
<b>all</b>	(Optional) Displays information about all control class maps.

Command Modes	
	User EXEC
	Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Examples

This is an example of output from the **show class-map** command:

```
Device# show class-map
Class Map match-any videowizard_10-10-10-10 (id 2)
  Match access-group name videowizard_10-10-10-10

Class Map match-any class-default (id 0)
  Match any
Class Map match-any dscp5 (id 3)
  Match ip dscp 5
```

# show platform hardware fed switch

To display device-specific hardware information, use the **show platform hardware fed switch***switch\_number* command.

This topic elaborates only the QoS-specific options, that is, the options available with the **show platform hardware fed switch** {*switch\_num* | **active** | **standby** } **qos** command.

**show platform hardware fed switch** *switch\_num* | **active** | **standby** **qos** **afd** | **config type** *type* | [**asic** *asic\_num*] | **stats clients all** | **bssid** *id* | **wlanid** *id* | **dscp-cos counters** **iifd\_id** *id* | **interface** *type number* | **le-info** | **iifd\_id** *id* | **interface** *type number* | **policer config** **iifd\_id** *id* | **interface** *type number* | **queue** | **config** | **iifd\_id** *id* | **interface** *type number* | **internal port-type** *type* **asic number** [**port\_num**] | **label2qmap** | [**aqmrepqostbl** | **iqslabelltable** | **sqlabelltable**] | **asicnumber** | **stats** | **iifd\_id** *id* | **interface** *type number* | **internal cpu policer** | **port-type** *type* **asic number** **asicnumber** [**port\_num**] | **resource**

## Syntax Description

**switch** { *switch\_num* | **active** | **standby** }

Switch for which you want to display information. You have the following options:

- *switch\_num*—ID of the switch.
- **active**—Displays information relating to the active switch.
- **standby**—Displays information relating to the standby switch, if available.

**Note** The switch keyword is now optional on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches

**qos**

Displays QoS hardware information. You must choose from the following options:

- **afd** —Displays Approximate Fair Drop (AFD) information in hardware.
- **dscp-cos**—Displays information dscp-cos counters for each port.
- **leinfo**—Displays logical entity information.
- **policer**—Displays QoS policer information in hardware.
- **queue**—Displays queue information in hardware.
- **resource**—Displays hardware resource information.



<b>afd</b> { <b>config type</b>   <b>stats client</b> }	<p>You must choose from the options under <b>config type</b> or <b>stats client</b> :</p> <p><b>config type:</b></p> <ul style="list-style-type: none"> <li>• <b>client</b>—Displays wireless client information</li> <li>• <b>port</b>—Displays port-specific information</li> <li>• <b>radio</b>—Displays wireless radio information</li> <li>• <b>ssid</b>—Displays wireless SSID information</li> </ul> <p><b>stats client :</b></p> <ul style="list-style-type: none"> <li>• <b>all</b>—Displays statistics of all client.</li> <li>• <b>bssid</b>—Valid range is from 1 to 4294967295.</li> <li>• <b>wlanid</b>—Valid range is from to 1 4294967295</li> </ul>
<b>asicasic_num</b>	(Optional) ASIC number. Valid range is from 0 to 255.
<b>dscp-cos counters</b> { <b>iifd_id id</b>   <b>interface type number</b> }	<p>Displays per port dscp-cos counters. You must choose from the following options under <b>dscp-cos counters</b>:</p> <ul style="list-style-type: none"> <li>• <b>iifd_id id</b>—The target interface ID. Valid range is from 1 to 4294967295.</li> <li>• <b>interface type number</b>—Target interface type and ID.</li> </ul>
<b>leinfo</b>	<p>You must choose from the following options under <b>dscp-cos counters</b>:</p> <ul style="list-style-type: none"> <li>• <b>iifd_id id</b>—The target interface ID. Valid range is from 1 to 4294967295.</li> <li>• <b>interface type number</b>—Target interface type and ID.</li> </ul>
<b>policer config</b>	<p>Displays configuration information related to policers in hardware. You must choose from the following options:</p> <ul style="list-style-type: none"> <li>• <b>iifd_id id</b>—The target interface ID. Valid range is from 1 to 4294967295.</li> <li>• <b>interface type number</b>—Target interface type and ID.</li> </ul>

---

**queue** { **config** { **iif\_id** *id* | **interface** *type number* | **internal** } | **label2qmap** | **stats** }

Displays queue information in hardware. You must choose from the following options:

- **config**—Configuration information. You must choose from the following options:
  - **iif\_id** *id*—The target interface ID. Valid range is from 1 to 4294967295.
  - **interface** *type number*—Target interface type and ID.
  - **internal**—Displays internal queue related information.
- **label2qmap**—Displays hardware label to queue mapping information. You can choose from the following options:
  - (Optional) **aqmrepqostbl**— AQM REP QoS label table lookup.
  - (Optional) **iqslabeltable**—IQS QoS label table lookup.
  - (Optional) **sqlabeltable**—SQS and local QoS label table lookup.
- **stats**—Displays queue statistics. You must choose from the following options:
  - **iif\_id** *id*—The target interface ID. Valid range is from 1 to 4294967295.
  - **interface** *type number*—Target interface type and ID.
  - **internal** { **cpu** **policer** | **port\_type** *port\_type* **asic** *asic\_num* [ **port\_num** *port\_num* ] }—Displays internal queue related information.

---

**resource** Displays hardware resource usage information. You must enter the following keyword: **usage**

---

**Command Modes**

User EXEC

Privileged EXEC

**Command History****Release****Modification**

This command was introduced.

This is an example of output from the **show platform hardware fed switch switch\_number qos queue stats internal cpu policer** command

```
Device#show platform hardware fed switch 3 qos queue stats internal cpu policer
```

QId	PlcIdx	Queue Name	Enabled	(default)	(set)	Drop
				Rate	Rate	
0	11	DOT1X Auth	No	1000	1000	0
1	1	L2 Control	No	500	500	0
2	14	Forus traffic	No	1000	1000	0
3	0	ICMP GEN	Yes	200	200	0
4	2	Routing Control	Yes	1800	1800	0
5	14	Forus Address resolution	No	1000	1000	0
6	3	ICMP Redirect	No	500	500	0
7	6	WLESS PRI-5	No	1000	1000	0

8	4	WLESS PRI-1	No	1000	1000	0
9	5	WLESS PRI-2	No	1000	1000	0
10	6	WLESS PRI-3	No	1000	1000	0
11	6	WLESS PRI-4	No	1000	1000	0
12	0	BROADCAST	Yes	200	200	0
13	10	Learning cache ovfl	Yes	100	100	0
14	13	Sw forwarding	Yes	1000	1000	0
15	8	Topology Control	No	13000	13000	0
16	12	Proto Snooping	No	500	500	0
17	16	DHCP Snooping	No	1000	1000	0
18	9	Transit Traffic	Yes	500	500	0
19	10	RPF Failed	Yes	100	100	0
20	15	MCAST END STATION	Yes	2000	2000	0
21	13	LOGGING	Yes	1000	1000	0
22	7	Punt Webauth	No	1000	1000	0
23	10	Crypto Control	Yes	100	100	0
24	10	Exception	Yes	100	100	0
25	3	General Punt	No	500	500	0
26	10	NFL SAMPLED DATA	Yes	100	100	0
27	2	SGT Cache Full	Yes	1800	1800	0
28	10	EGR Exception	Yes	100	100	0
29	16	Show frwd	No	1000	1000	0
30	9	MCAST Data	Yes	500	500	0
31	10	Gold Pkt	Yes	100	100	0

# show platform software fed switch qos

To display device-specific software information, use the **show platform hardware fed switch** *switch\_number* command.

This topic elaborates only the QoS-specific options available with the **show platform software fed switch** {*switch\_num* | **active** | **standby** } **qos** command.

**show platform software fed switch***switch number* | **active** | **standby****qos****avc** | **internal** | **label2qmap** | **nflqos** | **policer** | **policy** | **qsb** | **tablemap**

## Syntax Description

<b>switch</b> { <i>switch_num</i>   <b>active</b>   <b>standby</b> }	The device for which you want to display information. <ul style="list-style-type: none"> <li>• <i>switch_num</i>—Enter the switch ID. Displays information for the specified switch.</li> <li>• <b>active</b>—Displays information for the active switch.</li> <li>• <b>standby</b>—Displays information for the standby switch, if available.</li> </ul>
<b>qos</b>	Displays QoS software information. Choose one the following options: <ul style="list-style-type: none"> <li>• <b>avc</b> —Displays Application Visibility and Control (AVC) QoS information.</li> <li>• <b>internal</b>—Displays internal queue-related information.</li> <li>• <b>label2qmap</b>—Displays label to queue map table information.</li> <li>• <b>nflqos</b>—Displays NetFlow QoS information.</li> <li>• <b>policer</b>—Displays QoS policer information in hardware.</li> <li>• <b>policy</b>—Displays QoS policy information.</li> <li>• <b>qsb</b>—Displays QoS sub-block information.</li> <li>• <b>tablemap</b>—Displays table mapping information for QoS egress and ingress queues.</li> </ul>

## Command Modes

User EXEC  
Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## show platform software fed switch qos qsb

To display QoS sub-block information, use the **show platform software fed switch *switch\_number* qos qsb** command.



**Note** This command is not supported on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.

```
show platform software fed switch switch number | active | standby qos qsb brief | [all | type | client client_id | port port_number | radio radio_type | ssid ssid] | iif iif_id | interface | Auto-Template interface_number | BDI interface_number | Capwap interface_number | GigabitEthernet interface_number | InternalInterface interface_number | Loopback interface_number | Null interface_number | Port-channel interface_number | TenGigabitEthernet interface_number | Tunnel interface_number | Vlan interface_number
```

### Syntax Description

<b>switch</b> { <i>switch_num</i>   <b>active</b>   <b>standby</b> }	The switch for which you want to display information. <ul style="list-style-type: none"> <li>• <i>switch_num</i>—Enter the ID of the switch. Displays information for the specified switch.</li> <li>• <b>active</b>—Displays information for the active switch.</li> <li>• <b>standby</b>—Displays information for the standby switch, if available.</li> </ul>
<b>qos qsb</b>	Displays QoS sub-block software information.

---

**qsb {brief | iif\_id | brief  
interface}**

- **all**—Displays information for all client.
- **type**—Displays qsb information for the specified target type:
  - **client**—Displays QoS qsb information for wireless clients
  - **port**—Displays port-specific information
  - **radio**—Displays QoS qsb information for wireless radios
  - **ssid**—Displays QoS qsb information for wireless networks

**iif\_id**—Displays information for the iif\_ID

**interface**—Displays QoS qsb information for the specified interface:

- **Auto-Template**—Auto-template interface between 1 and 999.
- **BDI**—Bridge-domain interface between 1 and 16000.
- **Capwap**—CAPWAP interface between 0 and 2147483647.
- **GigabitEthernet**—GigabitEthernet interface between 0 and 9.
- **InternalInterface**—Internal interface between 0 and 9.
- **Loopback**—Loopback interface between 0 and 2147483647.
- **Null**—Null interface 0-0
- **Port-Channel**—Port-channel interface between 1 and 128.
- **TenGigabitEthernet**—TenGigabitEthernet interface between 0 and 9.
- **Tunnel**—Tunnel interface between 0 and 2147483647.
- **Vlan**—VLAN interface between 1 and 4094.

---

#### Command Modes

User EXEC

Privileged EXEC

---

#### Command History

Cisco IOS XE Everest 16.5.1a This command was introduced.

**Note** This command is not supported on the C9500-32C, C9500-32QC, C9500-48Y4C, and C9500-24Y4C models of the Cisco Catalyst 9500 Series Switches.

---

This is an example of the output for the **show platform software fed switch switch\_number qos qsb** command

```
Device#sh pl so fed sw 3 qos qsb interface g3/0/2
```

```
QoS subblock information:
```

```
Name:GigabitEthernet3/0/2 iif_id:0x0000000000007b iif_type:ETHER(146)
```

```
qsb ptr:0xffd8573350
```

```

Port type = Wired port
asic_num:0 is_uplink:false init_done:true
FRU events: Active-0, Inactive-0
def_qos_label:0 def_le_priority:13
trust_enabled:false trust_type:TRUST_DSCP ifm_trust_type:1
LE priority:13 LE trans_index(in, out): (0,0)
Stats (plc,q) export counters (in/out): 0/0
Policy Info:
  Ingress Policy: pmap::{(0xffd8685180,AutoQos-4.0-CiscoPhone-Input-Policy,1083231504,)}
    tcg::{0xffd867ad10,GigabitEthernet3/0/2 tgt(0x7b,IN) level:0 num_tccg:4 num_child:0},
status:VALID,SET_INHW
  Egress Policy: pmap::{(0xffd86857d0,AutoQos-4.0-Output-Policy,1076629088,)}
    tcg::{0xffd8685b40,GigabitEthernet3/0/2 tgt(0x7b,OUT) level:0 num_tccg:8 num_child:0},
status:VALID,SET_INHW
  TCG(in,out):(0xffd867ad10, 0xffd8685b40) le_label_id(in,out):(2, 1)
Policer Info:
  num_ag_policers(in,out)[1r2c,2r3c]: ([0,0],[0,0])
  num_mf_policers(in,out): (0,0)
  num_afd_policers:0
  [ag_plc_handle(in,out) = (0xd8688220,0)]
  [mf_plc_handle(in,out)=(nil),(nil)] num_mf_policers:(0,0)
  base:(0xffffffff,0xffffffff) rc:(0,0)]
Queueing Info:
  def_queueing = 0, shape_rate:0 interface_rate_kbps:1000000
  Port shaper:false
  lbl_to_qmap_index:1
Physical qparams:
  Queue Config: NodeType:Physical Id:0x40000049 parent:0x40000049 qid:0 attr:0x1 defq:0

  PARAMS: Excess Ratio:1 Min Cir:1000000 QBuffer:0
  Queue Limit Type:Single Unit:Percent Queue Limit:44192
  SHARED Queue

```

# show policy-map

To display quality of service (QoS) policy maps, which define classification criteria for incoming traffic, use the **show policy-map** command in EXEC mode.

**show policy-map** [*policy-map-name* | **interface** *interface-id*]

**show policy-map interface** { **Auto-template** | **Capwap** | **GigabitEthernet** | **GroupVI** | **InternalInterface** | **Loopback** | **Lspvif** | **Null** | **Port-channel** | **TenGigabitEthernet** | **Tunnel** | **Vlan** | **brief** | **class** | **input** | **output**

## Syntax Description

*policy-map-name* (Optional) Name of the policy-map.

**interface** *interface-id* (Optional) Displays the statistics and the configurations of the input and output policies that are attached to the interface.

## Command Modes

User EXEC

Privileged EXEC

## Command History

### Release

### Modification

Cisco IOS XE Everest 16.5.1a

This command was introduced.

## Usage Guidelines

Policy maps can include policers that specify the bandwidth limitations and the action to take if the limits are exceeded.



### Note

Though visible in the command-line help string, the **control-plane**, **session**, and **type** keywords are not supported, and the statistics shown in the display should be ignored.

To display classification counters for ternary content addressable memory (TCAM) (marking or policing) based policies, enter the interface ID. Classification counters have the following restrictions:

- Classification counters are supported only on wired ports (in the ingress and egress directions).
- Classification counters count packets instead of bytes.
- Only QoS configurations with marking or policing trigger the classification counter.
- As long as there is policing or marking action in the policy, the class-default will have classification counters.
- Classification counters are not port based. The counters are shared across targets sharing the same policy map. This means that the classification counter aggregates all packets belonging to the same class of the same policy which attach to different interfaces.

This is an example of output from the **show policy-map interface** command, where classification counters are displayed:



```

Device# show policy-map interface gigabitethernet1/0/1

GigabitEthernet1/0/1

Service-policy input: AutoQos-4.0-CiscoPhone-Input-Policy

Class-map: AutoQos-4.0-Voip-Data-CiscoPhone-Class (match-any)
  0 packets
  Match: cos 5
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp ef
  police:
    cir 128000 bps, bc 8000 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      set-dscp-transmit dscp table policed-dscp
    conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Voip-Signal-CiscoPhone-Class (match-any)
  0 packets
  Match: cos 3
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp cs3
  police:
    cir 32000 bps, bc 8000 bytes
    conformed 0 bytes; actions:
      transmit
    exceeded 0 bytes; actions:
      set-dscp-transmit dscp table policed-dscp
    conformed 0000 bps, exceed 0000 bps

Class-map: AutoQos-4.0-Default-Class (match-any)
  0 packets
  Match: access-group name AutoQos-4.0-Acl-Default
    0 packets, 0 bytes
    5 minute rate 0 bps
  QoS Set
    dscp default

Class-map: class-default (match-any)
  0 packets
  Match: any
    0 packets, 0 bytes
    5 minute rate 0 bps

Service-policy output: AutoQos-4.0-Output-Policy

queue stats for all priority classes:
  Queueing
  priority level 1

  (total drops) 0
  (bytes output) 0

Class-map: AutoQos-4.0-Output-Priority-Queue (match-any)
  0 packets
  Match: dscp cs4 (32) cs5 (40) ef (46)
    0 packets, 0 bytes
    5 minute rate 0 bps

```

```

Match: cos 5
    0 packets, 0 bytes
    5 minute rate 0 bps
Priority: 30% (300000 kbps), burst bytes 7500000,

Priority Level: 1

Class-map: AutoQos-4.0-Output-Control-Mgmt-Queue (match-any)
    0 packets
Match: dscp cs2 (16) cs3 (24) cs6 (48) cs7 (56)
    0 packets, 0 bytes
    5 minute rate 0 bps
Match: cos 3
    0 packets, 0 bytes
    5 minute rate 0 bps
Queueing
queue-limit dscp 16 percent 80
queue-limit dscp 24 percent 90
queue-limit dscp 48 percent 100
queue-limit dscp 56 percent 100

(total drops) 0
(bytes output) 0
bandwidth remaining 10%

queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Conf-Queue (match-any)
    0 packets
Match: dscp af41 (34) af42 (36) af43 (38)
    0 packets, 0 bytes
    5 minute rate 0 bps
Match: cos 4
    0 packets, 0 bytes
    5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 10%
queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Trans-Data-Queue (match-any)
    0 packets
Match: dscp af21 (18) af22 (20) af23 (22)
    0 packets, 0 bytes
    5 minute rate 0 bps
Match: cos 2
    0 packets, 0 bytes
    5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 10%
queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Bulk-Data-Queue (match-any)
    0 packets
Match: dscp af11 (10) af12 (12) af13 (14)
    0 packets, 0 bytes
    5 minute rate 0 bps
Match: cos 1
    0 packets, 0 bytes

```

```
    5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 4%
queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Scavenger-Queue (match-any)
  0 packets
Match: dscp cs1 (8)
  0 packets, 0 bytes
  5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 1%
queue-buffers ratio 10

Class-map: AutoQos-4.0-Output-Multimedia-Strm-Queue (match-any)
  0 packets
Match: dscp af31 (26) af32 (28) af33 (30)
  0 packets, 0 bytes
  5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 10%
queue-buffers ratio 10

Class-map: class-default (match-any)
  0 packets
Match: any
  0 packets, 0 bytes
  5 minute rate 0 bps
Queueing

(total drops) 0
(bytes output) 0
bandwidth remaining 25%
queue-buffers ratio 25
```

## trust device

To configure trust for supported devices connected to an interface, use the **trust device** command in interface configuration mode. Use the **no** form of this command to disable trust for the connected device.

```
trust device {cisco-phone | cts | ip-camera | media-player}
no trust device {cisco-phone | cts | ip-camera | media-player}
```

Syntax Description	
<b>cisco-phone</b>	Configures a Cisco IP phone
<b>cts</b>	Configures a Cisco TelePresence System
<b>ip-camera</b>	Configures an IP Video Surveillance Camera (IPVSC)
<b>media-player</b>	Configures a Cisco Digital Media Player (DMP)

**Command Default** Trust disabled

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **trust device** command on the following types of interfaces:

- **Auto**— auto-template interface
- **Capwap**—CAPWAP tunnel interface
- **GigabitEthernet**—Gigabit Ethernet IEEE 802
- **GroupVI**—Group virtual interface
- **Internal Interface**—Internal interface
- **Loopback**—Loopback interface
- **Null**—Null interface
- **Port-channel**—Ethernet Channel interface
- **TenGigabitEthernet--10-Gigabit Ethernet**
- **Tunnel**—Tunnel interface
- **Vlan**—Catalyst VLANs
- **range**—**interface range** command

### Example

The following example configures trust for a Cisco IP phone in Interface TwentyFiveGigE 1 1/0/1:

```
Device(config)# interface TwentyFiveGigE1 1/0/1  
Device(config-if)# trust device cisco-phone
```





## PART **X**

# Routing

- [Bidirectional Forwarding Detection Commands, on page 897](#)
- [IP Routing Commands, on page 913](#)







## Bidirectional Forwarding Detection Commands

---

- [authentication \(BFD\), on page 898](#)
- [bfd, on page 899](#)
- [bfd all-interfaces, on page 901](#)
- [bfd check-ctrl-plane-failure, on page 902](#)
- [bfd echo, on page 903](#)
- [bfd slow-timers, on page 905](#)
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- [bfd-template single-hop, on page 908](#)
- [ip route static bfd, on page 909](#)
- [ipv6 route static bfd, on page 911](#)

## authentication (BFD)

To configure authentication in a Bidirectional Forwarding Detection (BFD) template for single hop sessions, use the **authentication** command in BFD configuration mode. To disable authentication in BFD template for single-hop sessions, use the **no** form of this command

**authentication** *authentication-type* **keychain** *keychain-name*  
**no authentication** *authentication-type* **keychain** *keychain-name*

### Syntax Description

*authentication-type* Authentication type. Valid values are md5, meticulous-md5, meticulous-sha1, and sha-1.

**keychain** *keychain-name* Configures an authentication key chain with the specified name. The maximum number of characters allowed in the name is 32.

### Command Default

Authentication in BFD template for single hop sessions is not enabled.

### Command Modes

BFD configuration (config-bfd)

### Command History

#### Release Modification

This command was introduced.

### Usage Guidelines

You can configure authentication in single hop templates. We recommend that you configure authentication to enhance security. Authentication must be configured on each BFD source-destination pair, and authentication parameters must match on both devices.

### Examples

The following example shows how to configure authentication for the template1 BFD single-hop template:

```
> enable
# configuration terminal
(config)# bfd-template single-hop template1
(config-bfd)# authentication sha-1 keychain bfd-singlehop
```

# bfd

To set the baseline Bidirectional Forwarding Detection (BFD) session parameters on an interface, use the **bfd** interface configuration mode. To remove the baseline BFD session parameters, use the **no** form of this command

```
bfd interval milliseconds min_rx milliseconds multiplier multiplier-value
no bfd interval milliseconds min_rx milliseconds multiplier multiplier-value
```

Syntax Description	Parameter	Description
	<b>interval</b> <i>milliseconds</i>	Specifies the rate, in milliseconds, at which BFD control packets will be sent to BFD peers. The valid range for the milliseconds argument is from 50 to 9999.
	<b>min_rx</b> <i>milliseconds</i>	Specifies the rate, in milliseconds, at which BFD control packets will be expected to be received from BFD peers. The valid range for the milliseconds argument is from 50 to 9999.
	<b>multiplier</b> <i>multiplier-value</i>	Specifies the number of consecutive BFD control packets that must be missed from a BFD peer before BFD declares that the peer is unavailable and the Layer 3 BFD peer is informed of the failure. The valid range for the multiplier-value argument is from 3 to 50.

**Command Default** No baseline BFD session parameters are set.

**Command Modes** Interface configuration (config-if)

Command History	Release	Modification
		This command was introduced.

**Usage Guidelines** The **bfd** command can be configured on SVI, Ethernet and port-channel interfaces. If BFD runs on a port channel interface, BFD has a timer value restriction of  $750 * 3$  milliseconds.

The **bfd interval** configuration is not removed when:

- an IPv4 address is removed from an interface
- an IPv6 address is removed from an interface
- IPv6 is disabled from an interface
- an interface is shutdown
- IPv4 CEF is disabled globally or locally on an interface
- IPv6 CEF is disabled globally or locally on an interface

The **bfd interval** configuration is removed when the subinterface on which its is configured is removed.



---

**Note** If we configure `bfd interval` command in interface config mode, then `bfd echo` mode is enabled by default. We need to enable either `no ip redirect` (if BFD echo is needed) or `no bfd echo` in interface config mode.

Before using BFD echo mode, you must disable sending Internet Control Message Protocol (ICMP) redirect messages by entering the `no ip redirect` command, in order to avoid high CPU utilization.

---

## Examples

The following example shows the BFD session parameters set for Gigabit Ethernet 1/0/3:

```
> enable
# configuration terminal
(config)# interface gigabitethernet 1/0/3
(config-if)# bfd interval 100 min_rx 100 multiplier 3
```

# bfd all-interfaces

To enable Bidirectional Forwarding Detection (BFD) for all interfaces participating in the routing process, use the **bfd all-interfaces** command in router configuration or address family interface configuration mode. To disable BFD for all neighbors on a single interface, use the **no** form of this command

**bfd all-interfaces**  
**no bfd all-interfaces**

<b>Syntax Description</b>	This command has no arguments or keywords.				
<b>Command Default</b>	BFD is disabled on the interfaces participating in the routing process.				
<b>Command Modes</b>	Router configuration (config-router)				
<b>Command History</b>	<table><thead><tr><th>Release</th><th>Modification</th></tr></thead><tbody><tr><td></td><td>This command was introduced.</td></tr></tbody></table>	Release	Modification		This command was introduced.
Release	Modification				
	This command was introduced.				
<b>Usage Guidelines</b>	To enable BFD for all interfaces, enter the bfd all-interfaces command in router configuration mode				

## Examples

The following example shows how to enable BFD for all Enhanced Interior Gateway Routing Protocol (EIGRP) neighbors:

```
> enable
# configuration terminal
(config)# router eigrp 123
(config-router)# bfd all-interfaces
(config-router)# end
```

The following example shows how to enable BFD for all Intermediate System-to-Intermediate System (IS-IS) neighbors:

```
> enable
# configuration terminal
(config)# router isis tag1
(config-router)# bfd all-interfaces
(config-router)# end
```

## bfd check-ctrl-plane-failure

To enable Bidirectional Forwarding Detection (BFD) control plane failure checking for the Intermediate System-to-Intermediate System (IS-IS) routing protocol, use the **bfd check-control-plane-failure** command in router configuration mode. To disable control plane failure detection, use the **no** form of this command

**bfd check-ctrl-plane-failure**  
**no bfd check-ctrl-plane-failure**

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** BFD control plane failure checking is disabled.

---

**Command Modes** Router configuration (config-router)

---

Command History	Release	Modification
		This command was introduced.

---

**Usage Guidelines** The `bfd check-ctrl-plane-failure` command can be configured for an IS-IS routing process only. The command is not supported on other protocols.

When a switch restarts, a false BFD session failure can occur, where neighboring routers behave as if a true forwarding failure has occurred. However, if the `bfd check-ctrl-plane-failure` command is enabled on a switch, the router can ignore control plane related BFD session failures. We recommend that you add this command to the configuration of all neighboring routers just prior to a planned router restart, and that you remove the command from all neighboring routers when the restart is complete.

---

### Examples

The following example enables BFD control plane failure checking for the IS-IS routing protocol:

```
> enable
# configuration terminal
(config)# router isis
(config-router)# bfd check-ctrl-plane-failure
(config-router)# end
```

# bfd echo

To enable Bidirectional Forwarding Detection (BFD) echo mode, use the **bfd echo** command in interface configuration mode. To disable BFD echo mode, use the **no** form of this command

**bfd echo**  
**no bfd echo**

## Syntax Description

This command has no arguments or keywords.

## Command Default

BFD echo mode is enabled by default if BFD is configured using **bfd interval** command in interface configuration mode.

## Command Modes

Interface configuration (config-if)

## Command History

### Release Modification

This command was introduced.

## Usage Guidelines

Echo mode is enabled by default. Entering the **no bfd echo** command without any keywords turns off the sending of echo packets and signifies that the switch is unwilling to forward echo packets received from BFD neighbor switches.

When echo mode is enabled, the desired minimum echo transmit interval and required minimum transmit interval values are taken from the **bfd interval** *milliseconds* **min\_rx** *milliseconds* parameters, respectively.



### Note

Before using BFD echo mode, you must disable sending Internet Control Message Protocol (ICMP) redirect messages by entering the **no ip redirects** command, in order to avoid high CPU utilization.

## Examples

The following example configures echo mode between BFD neighbors:

```
> enable
# configuration terminal
(config)# interface GigabitEthernet 1/0/3
(config-if)# bfd echo
```

The following output from the **show bfd neighbors details** command shows that the BFD session neighbor is up and using BFD echo mode. The relevant command output is shown in bold in the output.

```
# show bfd neighbors details
OurAddr      NeighAddr  LD/RD  RH/RS  Holdown(mult)  State Int
172.16.1.2   172.16.1.1  1/6    Up     0 (3 )         Up   Fa0/1
Session state is UP and using echo function with 100 ms interval.
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 1000000, MinRxInt: 1000000, Multiplier: 3
Received MinRxInt: 1000000, Received Multiplier: 3
Holdown (hits): 3000(0), Hello (hits): 1000(337)
Rx Count: 341, Rx Interval (ms) min/max/avg: 1/1008/882 last: 364 ms ago
Tx Count: 339, Tx Interval (ms) min/max/avg: 1/1016/886 last: 632 ms ago
Registered protocols: EIGRP
```

```
Uptime: 00:05:00
Last packet: Version: 1          - Diagnostic: 0
              State bit: Up      - Demand bit: 0
              Poll bit: 0        - Final bit: 0
              Multiplier: 3      - Length: 24
              My Discr.: 6       - Your Discr.: 1
              Min tx interval: 1000000 - Min rx interval: 1000000
              Min Echo interval: 50000
```



## bfd slow-timers

To configure the Bidirectional Forwarding Detection (BFD) slow timers value, use the **bfd slow-timers** command in interface configuration mode. To change the slow timers used by BFD, use the **no** form of this command

```
bfd slow-timers [milliseconds]  
no bfd slow-timers
```

---

**Command Default** The BFD slow timer value is 1000 milliseconds

---

**Command Modes** Global configuration (config)

---

**Command History**

Release	Modification
	This command was introduced.

---

### Examples

The following example shows how to configure the BFD slow timers value to 14,000 milliseconds:

```
(config)# bfd slow-timers 14000
```

The following output from the show bfd neighbors details command shows that the BFD slow timers value of 14,000 milliseconds has been implemented. The values for the MinTxInt and MinRxInt will correspond to the configured value for the BFD slow timers. The relevant command output is shown in bold.

```
# show bfd neighbors details
OurAddr      NeighAddr  LD/RD  RH/RS  Holdown(mult)  State  Int
172.16.1.2   172.16.1.1  1/6    Up      0 (3 )         Up     Fa0/1
Session state is UP and using echo function with 100 ms interval.
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 14000, MinRxInt: 14000, Multiplier: 3
Received MinRxInt: 1000000, Received Multiplier: 3
Holdown (hits): 3600(0), Hello (hits): 1200(337)
Rx Count: 341, Rx Interval (ms) min/max/avg: 1/1008/882 last: 364 ms ago
Tx Count: 339, Tx Interval (ms) min/max/avg: 1/1016/886 last: 632 ms ago
Registered protocols: EIGRP
Uptime: 00:05:00
Last packet: Version: 1                - Diagnostic: 0
                State bit: Up          - Demand bit: 0
                Poll bit: 0            - Final bit: 0
                Multiplier: 3          - Length: 24
                My Discr.: 6           - Your Discr.: 1
                Min tx interval: 1000000 - Min rx interval: 1000000
                Min Echo interval: 50000
```

**Note**

- 
- If the BFD session is down, then the BFD control packets will be sent with the slow timer interval.
  - If the BFD session is up, then if echo is enabled, then BFD control packets will be sent in negotiated slow timer interval and echo packets will be sent in negotiated configured BFD interval. If echo is not enabled, then BFD control packets will be sent in negotiated configured interval.
-

# bfd template

To create a Bidirectional Forwarding Detection (BFD) template and to enter BFD configuration mode, use the **bfd-template** command in global configuration mode. To remove a BFD template, use the **no** form of this command

```
bfd template template-name  
no bfd template template-name
```

---

**Command Default** A BFD template is not bound to an interface.

---

**Command Modes** Interface configuration (config-if)

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.

---

---

**Usage Guidelines** Even if you have not created the template by using the **bfd-template** command, you can configure the name of the template under an interface, but the template is considered invalid until you define the template. You do not have to reconfigure the template name again. It becomes valid automatically.

---

**Examples**

```
> enable  
# configuration terminal  
(config)# interface GigabitEthernet 1/3/0  
(config-if)# bfd template template1
```

# bfd-template single-hop

To bind a single hop Bidirectional Forwarding Detection (BFD) template to an interface, use the **bfd template** command in interface configuration mode. To unbind single-hop BFD template from an interface, use the **no** form of this command

**bfd-template single-hop** *template-name*  
**no bfd-template single-hop** *template-name*

<b>Syntax Description</b>	<b>single-hop</b> Creates the single-hop BFD template.  <i>template-name</i> Template name.
---------------------------	---

<b>Command Default</b>	A BFD template does not exist.
------------------------	--------------------------------

<b>Command Modes</b>	Global configuration (config)
----------------------	-------------------------------

<b>Command History</b>	<b>Release</b> <b>Modification</b>
	This command was introduced.

<b>Usage Guidelines</b>	The bfd-template command allows you to create a BFD template and places the device in BFD configuration mode. The template can be used to specify a set of BFD interval values. BFD interval values specified as part of the BFD template are not specific to a single interface.
-------------------------	---

<b>Examples</b>	The following example shows how to create a BFD template and specify BFD interval values:
-----------------	---

```
> enable
# configuration terminal
(config)# bfd-template single-hop node1
(bfd-config)#interval min-tx 100 min-rx 100 multiplier 3
(bfd-config)#echo
```

The following example shows how to create a BFD single-hop template and configure BFD interval values and an authentication key chain:

```
> enable
# configuration terminal
(config)# bfd-template single-hop template1
(bfd-config)#interval min-tx 200 min-rx 200 multiplier 3
(bfd-config)#authentication keyed-sha-1 keychain bfd_singlehop
```



<b>Note</b>	BFD echo is not enabled by default in the bfd-template configuration. This needs to be configured explicitly.
-------------	---

## ip route static bfd

To specify static route bidirectional forwarding detection (BFD) neighbors, use the **ip route static bfd** command in global configuration mode. To remove a static route BFD neighbor, use the **no** form of this command

```
ip route static bfd { interface-type interface-number ip-address | vrf vrf-name } [group group-name]
[passive] [unassociate]
no ip route static bfd { interface-type interface-number ip-address | vrf vrf-name } [group group-name]
[passive] [unassociate]
```

Syntax Description		
	<i>interface-type interface-number</i>	Interface type and number.
	<i>ip-address</i>	IP address of the gateway, in A.B.C.D format.
	<b>vrf</b> <i>vrf-name</i>	Specifies Virtual Routing and Forwarding (VRF) instance and the destination vrf name.
	<b>group</b> <i>group-name</i>	(Optional) Assigns a BFD group. The group-name is a character string of up to 32 characters specifying the BFD group name.
	<b>unassociate</b>	(Optional) Unassociates the static route configured for a BFD.

**Command Default** No static route BFD neighbors are specified.

**Command Modes** Global configuration (config)

**Command History**

Release	Modification
	This command was introduced.

**Usage Guidelines** Use the **ip route static bfd** command to specify static route BFD neighbors. All static routes that have the same interface and gateway specified in the configuration share the same BFD session for reachability notification.

All static routes that specify the same values for the *interface-type*, *interface-number*, and *ip-address* arguments will automatically use BFD to determine gateway reachability and take advantage of fast failure detection.

The **group** keyword assigns a BFD group. The static BFD configuration is added to the VPN routing and forwarding (VRF) instance with which the interface is associated. The **passive** keyword specifies the passive member of the group. Adding static BFD in a group without the **passive** keyword makes the BFD an active member of the group. A static route should be tracked by the active BFD configuration in order to trigger a BFD session for the group. To remove all the static BFD configurations (active and passive) of a specific group, use the **no ip route static bfd** command and specify the BFD group name.

The **unassociate** keyword specifies that a BFD neighbor is not associated with static route, and the BFD sessions are requested if an interface has been configured with BFD. This is useful in bringing up a BFDv4

session in the absence of an IPv4 static route. If the unassociate keyword is not provided, then the IPv4 static routes are associated with BFD sessions.

BFD requires that BFD sessions are initiated on both endpoint devices. Therefore, this command must be configured on each endpoint device.

The BFD static session on a switch virtual interface (SVI) is established only after the **bfd interval milliseconds min\_rx milliseconds multiplier multiplier-value** command is disabled and enabled on that SVI.

To enable the static BFD sessions, perform the following steps:

1. Enable BFD timers on the SVI.

```
bfd interval milliseconds min_rx milliseconds multiplier multiplier-value
```

2. Enable BFD for the static IP route

```
ip route static bfd interface-type interface-number ip-address
```

3. Disable and enable the BFD timers on the SVI again.

```
no bfd interval milliseconds min_rx milliseconds multiplier multiplier-value
```

```
bfd interval milliseconds min_rx milliseconds multiplier multiplier-value
```

## Examples

The following example shows how to configure BFD for all static routes through a specified neighbor, group, and active member of the group:

```
# configuration terminal
(config)# ip route static bfd GigabitEthernet 1/0/1 10.1.1.1 group group1
```

The following example shows how to configure BFD for all static routes through a specified neighbor, group, and passive member of the group:

```
# configuration terminal
(config)# ip route static bfd GigabitEthernet 1/0/1 10.2.2.2 group group1 passive
```

The following example shows how to configure BFD for all static routes in an unassociated mode without the group and passive keywords:

```
# configuration terminal
(config)# ip route static bfd GigabitEthernet 1/0/1 10.2.2.2 unassociate
```

## ipv6 route static bfd

To specify static route Bidirectional Forwarding Detection for IPv6 (BFDv6) neighbors, use the **ipv6 route static bfd** command in global configuration mode. To remove a static route BFDv6 neighbor, use the **no** form of this command

**ipv6 route static bfd** [*vrf vrf-name*] *interface-type interface-number ipv6-address* [**unassociated**]  
**no ipv6 route static bfd**

Syntax Description		
	<i>vrf vrf-name</i>	(Optional) Name of the virtual routing and forwarding (VRF) instance by which static routes should be specified.
	<i>interface-type interface-number</i>	Interface type and number.
	<i>ipv6-address</i>	IPv6 address of the neighbor.
	<b>unassociated</b>	(Optional) Moves a static BFD neighbor from associated mode to unassociated mode.

**Command Default** No static route BFDv6 neighbors are specified.

**Command Modes** Global configuration (config)

**Command History**

Release	Modification
	This command was introduced.

**Usage Guidelines** Use the `ipv6 route static bfd` command to specify static route neighbors. All of the static routes that have the same interface and gateway specified in the configuration share the same BFDv6 session for reachability notification. BFDv6 requires that BFDv6 sessions are initiated on both endpoint routers. Therefore, this command must be configured on each endpoint router. An IPv6 static BFDv6 neighbor must be fully specified (with the interface and the neighbor address) and must be directly attached.

All static routes that specify the same values for `vrf vrf-name`, `interface-type interface-number`, and `ipv6-address` will automatically use BFDv6 to determine gateway reachability and take advantage of fast failure detection.

### Examples

The following example creates a neighbor on Ethernet interface 0/0 with an address of 2001::1:

```
# configuration terminal
(config)# ipv6 route static bfd ethernet 0/0 2001::1
```

The following example converts the neighbor to unassociated mode:

```
# configuration terminal
(config)# ipv6 route static bfd ethernet 0/0 2001::1 unassociated
```







## IP Routing Commands

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# accept-lifetime

To set the time period during which the authentication key on a key chain is received as valid, use the **accept-lifetime** command in key chain key configuration mode. To revert to the default value, use the **no** form of this command.

```
accept-lifetime [ local ] start-time infinite end-time | duration seconds
no accept-lifetime
```

Syntax Description	local	Specifies the time in local timezone.
<i>start-time</i>	Beginning time that the key specified by the <b>key</b> command is valid to be received. The syntax can be either of the following:  <i>hh : mm : ss month date year</i> <i>hh : mm : ss date month year</i>  <ul style="list-style-type: none"> <li>• <i>hh</i>: Hours</li> <li>• <i>mm</i>: Minutes</li> <li>• <i>ss</i>: Seconds</li> <li>• <i>month</i>: First three letters of the month</li> <li>• <i>date</i>: Date (1-31)</li> <li>• <i>year</i>: Year (four digits)</li> </ul> <p>The default start time and the earliest acceptable date is January 1, 1993.</p>	
<b>infinite</b>	Key is valid to be received from the <i>start-time</i> value on.	
<i>end-time</i>	Key is valid to be received from the <i>start-time</i> value until the <i>end-time</i> value. The syntax is the same as that for the <i>start-time</i> value. The <i>end-time</i> value must be after the <i>start-time</i> value. The default end time is an infinite time period.	
<b>duration</b> <i>seconds</i>	Length of time (in seconds) that the key is valid to be received. The range is from 1 to 864000.	

## Command Default

The authentication key on a key chain is received as valid forever (the starting time is January 1, 1993, and the ending time is infinite).

## Command Modes

Key chain key configuration (config-keychain-key)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Only DRP Agent, Enhanced Interior Gateway Routing Protocol (EIGRP), and Routing Information Protocol (RIP) Version 2 use key chains.

Specify a *start-time* value and one of the following values: **infinite**, *end-time*, or **duration seconds**.

We recommend running Network Time Protocol (NTP) or some other time synchronization method if you assign a lifetime to a key.

If the last key expires, authentication will continue and an error message will be generated. To disable authentication, you must manually delete the last valid key.

## Examples

The following example configures a key chain named chain1. The key named key1 will be accepted from 1:30 p.m. to 3:30 p.m. and will be sent from 2:00 p.m. to 3:00 p.m. The key named key2 will be accepted from 2:30 p.m. to 4:30 p.m. and will be sent from 3:00 p.m. to 4:00 p.m. The overlap allows for migration of keys or a discrepancy in the set time of the router. There is a 30-minute leeway on each side to handle time differences.

```
Device(config)# interface GigabitEthernet1/0/1
Device(config-if)# ip rip authentication key-chain chain1
Device(config-if)# ip rip authentication mode md5
Device(config-if)# exit
Device(config)# router rip
Device(config-router)# network 172.19.0.0
Device(config-router)# version 2
Device(config-router)# exit
Device(config)# key chain chain1
Device(config-keychain)# key 1
Device(config-keychain-key)# key-string key1
Device(config-keychain-key)# accept-lifetime 13:30:00 Jan 25 1996 duration 7200
Device(config-keychain-key)# send-lifetime 14:00:00 Jan 25 1996 duration 3600
Device(config-keychain-key)# exit
Device(config-keychain)# key 2
Device(config-keychain)# key-string key2
Device(config-keychain)# accept-lifetime 14:30:00 Jan 25 1996 duration 7200
Device(config-keychain)# send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

The following example configures a key chain named chain1 for EIGRP address-family. The key named key1 will be accepted from 1:30 p.m. to 3:30 p.m. and be sent from 2:00 p.m. to 3:00 p.m. The key named key2 will be accepted from 2:30 p.m. to 4:30 p.m. and be sent from 3:00 p.m. to 4:00 p.m. The overlap allows for migration of keys or a discrepancy in the set time of the router. There is a 30-minute leeway on each side to handle time differences.

```
Device(config)# router eigrp 10
Device(config-router)# address-family ipv4 autonomous-system 4453
Device(config-router-af)# network 10.0.0.0
Device(config-router-af)# af-interface ethernet0/0
Device(config-router-af-interface)# authentication key-chain trees
Device(config-router-af-interface)# authentication mode md5
Device(config-router-af-interface)# exit
Device(config-router-af)# exit
Device(config-router)# exit
Device(config)# key chain chain1
Device(config-keychain)# key 1
Device(config-keychain-key)# key-string key1
Device(config-keychain-key)# accept-lifetime 13:30:00 Jan 25 1996 duration 7200
Device(config-keychain-key)# send-lifetime 14:00:00 Jan 25 1996 duration 3600
Device(config-keychain-key)# exit
Device(config-keychain)# key 2
Device(config-keychain-key)# key-string key2
Device(config-keychain-key)# accept-lifetime 14:30:00 Jan 25 1996 duration 7200
Device(config-keychain-key)# send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>key</b>	Identifies an authentication key on a key chain.
<b>key chain</b>	Defines an authentication key-chain needed to enable authentication for routing protocols.
<b>key-string (authentication)</b>	Specifies the authentication string for a key.
<b>send-lifetime</b>	Sets the time period during which an authentication key on a key chain is valid to be sent.
<b>show key chain</b>	Displays authentication key information.

# aggregate-address

To create an aggregate entry in a Border Gateway Protocol (BGP) database, use the **aggregate-address** command in address family or router configuration mode. To disable this function, use the **no** form of this command.

```
aggregate-address address mask [as-set] [as-confed-set] [summary-only] [suppress-map map-name]
[advertise-map map-name] [attribute-map map-name]
no aggregate-address address mask [as-set] [as-confed-set] [summary-only] [suppress-map
map-name] [advertise-map map-name] [attribute-map map-name]
```

## Syntax Description

<i>address</i>	Aggregate address.
<i>mask</i>	Aggregate mask.
<b>as-set</b>	(Optional) Generates autonomous system set path information.
<b>as-confed-set</b>	(Optional) Generates autonomous confederation set path information.
<b>summary-only</b>	(Optional) Filters all more-specific routes from updates.
<b>suppress-map</b> <i>map-name</i>	(Optional) Specifies the name of the route map used to select the routes to be suppressed.
<b>advertise-map</b> <i>map-name</i>	(Optional) Specifies the name of the route map used to select the routes to create AS_SET origin communities.
<b>attribute-map</b> <i>map-name</i>	(Optional) Specifies the name of the route map used to set the attribute of the aggregate route.

## Command Default

The atomic aggregate attribute is set automatically when an aggregate route is created with this command unless the **as-set** keyword is specified.

## Command Modes

Address family configuration (config-router-af)  
Router configuration (config-router)

## Command History

*Table 109:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

You can implement aggregate routing in BGP and Multiprotocol BGP (mBGP) either by redistributing an aggregate route into BGP or mBGP, or by using the conditional aggregate routing feature.

Using the **aggregate-address** command with no keywords will create an aggregate entry in the BGP or mBGP routing table if any more-specific BGP or mBGP routes are available that fall within the specified range. (A longer prefix that matches the aggregate must exist in the Routing Information Base (RIB).) The aggregate route will be advertised as coming from your autonomous system and will have the atomic aggregate attribute

set to show that information might be missing. (By default, the atomic aggregate attribute is set unless you specify the **as-set** keyword.)

Using the **as-set** keyword creates an aggregate entry using the same rules that the command follows without this keyword, but the path advertised for this route will be an AS\_SET consisting of all elements contained in all paths that are being summarized. Do not use this form of the **aggregate-address** command when aggregating many paths, because this route must be continually withdrawn and updated as autonomous system path reachability information for the summarized routes changes.

Using the **as-confed-set** keyword creates an aggregate entry using the same rules that the command follows without this keyword. This keyword performs the same function as the **as-set** keyword, except that it generates autonomous confed set path information.

Using the **summary-only** keyword not only creates the aggregate route (for example, 192.\*.\*.\*) but also suppresses advertisements of more-specific routes to all neighbors. If you want to suppress only advertisements to certain neighbors, you may use the **neighbor distribute-list** command, with caution. If a more-specific route leaks out, all BGP or mBGP routers will prefer that route over the less-specific aggregate you are generating (using longest-match routing).

Using the **suppress-map** keyword creates the aggregate route but suppresses advertisement of specified routes. You can use the **match** clauses of route maps to selectively suppress some more-specific routes of the aggregate and leave others unsuppressed. IP access lists and autonomous system path access lists match clauses are supported.

Using the **advertise-map** keyword selects specific routes that will be used to build different components of the aggregate route, such as AS\_SET or community. This form of the **aggregate-address** command is useful when the components of an aggregate are in separate autonomous systems and you want to create an aggregate with AS\_SET, and advertise it back to some of the same autonomous systems. You must remember to omit the specific autonomous system numbers from the AS\_SET to prevent the aggregate from being dropped by the BGP loop detection mechanism at the receiving router. IP access lists and autonomous system path access lists **match** clauses are supported.

Using the **attribute-map** keyword allows attributes of the aggregate route to be changed. This form of the **aggregate-address** command is useful when one of the routes forming the AS\_SET is configured with an attribute such as the community no-export attribute, which would prevent the aggregate route from being exported. An attribute map route map can be created to change the aggregate attributes.

### AS-Set Example

In the following example, an aggregate BGP address is created in router configuration mode. The path advertised for this route will be an AS\_SET consisting of all elements contained in all paths that are being summarized.

```
Device(config)#router bgp 50000
Device(config-router)#aggregate-address 10.0.0.0 255.0.0.0 as-set
```

### Summary-Only Example

In the following example, an aggregate BGP address is created in address family configuration mode and applied to the multicast database under the IP Version 4 address family. Because the **summary-only** keyword is configured, more-specific routes are filtered from updates.

```
Device(config)#router bgp 50000
```

```
Device(config-router)#address-family ipv4 multicast
Device(config-router-af)#aggregate-address 10.0.0.0 255.0.0.0 summary-only
```

### Conditional Aggregation Example

In the following example, a route map called MAP-ONE is created to match on an AS-path access list. The path advertised for this route will be an AS\_SET consisting of elements contained in paths that are matched in the route map.

```
Device(config)#ip as-path access-list 1 deny ^1234_
Device(config)#ip as-path access-list 1 permit .*
Device(config)#!
Device(config)#route-map MAP-ONE
Device(config-route-map)#match ip as-path 1
Device(config-route-map)#exit
Device(config)#router bgp 50000
Device(config-router)#address-family ipv4
Device(config-router-af)#aggregate-address 10.0.0.0 255.0.0.0 as-set advertise-map
MAP-ONE
Router(config-router-af)#end
```

### Related Commands

Command	Description
<b>address-family ipv4 (BGP)</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard IPv4 address prefixes.
<b>ip as-path access-list</b>	Defines a BGP autonomous system path access list.
<b>match ip address</b>	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
<b>neighbor distribute-list</b>	Distributes BGP neighbor information in an access list.
<b>route-map (IP)</b>	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.



## area nssa

To configure a not-so-stubby area (NSSA), use the **area nssa** command in router address family topology or router configuration mode. To remove the NSSA distinction from the area, use the **no** form of this command.

```
area nssa command area area-id nssa [no-redistribution] [default-information-originate [metric]
[metric-type]] [no-summary] [nssa-only]
no area area-id nssa [no-redistribution] [default-information-originate [metric] [metric-type]]
[no-summary] [nssa-only]
```

### Syntax Description

<i>area-id</i>	Identifier for the stub area or NSSA. The identifier can be specified as either a decimal value or an IP address.
<b>no-redistribution</b>	(Optional) Used when the router is an NSSA Area Border Router (ABR) and you want the <b>redistribute</b> command to import routes only into the normal areas, but not into the NSSA area.
<b>default-information-originate</b>	(Optional) Used to generate a Type 7 default into the NSSA area. This keyword takes effect only on the NSSA ABR or the NSSA Autonomous System Boundary Router (ASBR).
<b>metric</b>	(Optional) Specifies the OSPF default metric.
<b>metric-type</b>	(Optional) Specifies the OSPF metric type for default routes.
<b>no-summary</b>	(Optional) Allows an area to be an NSSA but not have summary routes injected into it.
<b>nssa-only</b>	(Optional) Limits the default advertisement to this NSSA area by setting the propagate (P) bit in the type-7 LSA to zero.

### Command Default

No NSSA area is defined.

### Command Modes

Router address family topology configuration (config-router-af-topology) Router configuration (config-router)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

To remove the specified area from the software configuration, use the **no area area-id** command (with no other keywords). That is, the **no area area-id** command removes all area options, including **area authentication**, **area default-cost**, **area nssa**, **area range**, **area stub**, and **area virtual-link**.

#### Release 12.2(33)SRB

If you plan to configure the Multi-Topology Routing (MTR) feature, you need to enter the **area nssa** command in router address family topology configuration mode in order for this OSPF router configuration command to become topology-aware.

### Examples

The following example makes area 1 an NSSA area:

```
router ospf 1
 redistribute rip subnets
 network 172.19.92.0 0.0.0.255 area 1
 area 1 nssa
```

**Related Commands**

Command	Description
<b>redistribute</b>	Redistributes routes from one routing domain into another routing domain.

## area virtual-link

To define an Open Shortest Path First (OSPF) virtual link, use the **area virtual-link** command in router address family topology, router configuration, or address family configuration mode. To remove a virtual link, use the **no** form of this command.

```
area area-id virtual-link router-id authentication key-chain chain-name [hello-interval seconds]
[retransmit-interval seconds] [transmit-delay seconds] [dead-interval seconds] [tll-security hops
hop-count]
```

```
no area area-id virtual-link router-id authentication key-chain chain-name
```

### Syntax Description

Table 110:

<i>area-id</i>	Area ID assigned to the virtual link. This can be either a decimal value or a valid IPv6 prefix. There is no default.
<i>router-id</i>	Router ID associated with the virtual link neighbor. The router ID appears in the <b>show ip ospf</b> or <b>show ipv6 display</b> command. There is no default.
<b>authentication</b>	Enables virtual link authentication.
<b>key-chain</b>	Configures a key-chain for cryptographic authentication keys.
<i>chain-name</i>	Name of the authentication key that is valid.
<b>hello-interval</b> <i>seconds</i>	(Optional) Specifies the time (in seconds) between the hello packets that the Cisco IOS software sends on an interface. The hello interval is an unsigned integer value to be advertised in the hello packets. The value must be the same for all routers and access servers attached to a common network. The range is from 1 to 8192. The default is 10.
<b>retransmit-interval</b> <i>seconds</i>	(Optional) Specifies the time (in seconds) between link-state advertisement (LSA) retransmissions for adjacencies belonging to the interface. The retransmit interval is the expected round-trip delay between any two routers on the attached network. The value must be greater than the expected round-trip delay. The range is from 1 to 8192. The default is 5.
<b>transmit-delay</b> <i>seconds</i>	(Optional) Specifies the estimated time (in seconds) required to send a link-state update packet on the interface. The integer value that must be greater than zero. LSAs in the update packet have their age incremented by this amount before transmission. The range is from 1 to 8192. The default value is 1.

<b>dead-interval</b> <i>seconds</i>	(Optional) Specifies the time (in seconds) that hello packets are not seen before a neighbor declares the router down. The dead interval is an unsigned integer value. The default is four times the hello interval, or 40 seconds. As with the hello interval, this value must be the same for all routers and access servers attached to a common network.
<b>ttl-security hops</b> <i>hop-count</i>	(Optional) Configures Time-to-Live (TTL) security on a virtual link. The <i>hop-count</i> argument range is from 1 to 254.

**Command Default** No OSPF virtual link is defined.

**Command Modes** Router address family topology configuration (config-router-af-topology)  
Router configuration (config-router)  
Address family configuration (config-router-af)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** In OSPF, all areas must be connected to a backbone area. A lost connection to the backbone can be repaired by establishing a virtual link.

The shorter the hello interval, the faster topological changes will be detected, but more routing traffic will ensue. The setting of the retransmit interval should be conservative, or needless retransmissions will result. The value should be larger for serial lines and virtual links.

You should choose a transmit delay value that considers the transmission and propagation delays for the interface.

To configure a virtual link in OSPF for IPv6, you must use a router ID instead of an address. In OSPF for IPv6, the virtual link takes the router ID rather than the IPv6 prefix of the remote router.

Use the **ttl-security hops** *hop-count* keywords and argument to enable checking of TTL values on OSPF packets from neighbors or to set TTL values sent to neighbors. This feature adds an extra layer of protection to OSPF.



**Note** In order for a virtual link to be properly configured, each virtual link neighbor must include the transit area ID and the corresponding virtual link neighbor router ID. To display the router ID, use the **show ip ospf** or the **show ipv6 ospf** command in privileged EXEC mode.



**Note** To remove the specified area from the software configuration, use the **no area** *area-id* command (with no other keywords). That is, the **no area** *area-id* command removes all area options, such as **area default-cost**, **area nssa**, **area range**, **area stub**, and **area virtual-link**.

**Release 12.2(33)SRB**

If you plan to configure the Multitopology Routing (MTR) feature, you need to enter the **area virtual-link** command in router address family topology configuration mode in order for this OSPF router configuration command to become topology-aware.

**Examples**

The following example establishes a virtual link with default values for all optional parameters:

```
ipv6 router ospf 1
log-adjacency-changes
area 1 virtual-link 192.168.255.1
```

The following example establishes a virtual link in OSPF for IPv6:

```
ipv6 router ospf 1
log-adjacency-changes
area 1 virtual-link 192.168.255.1 hello-interval 5
```

The following example shows how to configure TTL security for a virtual link in OSPFv3 for IPv6:

```
Device(config)#router ospfv3 1
Device(config-router)#address-family ipv6 unicast vrf vrf1
Device(config-router-af)#area 1 virtual-link 10.1.1.1 ttl-security hops 10
```

The following example shows how to configure the authentication using a key chain for virtual-links:

```
area 1 virtual-link 1.1.1.1 authentication key-chain ospf-chain-1
```

**Related Commands**

Command	Description
<b>area</b>	Configures OSPFv3 area parameters.
<b>show ip ospf</b>	Enables the display of general information about OSPF routing processes.
<b>show ipv6 ospf</b>	Enables the display of general information about OSPF routing processes.
<b>ttl-security hops</b>	Enables checking of TTL values on OSPF packets from neighbors or setting TTL values sent to neighbors.

# auto-summary (BGP)

To configure automatic summarization of subnet routes into network-level routes, use the **auto-summary** command in address family or router configuration mode. To disable automatic summarization and send subprefix routing information across classful network boundaries, use the **no** form of this command.

**auto-summary**  
**no auto-summary**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Automatic summarization is disabled by default (the software sends subprefix routing information across classful network boundaries).

**Command Modes** Address family configuration (config-router-af)  
 Router configuration (config-router)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** BGP automatically summarizes routes to classful network boundaries when this command is enabled. Route summarization is used to reduce the amount of routing information in routing tables. Automatic summarization applies to connected, static, and redistributed routes.



**Note** The MPLS VPN Per VRF Label feature does not support auto-summary.

By default, automatic summarization is disabled and BGP accepts subnets redistributed from an Interior Gateway Protocol (IGP). To block subnets and create summary subprefixes to the classful network boundary when crossing classful network boundaries, use the **auto-summary** command.

To advertise and carry subnet routes in BGP when automatic summarization is enabled, use an explicit **network** command to advertise the subnet. The **auto-summary** command does not apply to routes injected into BGP via the **network** command or through iBGP or eBGP.

### Why auto-summary for BGP Is Disabled By Default

When **auto-summary** is enabled, routes injected into BGP via redistribution are summarized on a classful boundary. Remember that a 32-bit IP address consists of a network address and a host address. The subnet mask determines the number of bits used for the network address and the number of bits used for the host address. The IP address classes have a natural or standard subnet mask, as shown in the table below.

*Table 111: IP Address Classes*

Class	Address Range	Standard Mask
A	1.0.0.0 to 126.0.0.0	255.0.0.0 or /8
B	128.1.0.0 to 191.254.0.0	255.255.0.0 or /16

Class	Address Range	Standard Mask
C	192.0.1.0 to 223.255.254.0	255.255.255.0 or /24

Reserved addresses include 128.0.0.0, 191.255.0.0, 192.0.0.0, and 223.255.255.0.

When using the standard subnet mask, Class A addresses have one octet for the network, Class B addresses have two octets for the network, and Class C addresses have three octets for the network.

Consider the Class B address 156.26.32.1 with a 24-bit subnet mask, for example. The 24-bit subnet mask selects three octets, 156.26.32, for the network. The last octet is the host address. If the network 156.26.32.1/24 is learned via an IGP and is then redistributed into BGP, if **auto-summary** were enabled, the network would be automatically summarized to the natural mask for a Class B network. The network that BGP would advertise is 156.26.0.0/16. BGP would be advertising that it can reach the entire Class B address space from 156.26.0.0 to 156.26.255.255. If the only network that can be reached via the BGP router is 156.26.32.0/24, BGP would be advertising 254 networks that cannot be reached via this router. This is why the **auto-summary (BGP)** command is disabled by default.

## Examples

In the following example, automatic summarization is enabled for IPv4 address family prefixes:

```
Device(config)#router bgp 50000

Device(config-router)#address-family ipv4 unicast

Device(config-router-af)#auto-summary

Device(config-router-af)#network 7.7.7.7 255.255.255.255
```

In the example, there are different subnets, such as 7.7.7.6 and 7.7.7.7 on Loopback interface 6 and Loopback interface 7, respectively. Both **auto-summary** and a **network** command are configured.

```
Device#show ip interface brief
Interface          IP-Address      OK? Method Status        Protocol
Ethernet0/0        100.0.1.7       YES NVRAM    up            up
Ethernet0/1        unassigned      YES NVRAM    administratively down down
Ethernet0/2        unassigned      YES NVRAM    administratively down down
Ethernet0/3        unassigned      YES NVRAM    administratively down down
Ethernet1/0        108.7.9.7       YES NVRAM    up            up
Ethernet1/1        unassigned      YES NVRAM    administratively down down
Ethernet1/2        unassigned      YES NVRAM    administratively down down
Ethernet1/3        unassigned      YES NVRAM    administratively down down
Loopback6          7.7.7.6         YES NVRAM    up            up
Loopback7          7.7.7.7         YES NVRAM    up            up
```

Note that in the output below, because of the **auto-summary** command, the BGP routing table displays the summarized route 7.0.0.0 instead of 7.7.7.6. The 7.7.7.7/32 network is displayed because it was configured with the **network** command, which is not affected by the **auto-summary** command.

```
Device#show ip bgp
BGP table version is 10, local router ID is 7.7.7.7
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, x best-external
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network        Next Hop        Metric LocPrf Weight Path
*> 6.6.6.6/32     100.0.1.6       0           0 6 i
*> 7.0.0.0        0.0.0.0         0           32768 ?   <-- summarization
*> 7.7.7.7/32     0.0.0.0         0           32768 i   <-- network command
```

```

r>i9.9.9.9/32      108.7.9.9      0    100      0 i
*> 100.0.0.0      0.0.0.0        0          32768 ?
r> 100.0.1.0/24   100.0.1.6      0          0 6 ?
*> 108.0.0.0      0.0.0.0        0          32768 ?
r>i108.7.9.0/24   108.7.9.9      0    100      0 ?
*>i200.0.1.0      108.7.9.9

```

**Related Commands**

Command	Description
<b>address-family ipv4 (BGP)</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard IPv4 address prefixes.
<b>address-family vpnv4</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard VPNv4 address prefixes.
<b>network (BGP and multiprotocol BGP)</b>	Specifies the networks to be advertised by BGP and multiprotocol BGP.



# bgp graceful-restart

To enable the Border Gateway Protocol (BGP) graceful restart capability globally for all BGP neighbors, use the **bgp graceful-restart** command in address family or in router configuration mode. To disable the BGP graceful restart capability globally for all BGP neighbors, use the **no** form of this command.

**bgp graceful-restart** [**extended** | **restart-time** *seconds* | **stalepath-time** *seconds*] [**all**]  
**no bgp graceful-restart**

Syntax Description		
	<b>extended</b>	(Optional) Enables BGP graceful restart extension.
	<b>restart-time</b> <i>seconds</i>	(Optional) Sets the maximum time period that the local router will wait for a graceful-restart-capable neighbor to return to normal operation after a restart event occurs. The default value for this argument is 120 seconds. The configurable range of values is from 1 to 3600 seconds.
	<b>stalepath-time</b> <i>seconds</i>	(Optional) Sets the maximum time period that the local router will hold stale paths for a restarting peer. All stale paths are deleted after this timer expires. The default value for this argument is 360 seconds. The configurable range of values is from 1 to 3600 seconds.
	<b>all</b>	(Optional) Enables BGP graceful restart capability for all address family modes.

**Command Default** The following default values are used when this command is entered without any keywords or arguments:  
**restart-time** : 120 seconds **stalepath-time**: 360 seconds



**Note** Changing the restart and stalepath timer values is not required to enable the BGP graceful restart capability. The default values are optimal for most network deployments, and these values should be adjusted only by an experienced network operator.

**Command Modes** Address-family configuration (config-router-af)  
 Router configuration (config-router)

**Command History** *Table 112:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **bgp graceful-restart** command is used to enable or disable the graceful restart capability globally for all BGP neighbors in a BGP network. The graceful restart capability is negotiated between nonstop forwarding (NSF)-capable and NSF-aware peers in OPEN messages during session establishment. If the graceful restart

capability is enabled after a BGP session has been established, the session will need to be restarted with a hard reset.

The graceful restart capability is supported by NSF-capable and NSF-aware routers. A router that is NSF-capable can perform a stateful switchover (SSO) operation (graceful restart) and can assist restarting peers by holding routing table information during the SSO operation. A router that is NSF-aware functions like a router that is NSF-capable but cannot perform an SSO operation.

The BGP graceful restart capability is enabled by default when a supporting version of Cisco IOS software is installed. The default timer values for this feature are optimal for most network deployments. We recommend that they are adjusted only by experienced network operators. When adjusting the timer values, the restart timer should not be set to a value greater than the hold time that is carried in the OPEN message. If consecutive restart operations occur, routes (from a restarting router) that were previously marked as stale will be deleted.



**Note** Changing the restart and stalepath timer values is not required to enable the BGP graceful restart capability. The default values are optimal for most network deployments, and these values should be adjusted only by an experienced network operator.

## Examples

In the following example, the BGP graceful restart capability is enabled:

```
Device#configure terminal
Device(config)#router bgp 65000
Device(config-router)#bgp graceful-restart
```

In the following example, the restart timer is set to 130 seconds:

```
Device#configure terminal
Device(config)#router bgp 65000
Device(config-router)#bgp graceful-restart restart-time 130
```

In the following example, the stalepath timer is set to 350 seconds:

```
Device#configure terminal
Device(config)#router bgp 65000
Device(config-router)#bgp graceful-restart stalepath-time 350
```

In the following example, the **extended** keyword is used:

```
Device#configure terminal
Device(config)#router bgp 65000
Device(config-router)#bgp graceful-restart extended
```

## Related Commands

Table 113:

Command	Description
<b>show ip bgp</b>	Displays entries in the BGP routing table.
<b>show ip bgp neighbors</b>	Displays information about the TCP and BGP connections to neighbors.

# clear proximity ip bgp

To reset Border Gateway Protocol (BGP) connections using hard or soft reconfiguration, use the **clear proximity ip bgp** command in privileged EXEC mode.

**clear proximity ip bgp** \* | **all** *autonomous-system-number* *neighbor-address* | **peer-group** *group-name* [**in** [**prefix-filter**] | **out** | **slow** | **soft** [**in** [**prefix-filter**] | **out** | **slow**]]

Syntax	Description
<b>*</b>	Specifies that all current BGP sessions will be reset.
<b>all</b>	(Optional) Specifies the reset of all address family sessions.
<i>autonomous-system-number</i>	Number of the autonomous system in which all BGP peer sessions will be reset. Number in the range from 1 to 65535. <ul style="list-style-type: none"> <li>In Cisco IOS Release 12.0(32)SY8, 12.0(33)S3, 12.2(33)SRE, 12.2(33)XNE, 12.2(33)SX11, Cisco IOS XE Release 2.4, and later releases, 4-byte autonomous system numbers are supported in the range from 65536 to 4294967295 in asplain notation and in the range from 1.0 to 65535.65535 in asdot notation.</li> <li>In Cisco IOS Release 12.0(32)S12, 12.4(24)T, and Cisco IOS XE Release 2.3, 4-byte autonomous system numbers are supported in the range from 1.0 to 65535.65535 in asdot notation only.</li> </ul> For more details about autonomous system number formats, see the <b>router bgp</b> command.
<i>neighbor-address</i>	Specifies that only the identified BGP neighbor will be reset. The value for this argument can be an IPv4 or IPv6 address.
<b>peer-group</b> <i>group-name</i>	Specifies that only the identified BGP peer group will be reset.
<b>in</b>	(Optional) Initiates inbound reconfiguration. If neither the <b>in</b> nor <b>out</b> keywords are specified, both inbound and outbound sessions are reset.
<b>prefix-filter</b>	(Optional) Clears the existing outbound route filter (ORF) prefix list to trigger a new route refresh or soft reconfiguration, which updates the ORF prefix list.
<b>out</b>	(Optional) Initiates inbound or outbound reconfiguration. If neither the <b>in</b> nor <b>out</b> keywords are specified, both inbound and outbound sessions are reset.
<b>slow</b>	(Optional) Clears slow-peer status forcefully and moves it to original update group.
<b>soft</b>	(Optional) Initiates a soft reset. Does not tear down the session.

## Command Modes

Privileged EXEC (#)

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

The **clear proximity ip bgp** command can be used to initiate a hard reset or soft reconfiguration. A hard reset tears down and rebuilds the specified peering sessions and rebuilds the BGP routing tables. A soft reconfiguration uses stored prefix information to reconfigure and activate BGP routing tables without tearing down existing peering sessions. Soft reconfiguration uses stored update information, at the cost of additional memory for storing the updates, to allow you to apply new BGP policy without disrupting the network. Soft reconfiguration can be configured for inbound or outbound sessions.

**Note**

Due to the complexity of some of the keywords available for the **clear proximity ip bgp** command, some of the keywords are documented as separate commands. All of the complex keywords that are documented separately start with **clear ip bgp**. For example, for information on resetting BGP connections using hard or soft reconfiguration for all BGP neighbors in IPv4 address family sessions, refer to the **clear ip bgp ipv4** command.

**Generating Updates from Stored Information**

To generate new inbound updates from stored update information (rather than dynamically) without resetting the BGP session, you must preconfigure the local BGP router using the **neighbor soft-reconfiguration inbound** command. This preconfiguration causes the software to store all received updates without modification regardless of whether an update is accepted by the inbound policy. Storing updates is memory intensive and should be avoided if possible.

Outbound BGP soft configuration has no memory overhead and does not require any preconfiguration. You can trigger an outbound reconfiguration on the other side of the BGP session to make the new inbound policy take effect.

Use this command whenever any of the following changes occur:

- Additions or changes to the BGP-related access lists
- Changes to BGP-related weights
- Changes to BGP-related distribution lists
- Changes to BGP-related route maps

**Dynamic Inbound Soft Reset**

The route refresh capability, as defined in RFC 2918, allows the local router to reset inbound routing tables dynamically by exchanging route refresh requests to supporting peers. The route refresh capability does not store update information locally for non-disruptive policy changes. It instead relies on dynamic exchange with supporting peers. Route refresh is advertised through BGP capability negotiation. All BGP routers must support the route refresh capability.

To determine if a BGP router supports this capability, use the **show ip bgp neighbors** command. The following message is displayed in the output when the router supports the route refresh capability:

```
Received route refresh capability from peer.
```

If all BGP routers support the route refresh capability, use the **clear proximityip bgp** command with the **in** keyword. You need not use the **soft** keyword, because soft reset is automatically assumed when the route refresh capability is supported.



**Note** After configuring a soft reset (inbound or outbound), it is normal for the BGP routing process to hold memory. The amount of memory that is held depends on the size of routing tables and the percentage of the memory chunks that are utilized. Partially used memory chunks will be used or released before more memory is allocated from the global router pool.

## Examples

In the following example, a soft reconfiguration is initiated for the inbound session with the neighbor 10.100.0.1, and the outbound session is unaffected:

```
Device#clear proximity ip bgp 10.100.0.1 soft in
```

In the following example, the route refresh capability is enabled on the BGP neighbor routers and a soft reconfiguration is initiated for the inbound session with the neighbor 172.16.10.2, and the outbound session is unaffected:

```
Device#clear proximity ip bgp 172.16.10.2 in
```

In the following example, a hard reset is initiated for sessions with all routers in the autonomous system numbered 35700:

```
Device#clear proximity ip bgp 35700
```

In the following example, a hard reset is initiated for sessions with all routers in the 4-byte autonomous system numbered 65538 in asplain notation. This example requires Cisco IOS Release 12.0(32)SY8, 12.0(33)S3, 12.2(33)SRE, 12.2(33)XNE, 12.2(33)SX11, Cisco IOS XE Release 2.4, or a later release.

```
Device#clear proximity ip bgp 65538
```

In the following example, a hard reset is initiated for sessions with all routers in the 4-byte autonomous system numbered 1.2 in asdot notation. This example requires Cisco IOS Release 12.0(32)SY8, 12.0(32)S12, 12.2(33)SRE, 12.2(33)XNE, 12.2(33)SX11, 12.4(24)T, and Cisco IOS XE Release 2.3, or a later release.

```
Device#clear proximity ip bgp 1.2
```

## Related Commands

Command	Description
<b>bgp slow-peer split-update-group dynamic permanent</b>	Moves a dynamically detected slow peer to a slow update group.
<b>clear ip bgp ipv4</b>	Resets BGP connections using hard or soft reconfiguration for IPv4 address family sessions.
<b>clear ip bgp ipv6</b>	Resets BGP connections using hard or soft reconfiguration for IPv6 address family sessions.

Command	Description
<b>clear ip bgp vpnv4</b>	Resets BGP connections using hard or soft reconfiguration for VPNv4 address family sessions.
<b>clear ip bgp vpnv6</b>	Resets BGP connections using hard or soft reconfiguration for VPNv6 address family sessions.
<b>neighbor slow-peer split-update-group dynamic permanent</b>	Moves a dynamically detected slow peer to a slow update group.
<b>neighbor soft-reconfiguration</b>	Configures the Cisco IOS software to start storing updates.
<b>router bgp</b>	Configures the BGP routing process.
<b>show ip bgp</b>	Displays entries in the BGP routing table.
<b>show ip bgp neighbors</b>	Displays information about BGP and TCP connections to neighbors.
<b>slow-peer split-update-group dynamic permanent</b>	Moves a dynamically detected slow peer to a slow update group.

## default-information originate (OSPF)

To generate a default external route into an Open Shortest Path First (OSPF) routing domain, use the **default-information originate** command in router configuration or router address family topology configuration mode. To disable this feature, use the **no** form of this command.

**default-information originate** [**always**] [**metric** *metric-value*] [**metric-type** *type-value*] [**route-map** *map-name*]

**no default-information originate** [**always**] [**metric** *metric-value*] [**metric-type** *type-value*] [**route-map** *map-name*]

Syntax Description		
<b>always</b>	(Optional) Always advertises the default route regardless of whether the software has a default route.	<b>Note</b> The <b>always</b> keyword includes the following exception when the route map is used. When a route map is used, the origination of the default route by OSPF is not bound to the existence of a default route in the routing table and the <b>always</b> keyword is ignored.
<b>metric</b> <i>metric-value</i>	(Optional) Metric used for generating the default route. If you omit a value and do not specify a value using the <b>default-metric</b> router configuration command, the default metric value is 10. The value used is specific to the protocol.	
<b>metric-type</b> <i>type-value</i>	(Optional) External link type associated with the default route that is advertised into the OSPF routing domain. It can be one of the following values: <ul style="list-style-type: none"> <li>Type 1 external route.</li> <li>Type 2 external route.</li> </ul> The default is type 2 external route.	
<b>route-map</b> <i>map-name</i>	(Optional) The routing process will generate the default route if the route map is satisfied.	

**Command Default** This command is disabled by default. No default external route is generated into the OSPF routing domain.

**Command Modes** Router configuration (config-router) Router address family topology configuration (config-router-af-topology)

Command History	
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Whenever you use the **redistribute** or the **default-information** router configuration command to redistribute routes into an OSPF routing domain, the Cisco IOS software automatically becomes an Autonomous System Boundary Router (ASBR). However, an ASBR does not, by default, generate a default route into the OSPF routing domain. The software must still have a default route for itself before it generates one, except when you have specified the **always** keyword.

When a route map is used, the origination of the default route by OSPF is not bound to the existence of a default route in the routing table.

**Release 12.2(33)SRB**

If you plan to configure the Multi-Topology Routing (MTR) feature, you need to enter the **default-information originate** command in router address family topology configuration mode in order for this OSPF router configuration command to become topology-aware.

**Examples**

The following example specifies a metric of 100 for the default route that is redistributed into the OSPF routing domain and specifies an external metric type of 1:

```
router ospf 109
 redistribute eigrp 108 metric 100 subnets
 default-information originate metric 100 metric-type 1
```

**Related Commands**

Command	Description
<b>default-information</b>	Accepts exterior or default information into Enhanced Interior Gateway Routing Protocol (EIGRP) processes.
<b>default-metric</b>	Sets default metric values for routes.
<b>redistribute (IP)</b>	Redistributes routes from one routing domain into another routing domain.



## default-metric (BGP)

To set a default metric for routes redistributed into Border Gateway Protocol (BGP), use the **default-metric** command in address family or router configuration mode. To remove the configured value and return BGP to default operation, use the **no** form of this command.

**default-metric** *number*  
**no default-metric** *number*

### Syntax Description

<i>number</i>	Default metric value applied to the redistributed route. The range of values for this argument is from 1 to 4294967295.
---------------	---

### Command Default

The following is default behavior if this command is not configured or if the **no** form of this command is entered:

- The metric of redistributed interior gateway protocol (IGP) routes is set to a value that is equal to the interior BGP (iBGP) metric.
- The metric of redistributed connected and static routes is set to 0.

When this command is enabled, the metric for redistributed connected routes is set to 0.

### Command Modes

Address family configuration (config-router-af)

Router configuration (config-router)

### Command History

*Table 114:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **default-metric** command is used to set the metric value for routes redistributed into BGP and can be applied to any external BGP (eBGP) routes received and subsequently advertised internally to iBGP peers.

This value is the Multi Exit Discriminator (MED) that is evaluated by BGP during the best path selection process. The MED is a non-transitive value that is processed only within the local autonomous system and adjacent autonomous systems. The default metric is not set if the received route has a MED value.



**Note** When enabled, the **default-metric** command applies a metric value of 0 to redistributed connected routes. The **default-metric** command does not override metric values that are applied with the **redistribute** command.

### Examples

In the following example, a metric of 1024 is set for routes redistributed into BGP from OSPF:

```
Device(config)#router bgp 50000
Device(config-router)#address-family ipv4 unicast

Device(config-router-af)#default-metric 1024
```

```
Device(config-router-af)#redistribute ospf 10
Device(config-router-af)#end
```

In the following configuration and output examples, a metric of 300 is set for eBGP routes received and advertised internally to an iBGP peer.

```
Device(config)#router bgp 65501
Device(config-router)#no synchronization
Device(config-router)#bgp log-neighbor-changes
Device(config-router)#network 172.16.1.0 mask 255.255.255.0
Device(config-router)#neighbor 172.16.1.1 remote-as 65501
Device(config-router)#neighbor 172.16.1.1 soft-reconfiguration inbound
Device(config-router)#neighbor 192.168.2.2 remote-as 65502
Device(config-router)#neighbor 192.168.2.2 soft-reconfiguration inbound
Device(config-router)#default-metric 300
Device(config-router)#no auto-summary
```

After the above configuration, some routes are received from the eBGP peer at 192.168.2.2 as shown in the output from the **show ip bgp neighbors received-routes** command.

```
Device#show ip bgp neighbors 192.168.2.2 received-routes

BGP table version is 7, local router ID is 192.168.2.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete
               Network      Next Hop          Metric LocPrf Weight Path
*> 172.17.1.0/24    192.168.2.2          0       0       0 65502 i
```

After the received routes from the eBGP peer at 192.168.2.2 are advertised internally to iBGP peers, the output from the **show ip bgp neighbors received-routes** command shows that the metric (MED) has been set to 300 for these routes.

```
Device#show ip bgp neighbors 172.16.1.2 received-routes

BGP table version is 2, local router ID is 172.16.1.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete
               Network      Next Hop          Metric LocPrf Weight Path
* i172.16.1.0/24    172.16.1.2          0       100     0 i
* i172.17.1.0/24    192.168.2.2          300     100     0 65502 i
Total number of prefixes 2
```

#### Related Commands

Command	Description
<b>redistribute (IP)</b>	Redistributes routes from one routing domain into another routing domain.

## distance (OSPF)

To define an administrative distance, use the **distance** command in router configuration mode or VRF configuration mode. To remove the **distance** command and restore the system to its default condition, use the **no** form of this command.

```
distance weight
[ip-address wildcard-mask [access-list name]]
no distance weight ip-address wildcard-mask [access-list-name]
```

### Syntax Description

<i>weight</i>	Administrative distance. Range is 10 to 255. Used alone, the <i>weight</i> argument specifies a default administrative distance that the software uses when no other specification exists for a routing information source. Routes with a distance of 255 are not installed in the routing table. The table in the “Usage Guidelines” section lists the default administrative distances.
<i>ip-address</i>	(Optional) IP address in four-part dotted-decimal notation.
<i>wildcard-mask</i>	(Optional) Wildcard mask in four-part, dotted-decimal format. A bit set to 1 in the <i>wildcard-mask</i> argument instructs the software to ignore the corresponding bit in the address value.
<i>access-list-name</i>	(Optional) Name of an IP access list to be applied to incoming routing updates.

### Command Default

If this command is not specified, the administrative distance is the default. The table in the “Usage Guidelines” section lists the default administrative distances.

### Command Modes

Router configuration (config-router)  
VRF configuration (config-vrf)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

To use this command, you must be in a user group associated with a task group that includes the appropriate task IDs. If the user group assignment is preventing you from using a command contact your AAA administrator for assistance.

An administrative distance is an integer from 10 to 255. In general, the higher the value, the lower the trust rating. An administrative distance of 255 means that the routing information source cannot be trusted at all and should be ignored. Weight values are subjective; no quantitative method exists for choosing weight values.

If an access list is used with this command, it is applied when a network is being inserted into the routing table. This behavior allows you to filter networks based on the IP prefix supplying the routing information. For example, you could filter possibly incorrect routing information from networking devices not under your administrative control.

The order in which you enter **distance** commands can affect the assigned administrative distances, as shown in the “Examples” section. The following table lists default administrative distances.

Table 115: Default Administrative Distances

Rate Source	Default Distance
Connected interface	0
Static route out on interface	0
Static route to next hop	1
EIGRP summary route	5
External BGP	20
Internal EIGRP	90
OSPF	110
IS-IS	115
RIP version 1 and 2	120
External EIGRP	170
Internal BGP	200
Unknown	255

**Task ID**

Task ID	Operations
ospf	read, write

**Examples**

In the following example, the **router ospf** command sets up Open Shortest Path First (OSPF) routing instance 1. The first **distance** command sets the default administrative distance to 255, which instructs the software to ignore all routing updates from networking devices for which an explicit distance has not been set. The second **distance** command sets the administrative distance for all devices on the network 192.168.40.0 to 90.

```
Device#configure terminal
Device(config)#router ospf 1
Device(config-ospf)#distance 255
Device(config-ospf)#distance 90 192.168.40.0 0.0.0.255
```

**Related Commands**

Command	Description
<b>distance bgp</b>	Allows the use of external, internal, and local administrative distances that could be a better route to a BGP node.
<b>distance ospf</b>	Allows the use of external, internal, and local administrative distances that could be a better route to an OSPF node.

Command	Description
<b>router ospf</b>	Configures the OSPF routing process.

# eigrp log-neighbor-changes

To enable the logging of changes in Enhanced Interior Gateway Routing Protocol (EIGRP) neighbor adjacencies, use the **eigrp log-neighbor-changes** command in router configuration mode, address-family configuration mode, or service-family configuration mode. To disable the logging of changes in EIGRP neighbor adjacencies, use the **no** form of this command.

**eigrp log-neighbor-changes**  
**no eigrp log-neighbor-changes**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Adjacency changes are logged.

**Command Modes** Router configuration (config-router) Address-family configuration (config-router-af) Service-family configuration (config-router-sf)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command enables the logging of neighbor adjacency changes to monitor the stability of the routing system and to help detect problems. Logging is enabled by default. To disable the logging of neighbor adjacency changes, use the **no** form of this command.

To enable the logging of changes for EIGRP address-family neighbor adjacencies, use the **eigrp log-neighbor-changes** command in address-family configuration mode.

To enable the logging of changes for EIGRP service-family neighbor adjacencies, use the **eigrp log-neighbor-changes** command in service-family configuration mode.

## Examples

The following configuration disables logging of neighbor changes for EIGRP process 209:

```
Device(config)# router eigrp 209
Device(config-router)# no eigrp log-neighbor-changes
```

The following configuration enables logging of neighbor changes for EIGRP process 209:

```
Device(config)# router eigrp 209
Device(config-router)# eigrp log-neighbor-changes
```

The following example shows how to disable logging of neighbor changes for EIGRP address-family with autonomous-system 4453:

```
Device(config)# router eigrp virtual-name
Device(config-router)# address-family ipv4 autonomous-system 4453
Device(config-router-af)# no eigrp log-neighbor-changes
Device(config-router-af)# exit-address-family
```

The following configuration enables logging of neighbor changes for EIGRP service-family process 209:

```
Device(config)# router eigrp 209
Device(config-router)# service-family ipv4 autonomous-system 4453
Device(config-router-sf)# eigrp log-neighbor-changes
Device(config-router-sf)# exit-service-family
```

**Related Commands**

Command	Description
<b>address-family (EIGRP)</b>	Enters address-family configuration mode to configure an EIGRP routing instance.
<b>exit-address-family</b>	Exits address-family configuration mode.
<b>exit-service-family</b>	Exits service-family configuration mode.
<b>router eigrp</b>	Configures the EIGRP routing process.
<b>service-family</b>	Specifies service-family configuration mode.

## ip authentication key-chain eigrp

To enable authentication of Enhanced Interior Gateway Routing Protocol (EIGRP) packets, use the **ip authentication key-chain eigrp** command in interface configuration mode. To disable such authentication, use the **no** form of this command.

**ip authentication key-chain eigrp** *as-number* *key-chain*

**no ip authentication key-chain eigrp** *as-number* *key-chain*

### Syntax Description

<i>as-number</i>	Autonomous system number to which the authentication applies.
<i>key-chain</i>	Name of the authentication key chain.

### Command Default

No authentication is provided for EIGRP packets.

### Command Modes

Interface configuration (config-if) Virtual network interface (config-if-vnet)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Examples

The following example applies authentication to autonomous system 2 and identifies a key chain named SPORTS:

```
Device (config-if) #ip authentication key-chain eigrp 2 SPORTS
```

### Related Commands

Command	Description
<b>accept-lifetime</b>	Sets the time period during which the authentication key on a key chain is received as valid.
<b>ip authentication mode eigrp</b>	Specifies the type of authentication used in EIGRP packets.
<b>key</b>	Identifies an authentication key on a key chain.
<b>key chain</b>	Enables authentication of routing protocols.
<b>key-string (authentication)</b>	Specifies the authentication string for a key.
<b>send-lifetime</b>	Sets the time period during which an authentication key on a key chain is valid to be sent.



## ip authentication mode eigrp

To specify the type of authentication used in Enhanced Interior Gateway Routing Protocol (EIGRP) packets, use the **ip authentication mode eigrp** command in interface configuration mode. To disable that type of authentication, use the **no** form of this command.

```
ip authentication mode eigrp as-number md5
no ip authentication mode eigrp as-number md5
```

Syntax Description	
<i>as-number</i>	Autonomous system number.
<b>md5</b>	Keyed Message Digest 5 ( MD5) authentication.

**Command Default** No authentication is provided for EIGRP packets.

**Command Modes** Interface configuration (config-if) Virtual network interface (config-if-vnet)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Configure authentication to prevent unapproved sources from introducing unauthorized or false routing messages. When authentication is configured, an MD5 keyed digest is added to each EIGRP packet in the specified autonomous system.

**Examples** The following example configures the interface to use MD5 authentication in EIGRP packets in autonomous system 10:

```
Device(config-if) #ip authentication mode eigrp 10 md5
```

Related Commands	Command	Description
	<b>accept-lifetime</b>	Sets the time period during which the authentication key on a key chain is received as valid.
	<b>ip authentication key-chain eigrp</b>	Enables authentication of EIGRP packets.
	<b>key</b>	Identifies an authentication key on a key chain.
	<b>key chain</b>	Enables authentication of routing protocols.
	<b>key-string (authentication)</b>	Specifies the authentication string for a key.
	<b>send-lifetime</b>	Sets the time period during which an authentication key on a key chain is valid to be sent.

## ip bandwidth-percent eigrp

To configure the percentage of bandwidth that may be used by Enhanced Interior Gateway Routing Protocol (EIGRP) on an interface, use the **ip bandwidth-percent eigrp** command in interface configuration mode. To restore the default value, use the **no** form of this command.

**ip bandwidth-percent eigrp** *as-number percent*  
**no ip bandwidth-percent eigrp** *as-number percent*

### Syntax Description

<i>as-number</i>	Autonomous system number.
<i>percent</i>	Percent of bandwidth that EIGRP may use.

### Command Default

EIGRP may use 50 percent of available bandwidth.

### Command Modes

Interface configuration (config-if) Virtual network interface (config-if-vnet)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

EIGRP will use up to 50 percent of the bandwidth of a link, as defined by the **bandwidth** interface configuration command. This command may be used if some other fraction of the bandwidth is desired. Note that values greater than 100 percent may be configured. The configuration option may be useful if the bandwidth is set artificially low for other reasons.

### Examples

The following example allows EIGRP to use up to 75 percent (42 kbps) of a 56-kbps serial link in autonomous system 209:

```
Device(config)#interface serial 0
Device(config-if)#bandwidth 56
Device(config-if)#ip bandwidth-percent eigrp 209 75
```

### Related Commands

Command	Description
<b>bandwidth (interface)</b>	Sets a bandwidth value for an interface.

## ip community-list

To configure a BGP community list and to control which routes are permitted or denied based on their community values, use the **ip community-list** command in global configuration mode. To delete the community list, use the **no** form of this command.

### Standard Community Lists

```
ip community-list standard | standard list-name deny | permit [community-number] [AA:NN] [internet]
[local-as] [no-advertise] [no-export] [gshut]
no ip community-list standard | standard list-name
```

### Expanded Community Lists

```
ip community-list expanded | expanded list-name deny | permit regex
no ip community-list expanded | expanded list-name
```

### Syntax Description

<i>standard</i>	Standard community list number from 1 to 99 to identify one or more permit or deny groups of communities.
<b>standard</b> <i>list-name</i>	Configures a named standard community list.
<b>deny</b>	Denies routes that match the specified community or communities.
<b>permit</b>	Permits routes that match the specified community or communities.
<i>community-number</i>	(Optional) 32-bit number from 1 to 4294967200. A single community can be entered or multiple communities can be entered, each separated by a space.

AA :NN	(Optional) Autonomous system number and network number entered in the 4-byte new community format. This value is configured with two 2-byte numbers separated by a colon. A number from 1 to 65535 can be entered for each 2-byte number. A single community can be entered or multiple communities can be entered, each separated by a space.
<b>internet</b>	(Optional) Specifies the Internet community. Routes with this community are advertised to all peers (internal and external).
<b>local-as</b>	(Optional) Specifies the local-as community. Routes with community are advertised to only peers that are part of the local autonomous system or to only peers within a subautonomous system of a confederation. These routes are not advertised to external peers or to other subautonomous systems within a confederation.
<b>no-advertise</b>	(Optional) Specifies the no-advertise community. Routes with this community are not advertised to any peer (internal or external).
<b>no-export</b>	(Optional) Specifies the no-export community. Routes with this community are advertised to only peers in the same autonomous system or to only other subautonomous systems within a confederation. These routes are not advertised to external peers.

<b>gshut</b>	(Optional) Specifies the Graceful Shutdown (GSHUT) community.
<i>expanded</i>	Expanded community list number from 100 to 500 to identify one or more permit or deny groups of communities.
<b>expanded</b> <i>list-name</i>	Configures a named expanded community list.
<i>regexp</i>	Regular expression that is used to specify a pattern to match against an input string.  <b>Note</b> Regular expressions can be used only with expanded community lists.

**Command Default** BGP community exchange is not enabled by default.

**Command Modes** Global configuration (config)

**Command History** *Table 116:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **ip community-list** command is used to filter BGP routes based on one or more community values. BGP community values are configured as a 32-bit number (old format) or as a 4-byte number (new format). The new community format is enabled when the **ip bgp-community new-format** command is entered in global configuration mode. The new community format consists of a 4-byte value. The first two bytes represent the autonomous system number, and the trailing two bytes represent a user-defined network number. Named and numbered community lists are supported.

BGP community exchange is not enabled by default. The exchange of BGP community attributes between BGP peers is enabled on a per-neighbor basis with the **neighbor send-community** command. The BGP community attribute is defined in RFC 1997 and RFC 1998.

The Internet community is applied to all routes or prefixes by default, until any other community value is configured with this command or the **set community** command.

Use a route map to reference a community list and thereby apply policy routing or set values.

### Community List Processing

Once a **permit** value has been configured to match a given set of communities, the community list defaults to an implicit deny for all other community values. Unlike an access list, it is feasible for a community list to contain only **deny** statements.

- When multiple communities are configured in the same **ip community-list** statement, a logical AND condition is created. All community values for a route must match the communities in the community list statement to satisfy an AND condition.
- When multiple communities are configured in separate **ip community-list** statements, a logical OR condition is created. The first list that matches a condition is processed.

### Standard Community Lists

Standard community lists are used to configure well-known communities and specific community numbers. A maximum of 16 communities can be configured in a standard community list. If you attempt to configure more than 16 communities, the trailing communities that exceed the limit are not processed or saved to the running configuration file.

### Expanded Community Lists

Expanded community lists are used to filter communities using a regular expression. Regular expressions are used to configure patterns to match community attributes. The order for matching using the \* or + character is longest construct first. Nested constructs are matched from the outside in. Concatenated constructs are matched beginning at the left side. If a regular expression can match two different parts of an input string, it will match the earliest part first. For more information about configuring regular expressions, see the “Regular Expressions” appendix of the *Terminal Services Configuration Guide*.

## Examples

In the following example, a standard community list is configured that permits routes from network 10 in autonomous system 50000:

```
Device(config)#ip community-list 1 permit 50000:10
```

In the following example, a standard community list is configured that permits only routes from peers in the same autonomous system or from subautonomous system peers in the same confederation:

```
Device(config)#ip community-list 1 permit no-export
```

In the following example, a standard community list is configured to deny routes that carry communities from network 40 in autonomous system 65534 and from network 60 in autonomous system 65412. This example shows a logical AND condition; all community values must match in order for the list to be processed.

```
Device(config)#ip community-list 2 deny 65534:40 65412:60
```

In the following example, a named, standard community list is configured that permits all routes within the local autonomous system or permits routes from network 20 in autonomous system 40000. This example shows a logical OR condition; the first match is processed.

```
Device(config)#ip community-list standard RED permit local-as
Device(config)#ip community-list standard RED permit 40000:20
```

In the following example, a standard community list is configured that denies routes with the GSHUT community and permits routes with the local-AS community. This example shows a logical OR condition; the first match is processed.

```
Device(config)#ip community-list 18 deny gshut
Device(config)#ip community-list 18 permit local-as
```

In the following example, an expanded community list is configured that denies routes that carry communities from any private autonomous system:

```
Device(config)#ip community-list 500 deny _64[6-9][0-9][0-9]_|_65[0-9][0-9][0-9]_
```

In the following example, a named expanded community list is configured that denies routes from network 1 to 99 in autonomous system 50000:

```
Device(config)#ip community-list expanded BLUE deny 50000:[0-9][0-9]_
```

### Related Commands

Command	Description
<b>match community</b>	Defines a BGP community that must match the community of a route.
<b>neighbor send-community</b>	Allows BGP community exchange with a neighbor.
<b>neighbor shutdown graceful</b>	Configures the BGP Graceful Shutdown feature.
<b>route-map (IP)</b>	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
<b>set community</b>	Sets the BGP communities attribute.
<b>set comm-list delete</b>	Removes communities from the community attribute of an inbound or outbound update.
<b>show ip bgp community</b>	Displays routes that belong to specified BGP communities.
<b>show ip bgp regexp</b>	Displays routes that match a locally configured regular expression.

## ip cef load-sharing algorithm

To select a Cisco Express Forwarding load-balancing algorithm, use the **ip cef load-sharing algorithm** command in global configuration mode. To return to the default universal load-balancing algorithm, use the **no** form of this command.

**ip cef load-sharing algorithm original** | [**universal** [*id*]]  
**no ip cef load-sharing algorithm**

### Syntax Description

<b>original</b>	Sets the load-balancing algorithm to the original algorithm based on a source and destination hash.
<b>universal</b>	Sets the load-balancing algorithm to the universal algorithm that uses a source and destination and an ID hash.
<i>id</i>	(Optional) Fixed identifier.

### Command Default

The universal load-balancing algorithm is selected by default. If you do not configure the fixed identifier for a load-balancing algorithm, the router automatically generates a unique ID.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The original Cisco Express Forwarding load-balancing algorithm produced distortions in load sharing across multiple devices because of the use of the same algorithm on every device. When the load-balancing algorithm is set to universal mode, each device on the network can make a different load sharing decision for each source-destination address pair, and that resolves load-balancing distortions.

### Examples

The following example shows how to enable the Cisco Express Forwarding original load-balancing algorithm:

```
Device> enable
Device# configure terminal
Device(config)# ip cef load-sharing algorithm original
Device(config)# exit
```

### Related Commands

Command	Description
<b>ip load-sharing</b>	Enables load balancing for Cisco Express Forwarding.



## ip prefix-list

To create a prefix list or to add a prefix-list entry, use the **ip prefix-list** command in global configuration mode. To delete a prefix-list entry, use the **no** form of this command.

```
ip prefix-list list-name [seq number] deny | permit network/length [ge ge-length] [le le-length] |
description description | sequence-number
no ip prefix-list list-name [seq number] [deny | permit network/length [ge ge-length] [le le-length]]
| description description | sequence-number
```

### Syntax Description

<i>list-name</i>	Configures a name to identify the prefix list. Do not use the word “detail” or “summary” as a list name because they are keywords in the <b>show ip prefix-list</b> command.
<b>seq</b>	(Optional) Applies a sequence number to a prefix-list entry.
<i>number</i>	(Optional) Integer from 1 to 4294967294. If a sequence number is not entered when configuring this command, default sequence numbering is applied to the prefix list. The number 5 is applied to the first prefix entry, and subsequent unnumbered entries are incremented by 5.
<b>deny</b>	Denies access for a matching condition.
<b>permit</b>	Permits access for a matching condition.
<i>network / length</i>	Configures the network address and the length of the network mask in bits. The network number can be any valid IP address or prefix. The bit mask can be a number from 1 to 32.
<b>ge</b>	(Optional) Specifies the lesser value of a range (the “from” portion of the range description) by applying the <i>ge-length</i> argument to the range specified. <b>Note</b> The <b>ge</b> keyword represents the greater than or equal to operator.
<i>ge-length</i>	(Optional) Represents the minimum prefix length to be matched.
<b>le</b>	(Optional) Specifies the greater value of a range (the “to” portion of the range description) by applying the <i>le-length</i> argument to the range specified. <b>Note</b> The <b>le</b> keyword represents the less than or equal to operator.
<i>le-length</i>	(Optional) Represents the maximum prefix length to be matched.
<b>description</b>	(Optional) Configures a descriptive name for the prefix list.
<i>description</i>	(Optional) Descriptive name of the prefix list, from 1 to 80 characters in length.
<b>sequence-number</b>	(Optional) Enables or disables the use of sequence numbers for prefix lists.

### Command Default

No prefix lists or prefix-list entries are created.

### Command Modes

Global configuration (config)

## Command History

Table 117:

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **ip prefix-list** command to configure IP prefix filtering. Prefix lists are configured with **permit** or **deny** keywords to either permit or deny a prefix based on a matching condition. An implicit deny is applied to traffic that does not match any prefix-list entry.

A prefix-list entry consists of an IP address and a bit mask. The IP address can be for a classful network, a subnet, or a single host route. The bit mask is a number from 1 to 32.

Prefix lists are configured to filter traffic based on a match of an exact prefix length or a match within a range when the **ge** and **le** keywords are used. The **ge** and **le** keywords are used to specify a range of prefix lengths and provide more flexible configuration than using only the *network/length* argument. A prefix list is processed using an exact match when neither the **ge** nor **le** keyword is specified. If only the **ge** value is specified, the range is the value entered for the **ge ge-length** argument to a full 32-bit length. If only the **le** value is specified, the range is from the value entered for the *network/length* argument to the **le le-length** argument. If both the **ge ge-length** and **le le-length** keywords and arguments are entered, the range is between the values used for the *ge-length* and *le-length* arguments.

The following formula shows this behavior:

*length* <**ge** *ge-length* <**le** *le-length* <= 32

If the **seq** keyword is configured without a sequence number, the default sequence number is 5. In this scenario, the first prefix-list entry is assigned the number 5 and subsequent prefix list entries increment by 5. For example, the next two entries would have sequence numbers 10 and 15. If a sequence number is entered for the first prefix list entry but not for subsequent entries, the subsequent entry numbers increment by 5. For example, if the first configured sequence number is 3, subsequent entries will be 8, 13, and 18. Default sequence numbers can be suppressed by entering the **no ip prefix-list** command with the **seq** keyword.

Evaluation of a prefix list starts with the lowest sequence number and continues down the list until a match is found. When an IP address match is found, the permit or deny statement is applied to that network and the remainder of the list is not evaluated.



### Tip

For best performance, the most frequently processed prefix list statements should be configured with the lowest sequence numbers. The **seq number** keyword and argument can be used for resequencing.

A prefix list is applied to inbound or outbound updates for a specific peer by entering the **neighbor prefix-list** command. Prefix list information and counters are displayed in the output of the **show ip prefix-list** command. Prefix-list counters can be reset by entering the **clear ip prefix-list** command.

## Examples

In the following example, a prefix list is configured to deny the default route 0.0.0.0/0:

```
Device(config)#ip prefix-list RED deny 0.0.0.0/0
```

In the following example, a prefix list is configured to permit traffic from the 172.16.1.0/24 subnet:

```
Device(config)#ip prefix-list BLUE permit 172.16.1.0/24
```

In the following example, a prefix list is configured to permit routes from the 10.0.0.0/8 network that have a mask length that is less than or equal to 24 bits:

```
Device(config)#ip prefix-list YELLOW permit 10.0.0.0/8 le 24
```

In the following example, a prefix list is configured to deny routes from the 10.0.0.0/8 network that have a mask length that is greater than or equal to 25 bits:

```
Device(config)#ip prefix-list PINK deny 10.0.0.0/8 ge 25
```

In the following example, a prefix list is configured to permit routes from any network that have a mask length from 8 to 24 bits:

```
Device(config)#ip prefix-list GREEN permit 0.0.0.0/0 ge 8 le 24
```

In the following example, a prefix list is configured to deny any route with any mask length from the 10.0.0.0/8 network:

```
Device(config)#ip prefix-list ORANGE deny 10.0.0.0/8 le 32
```

#### Related Commands

Command	Description
<b>clear ip prefix-list</b>	Resets the prefix list entry counters.
<b>ip prefix-list description</b>	Adds a text description of a prefix list.
<b>ip prefix-list sequence</b>	Enables or disables default prefix-list sequencing.
<b>match ip address</b>	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
<b>neighbor prefix-list</b>	Filters routes from the specified neighbor using a prefix list.
<b>show ip prefix-list</b>	Displays information about a prefix list or prefix list entries.

## ip hello-interval eigrp

To configure the hello interval for an Enhanced Interior Gateway Routing Protocol (EIGRP) process, use the **ip hello-interval eigrp** command in interface configuration mode. To restore the default value, use the **no** form of this command.

```
ip hello-interval eigrp as-number seconds
no ip hello-interval eigrp as-number [seconds]
```

### Syntax Description

<i>as-number</i>	Autonomous system number.
<i>seconds</i>	Hello interval (in seconds). The range is from 1 to 65535.

### Command Default

The hello interval for low-speed, nonbroadcast multiaccess (NBMA) networks is 60 seconds and 5 seconds for all other networks.

### Command Modes

Interface configuration (config-if) Virtual network interface (config-if-vnet)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The default of 60 seconds applies only to low-speed, NBMA media. Low speed is considered to be a rate of T1 or slower, as specified with the **bandwidth** interface configuration command. Note that for the purposes of EIGRP, Frame Relay and Switched Multimegabit Data Service (SMDS) networks may be considered to be NBMA. These networks are considered NBMA if the interface has not been configured to use physical multicasting; otherwise, they are considered not to be NBMA.

### Examples

The following example sets the hello interval for Ethernet interface 0 to 10 seconds:

```
Device(config)#interface ethernet 0
Device(config-if)#ip hello-interval eigrp 109 10
```

### Related Commands

Command	Description
<b>bandwidth (interface)</b>	Sets a bandwidth value for an interface.
<b>ip hold-time eigrp</b>	Configures the hold time for a particular EIGRP routing process designated by the autonomous system number.

## ip hold-time eigrp

To configure the hold time for an Enhanced Interior Gateway Routing Protocol (EIGRP) process, use the **ip hold-time eigrp** command in interface configuration mode. To restore the default value, use the **no** form of this command.

```
ip hold-time eigrp as-number seconds
no ip hold-time eigrp as-number seconds
```

Syntax Description	
<i>as-number</i>	Autonomous system number.
<i>seconds</i>	Hold time (in seconds). The range is from 1 to 65535.

**Command Default** The EIGRP hold time is 180 seconds for low-speed, nonbroadcast multiaccess (NBMA) networks and 15 seconds for all other networks.

**Command Modes** Interface configuration (config-if) Virtual network interface (config-if-vnet)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** On very congested and large networks, the default hold time might not be sufficient time for all routers and access servers to receive hello packets from their neighbors. In this case, you may want to increase the hold time.

We recommend that the hold time be at least three times the hello interval. If a router does not receive a hello packet within the specified hold time, routes through this router are considered unavailable.

Increasing the hold time delays route convergence across the network.

The default of 180 seconds hold time and 60 seconds hello interval apply only to low-speed, NBMA media. Low speed is considered to be a rate of T1 or slower, as specified with the **bandwidth** interface configuration command.

### Examples

The following example sets the hold time for Ethernet interface 0 to 40 seconds:

```
Device(config)#interface ethernet 0
Device(config-if)#ip hold-time eigrp 109 40
```

Related Commands	Command	Description
	<b>bandwidth (interface)</b>	Sets a bandwidth value for an interface.
	<b>ip hello-interval eigrp</b>	Configures the hello interval for the EIGRP routing process designated by an autonomous system number.

# ip load-sharing

To enable load balancing for Cisco Express Forwarding on an interface, use the **ip load-sharing** command in interface configuration mode. To disable load balancing for Cisco Express Forwarding on the interface, use the **no** form of this command.

**ip load-sharing per-packet | per-destination**  
**no ip load-sharing per-packet**

## Syntax Description

<b>per-packet</b>	Enables per-packet load balancing for Cisco Express Forwarding on the interface. This functionality and keyword are not supported on all platforms. See "Usage Guidelines" for more information.
<b>per-destination</b>	Enables per-destination load balancing for Cisco Express Forwarding on the interface.

## Command Default

Per-destination load balancing is enabled by default when you enable Cisco Express Forwarding.

## Command Modes

Interface configuration (config-if)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Per-packet load balancing allows the router to send data packets over successive equal-cost paths without regard to individual destination hosts or user sessions. Path utilization is good, but packets destined for a given destination host might take different paths and might arrive out of order.

Per-destination load balancing allows the device to use multiple, equal-cost paths to achieve load sharing. Packets for a given source-destination host pair are guaranteed to take the same path, even if multiple, equal-cost paths are available. Traffic for different source-destination host pairs tends to take different paths.



### Note

If you want to enable per-packet load sharing to a particular destination, then all interfaces that can forward traffic to the destination must be enabled for per-packet load sharing.

## Examples

The following example shows how to enable per-packet load balancing:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 1/0/1
Device(config-if)# ip load-sharing per-packet
```

The following example shows how to enable per-destination load balancing:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 1/0/1
Device(config-if)# ip load-sharing per-destination
```

## ip next-hop-self eigrp

To enable the Enhanced Interior Gateway Routing Protocol (EIGRP) to advertise routes with the local outbound interface address as the next hop, use the **ip next-hop-self eigrp** command in interface configuration mode or virtual network interface mode. To instruct EIGRP to use the received next hop instead of the local outbound interface address, use the **no** form of this command.

**ip next-hop-self eigrp** *as-number*  
**no ip next-hop-self eigrp** *as-number*

<b>Syntax Description</b>	<i>as-number</i>	Autonomous system number.
---------------------------	------------------	---------------------------

**Command Default** The IP next-hop-self state is enabled.

**Command Modes** Interface configuration (config-if)  
 Virtual network interface (config-if-vnet)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** EIGRP, by default, sets the next-hop value to the local outbound interface address for routes that it is advertising, even when advertising those routes back out of the same interface on which they were learned. To change this default, you must use the **no ip next-hop-self eigrp** interface configuration command to instruct EIGRP to use the received next-hop value when advertising these routes. Following are some exceptions to this guideline:

- If your topology does not require spoke-to-spoke dynamic tunnels, you need not configure the **no ip next-hop-self eigrp** command.
- If your topology requires spoke-to-spoke dynamic tunnels, you must use process switching on the tunnel interface of spoke devices. Otherwise, you will need to use a different routing protocol over Dynamic Multipoint VPN (DMVPN).

### Examples

The following example shows how to change the default next-hop value in IPv4 classic mode configurations by disabling the **ip next-hop-self** functionality and configuring EIGRP to use the received next-hop value to advertise routes:

```
Device(config)#interface tun 0
Device(config-if)#no ip next-hop-self eigrp 101
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>ipv6 next-hop self eigrp</b>	Instructs an EIGRP device that the IPv6 next hop is the local outbound interface.

Command	Description
<b>next-hop-self</b>	Enables EIGRP to advertise routes with the local outbound interface address as the next hop.



## ip ospf database-filter all out

To filter outgoing link-state advertisements (LSAs) to an Open Shortest Path First (OSPF) interface, use the **ip ospf database-filter all out** command in interface or virtual network interface configuration modes. To restore the forwarding of LSAs to the interface, use the **no** form of this command.

```
ip ospf database-filter all out [disable]
no ip ospf database-filter all out
```

<b>Syntax Description</b>	<b>disable</b>	(Optional) Disables the filtering of outgoing LSAs to an OSPF interface; all outgoing LSAs are flooded to the interface.
	<b>Note</b>	This keyword is available only in virtual network interface mode.

**Command Default** This command is disabled by default. All outgoing LSAs are flooded to the interface.

**Command Modes** Interface configuration (config-if)  
Virtual network interface (config-if-vnet)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command performs the same function that the **neighbor database-filter** command performs on a neighbor basis.

If the **ip ospf database-filter all out** command is enabled for a virtual network and you want to disable it, use the **disable** keyword in virtual network interface configuration mode.

### Examples

The following example prevents filtering of OSPF LSAs to broadcast, nonbroadcast, or point-to-point networks reachable through Ethernet interface 0:

```
Device(config)#interface ethernet 0
Device(config-if)#ip ospf database-filter all out
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>neighbor database-filter</b>	Filters outgoing LSAs to an OSPF neighbor.

## ip ospf name-lookup

To configure Open Shortest Path First (OSPF) to look up Domain Name System (DNS) names for use in all OSPF **show EXEC** command displays, use the **ip ospf name-lookup** command in global configuration mode. To disable this function, use the **no** form of this command.

**ip ospf name-lookup**  
**no ip ospf name-lookup**

**Syntax Description** This command has no arguments or keywords.

**Command Default** This command is disabled by default.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command makes it easier to identify a router because the router is displayed by name rather than by its router ID or neighbor ID.

**Examples** The following example configures OSPF to look up DNS names for use in all OSPF **show EXEC** command displays:

```
Device(config)#ip ospf name-lookup
```

## ip split-horizon eigrp

To enable Enhanced Interior Gateway Routing Protocol (EIGRP) split horizon, use the **ip split-horizon eigrp** command in interface configuration mode. To disable split horizon, use the **no** form of this command.

**ip split-horizon eigrp** *as-number*  
**no ip split-horizon eigrp** *as-number*

### Syntax Description

<i>as-number</i>	Autonomous system number.
------------------	---------------------------

### Command Default

The behavior of this command is enabled by default.

### Command Modes

Interface configuration (config-if)  
 Virtual network interface (config-if-vnet)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **no ip split-horizon eigrp** command to disable EIGRP split horizon in your configuration.

### Examples

The following is an example of how to enable EIGRP split horizon:

```
Device(config-if)#ip split-horizon eigrp 101
```

### Related Commands

Command	Description
<b>ip split-horizon (RIP)</b>	Enables the split horizon mechanism.
<b>neighbor (EIGRP)</b>	Defines a neighboring router with which to exchange routing information.

## ip summary-address eigrp

To configure address summarization for the Enhanced Interior Gateway Routing Protocol (EIGRP) on a specified interface, use the **ip summary-address eigrp** command in interface configuration or virtual network interface configuration mode. To disable the configuration, use the **no** form of this command.

```
ip summary-address eigrp as-number ip-address mask [admin-distance] [leak-map name]  
no ip summary-address eigrp as-number ip-address mask
```

### Syntax Description

<i>as-number</i>	Autonomous system number.
<i>ip-address</i>	Summary IP address to apply to an interface.
<i>mask</i>	Subnet mask.
<i>admin-distance</i>	(Optional) Administrative distance. Range: 0 to 255.  <b>Note</b> Starting with Cisco IOS XE Release 3.2S, the <i>admin-distance</i> argument was removed. Use the <b>summary-metric</b> command to configure the administrative distance.
<b>leak-map</b> <i>name</i>	(Optional) Specifies the route-map reference that is used to configure the route leaking through the summary.

### Command Default

- An administrative distance of 5 is applied to EIGRP summary routes.
- EIGRP automatically summarizes to the network level, even for a single host route.
- No summary addresses are predefined.
- The default administrative distance metric for EIGRP is 90.

### Command Modes

Interface configuration (config-if)

Virtual network interface configuration (config-if-vnet)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **ip summary-address eigrp** command is used to configure interface-level address summarization. EIGRP summary routes are given an administrative-distance value of 5. The administrative-distance metric is used to advertise a summary without installing it in the routing table.

By default, EIGRP summarizes subnet routes to the network level. The **no auto-summary** command can be entered to configure the subnet-level summarization.

The summary address is not advertised to the peer if the administrative distance is configured as 255.

#### EIGRP Support for Leaking Routes

Configuring the **leak-map** keyword allows a component route that would otherwise be suppressed by the manual summary to be advertised. Any component subset of the summary can be leaked. A route map and access list must be defined to source the leaked route.

The following is the default behavior if an incomplete configuration is entered:

- If the **leak-map** keyword is configured to reference a nonexistent route map, the configuration of this keyword has no effect. The summary address is advertised but all component routes are suppressed.
- If the **leak-map** keyword is configured but the access list does not exist or the route map does not reference the access list, the summary address and all component routes are advertised.

If you are configuring a virtual-network trunk interface and you configure the **ip summary-address eigrp** command, the *admin-distance* value of the command is not inherited by the virtual networks running on the trunk interface because the administrative distance option is not supported in the **ip summary-address eigrp** command on virtual network subinterfaces.

## Examples

The following example shows how to configure an administrative distance of 95 on Ethernet interface 0/0 for the 192.168.0.0/16 summary address:

```
Device(config)#router eigrp 1
Device(config-router)#no auto-summary
Device(config-router)#exit
Device(config)#interface Ethernet 0/0
Device(config-if)#ip summary-address eigrp 1 192.168.0.0 255.255.0.0 95
```

The following example shows how to configure the 10.1.1.0/24 subnet to be leaked through the 10.2.2.0 summary address:

```
Device(config)#router eigrp 1
Device(config-router)#exit
Device(config)#access-list 1 permit 10.1.1.0 0.0.0.255
Device(config)#route-map LEAK-10-1-1 permit 10
Device(config-route-map)#match ip address 1
Device(config-route-map)#exit
Device(config)#interface Serial 0/0
Device(config-if)#ip summary-address eigrp 1 10.2.2.0 255.0.0.0 leak-map LEAK-10-1-1
Device(config-if)#end
```

The following example configures GigabitEthernet interface 0/0/0 as a virtual network trunk interface:

```
Device(config)#interface gigabitethernet 0/0/0
Device(config-if)#vnet global
Device(config-if-vnet)#ip summary-address eigrp 1 10.3.3.0 255.0.0.0 33
```

## Related Commands

Command	Description
<b>auto-summary (EIGRP)</b>	Configures automatic summarization of subnet routes to network-level routes (default behavior).
<b>summary-metric</b>	Configures fixed metrics for an EIGRP summary aggregate address.

## metric weights (EIGRP)

To tune the Enhanced Interior Gateway Routing Protocol (EIGRP) metric calculations, use the **metric weights** command in router configuration mode or address family configuration mode. To reset the values to their defaults, use the **no** form of this command.

### Router Configuration

**metric weights** *tos k1 k2 k3 k4 k5*

**no metric weights**

### Address Family Configuration

**metric weights** *tos [k1 [k2 [k3 [k4 [k5 [k6]]]]]]]*

**no metric weights**

### Syntax Description

<i>tos</i>	Type of service. This value must always be zero.
<i>k1 k2 k3 k4 k5 k6</i>	<p>(Optional) Constants that convert an EIGRP metric vector into a scalar quantity. Valid values are 0 to 255. Given below are the default values:</p> <ul style="list-style-type: none"> <li>• <i>k1</i>: 1</li> <li>• <i>k2</i>: 0</li> <li>• <i>k3</i>: 1</li> <li>• <i>k4</i>: 0</li> <li>• <i>k5</i>: 0</li> <li>• <i>k6</i>: 0</li> </ul> <p><b>Note</b> In address family configuration mode, if the values are not specified, default values are configured. The <i>k6</i> argument is supported only in address family configuration mode.</p>

### Command Default

EIGRP metric K values are set to their default values.

### Command Modes

Router configuration (config-router)

Address family configuration (config-router-af)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use this command to alter the default behavior of EIGRP routing and metric computation and to allow the tuning of the EIGRP metric calculation for a particular type of service (ToS).

If *k5* equals 0, the composite EIGRP metric is computed according to the following formula:

metric = [*k1* \* bandwidth + (*k2* \* bandwidth)/(256 – load) + *k3* \* delay + *K6* \* extended metrics]

If k5 does not equal zero, an additional operation is performed:

$$\text{metric} = \text{metric} * [\text{k5}/(\text{reliability} + \text{k4})]$$

$$\text{Scaled Bandwidth} = 10^7 / \text{minimum interface bandwidth (in kilobits per second)} * 256$$

Delay is in tens of microseconds for classic mode and pico seconds for named mode. In classic mode, a delay of hexadecimal FFFFFFFF (decimal 4294967295) indicates that the network is unreachable. In named mode, a delay of hexadecimal FFFFFFFFFF (decimal 281474976710655) indicates that the network is unreachable.

Reliability is given as a fraction of 255. That is, 255 is 100 percent reliability or a perfectly stable link.

Load is given as a fraction of 255. A load of 255 indicates a completely saturated link.

## Examples

The following example shows how to set the metric weights to slightly different values than the defaults:

```
Device(config)#router eigrp 109
Device(config-router)#network 192.168.0.0
Device(config-router)#metric weights 0 2 0 2 0 0
```

The following example shows how to configure an address-family metric weight to ToS: 0; K1: 2; K2: 0; K3: 2; K4: 0; K5: 0; K6:1:

```
Device(config)#router eigrp virtual-name
Device(config-router)#address-family ipv4 autonomous-system 4533
Device(config-router-af)#metric weights 0 2 0 2 0 0 1
```

## Related Commands

Command	Description
<b>address-family (EIGRP)</b>	Enters address family configuration mode to configure an EIGRP routing instance.
<b>bandwidth (interface)</b>	Sets a bandwidth value for an interface.
<b>delay (interface)</b>	Sets a delay value for an interface.
<b>ipv6 router eigrp</b>	Configures an IPv6 EIGRP routing process.
<b>metric holddown</b>	Keeps new EIGRP routing information from being used for a certain period of time.
<b>metric maximum-hops</b>	Causes IP routing software to advertise routes with a hop count higher than what is specified by the command (EIGRP only) as unreachable routes.
<b>router eigrp</b>	Configures an EIGRP routing process.

# neighbor advertisement-interval

To set the minimum route advertisement interval (MRAI) between the sending of BGP routing updates, use the **neighbor advertisement-interval** command in address family or router configuration mode. To restore the default value, use the **no** form of this command.

**neighbor** *ip-address**peer-group-name* **advertisement-interval** *seconds*  
**no neighbor** *ip-address**peer-group-name* **advertisement-interval** *seconds*

## Syntax Description

<i>ip-address</i>	IP address of the neighbor.
<i>peer-group-name</i>	Name of a BGP peer group.
<i>seconds</i>	Time (in seconds) is specified by an integer ranging from 0 to 600.

## Command Default

eBGP sessions not in a VRF: 30 seconds  
 eBGP sessions in a VRF: 0 seconds  
 iBGP sessions: 0 seconds

## Command Modes

Router configuration (config-router)

## Command History

*Table 118:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

When the MRAI is equal to 0 seconds, BGP routing updates are sent as soon as the BGP routing table changes. If you specify a BGP peer group by using the *peer-group-name* argument, all the members of the peer group will inherit the characteristic configured with this command.

## Examples

The following router configuration mode example sets the minimum time between sending BGP routing updates to 10 seconds:

```
router bgp 5
 neighbor 10.4.4.4 advertisement-interval 10
```

The following address family configuration mode example sets the minimum time between sending BGP routing updates to 10 seconds:

```
router bgp 5
 address-family ipv4 unicast
 neighbor 10.4.4.4 advertisement-interval 10
```



**Related Commands**

<b>Command</b>	<b>Description</b>
<b>address-family ipv4 (BGP)</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard IPv4 address prefixes.
<b>address-family vpnv4</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard VPNv4 address prefixes.
<b>neighbor peer-group (creating)</b>	Creates a BGP peer group.

## neighbor default-originate

To allow a BGP speaker (the local router) to send the default route 0.0.0.0 to a neighbor for use as a default route, use the **neighbor default-originate** command in address family or router configuration mode. To send no route as a default, use the **no** form of this command.

**neighbor** *ip-address**peer-group-name* **default-originate** [**route-map** *map-name*]  
**no neighbor** *ip-address**peer-group-name* **default-originate** [**route-map** *map-name*]

Syntax Description		
	<i>ip-address</i>	IP address of the neighbor.
	<i>peer-group-name</i>	Name of a BGP peer group.
	<b>route-map</b> <i>map-name</i>	(Optional) Name of the route map. The route map allows route 0.0.0.0 to be injected conditionally.

**Command Default** No default route is sent to the neighbor.

**Command Modes** Address family configuration (config-router-af)  
 Router configuration (config-router)

**Command History** *Table 119:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command does not require the presence of 0.0.0.0 in the local router. When used with a route map, the default route 0.0.0.0 is injected if the route map contains a **match ip address** clause and there is a route that matches the IP access list exactly. The route map can contain other match clauses also.

You can use standard or extended access lists with the **neighbor default-originate** command.

### Examples

In the following router configuration example, the local router injects route 0.0.0.0 to the neighbor 172.16.2.3 unconditionally:

```
router bgp 109
network 172.16.0.0
neighbor 172.16.2.3 remote-as 200
neighbor 172.16.2.3 default-originate
```

In the following example, the local router injects route 0.0.0.0 to the neighbor 172.16.2.3 only if there is a route to 192.168.68.0 (that is, if a route with any mask exists, such as 255.255.255.0 or 255.255.0.0):

```
router bgp 109
network 172.16.0.0
neighbor 172.16.2.3 remote-as 200
neighbor 172.16.2.3 default-originate route-map default-map
!
```

```
route-map default-map 10 permit
  match ip address 1
!
access-list 1 permit 192.168.68.0
```

In the following example, the last line of the configuration has been changed to show the use of an extended access list. The local router injects route 0.0.0.0 to the neighbor 172.16.2.3 only if there is a route to 192.168.68.0 with a mask of 255.255.0.0:

```
router bgp 109
  network 172.16.0.0
  neighbor 172.16.2.3 remote-as 200
  neighbor 172.16.2.3 default-originate route-map default-map
!
route-map default-map 10 permit
  match ip address 100
!
access-list 100 permit ip host 192.168.68.0 host 255.255.0.0
```

### Related Commands

Command	Description
<b>address-family ipv4 (BGP)</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard IPv4 address prefixes.
<b>address-family vpnv4</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard VPNv4 address prefixes.
<b>neighbor ebgp-multihop</b>	Accepts and attempts BGP connections to external peers residing on networks that are not directly connected.

# neighbor description

To associate a description with a neighbor, use the **neighbor description** command in router configuration mode or address family configuration mode. To remove the description, use the **no** form of this command.

**neighbor** *ip-address***peer-group-name** **description** *text*  
**no neighbor** *ip-address***peer-group-name** **description** [*text*]

## Syntax Description

<i>ip-address</i>	IP address of the neighbor.
<i>peer-group-name</i>	Name of an EIGRP peer group. This argument is not available in address-family configuration mode.
<i>text</i>	Text (up to 80 characters in length) that describes the neighbor.

## Command Default

There is no description of the neighbor.

## Command Modes

Router configuration (config-router) Address family configuration (config-router-af)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

In the following examples, the description of the neighbor is “peer with example.com”:

```
Device(config)#router bgp 109
Device(config-router)#network 172.16.0.0
Device(config-router)#neighbor 172.16.2.3 description peer with example.com
```

In the following example, the description of the address family neighbor is “address-family-peer”:

```
Device(config)#router eigrp virtual-name
Device(config-router)#address-family ipv4 autonomous-system 4453
Device(config-router-af)#network 172.16.0.0
Device(config-router-af)#neighbor 172.16.2.3 description address-family-peer
```

## Related Commands

Command	Description
<b>address-family (EIGRP)</b>	Enters address family configuration mode to configure an EIGRP routing instance.
<b>network (EIGRP)</b>	Specifies the network for an EIGRP routing process.
<b>router eigrp</b>	Configures the EIGRP address family process.

# neighbor ebgp-multihop

To accept and attempt BGP connections to external peers residing on networks that are not directly connected, use the **neighbor ebgp-multihop** command in router configuration mode. To return to the default, use the **no** form of this command.

**neighbor** *ip-address**ipv6-address**peer-group-name* **ebgp-multihop** [*tll*]  
**no neighbor** *ip-address**ipv6-address**peer-group-name* **ebgp-multihop**

## Syntax Description

<i>ip-address</i>	IP address of the BGP-speaking neighbor.
<i>ipv6-address</i>	IPv6 address of the BGP-speaking neighbor.
<i>peer-group-name</i>	Name of a BGP peer group.
<i>tll</i>	(Optional) Time-to-live in the range from 1 to 255 hops.

## Command Default

Only directly connected neighbors are allowed.

## Command Modes

Router configuration (config-router)

## Command History

*Table 120:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

This feature should be used only under the guidance of Cisco technical support staff.

If you specify a BGP peer group by using the *peer-group-name* argument, all the members of the peer group will inherit the characteristic configured with this command.

To prevent the creation of loops through oscillating routes, the multihop will not be established if the only route to the multihop peer is the default route (0.0.0.0).

## Examples

The following example allows connections to or from neighbor 10.108.1.1, which resides on a network that is not directly connected:

```
Device(config)#router bgp 109
Device(config-router)#neighbor 10.108.1.1 ebgp-multihop
```

## Related Commands

Command	Description
<b>neighbor advertise-map non-exist-map</b>	Allows a BGP speaker (the local router) to send the default route 0.0.0.0 to a neighbor for use as a default route.
<b>neighbor peer-group (creating)</b>	Creates a BGP peer group.
<b>network (BGP and multiprotocol BGP)</b>	Specifies the list of networks for the BGP routing process.

## neighbor maximum-prefix (BGP)

To control how many prefixes can be received from a neighbor, use the **neighbor maximum-prefix** command in router configuration mode. To disable this function, use the **no** form of this command.

```
neighbor ip-address peer-group-name maximum-prefix maximum [threshold] [restart restart-interval]
[warning-only]
no neighbor ip-address peer-group-name maximum-prefix maximum
```

### Syntax Description

<i>ip-address</i>	IP address of the neighbor.
<i>peer-group-name</i>	Name of a Border Gateway Protocol (BGP) peer group.
<i>maximum</i>	Maximum number of prefixes allowed from the specified neighbor. The number of prefixes that can be configured is limited only by the available system resources on a router.
<i>threshold</i>	(Optional) Integer specifying at what percentage of the <i>maximum-prefix</i> limit the router starts to generate a warning message. The range is from 1 to 100; the default is 75.
<b>restart</b>	(Optional) Configures the router that is running BGP to automatically reestablish a peering session that has been disabled because the maximum-prefix limit has been exceeded. The restart timer is configured with the <i>restart-interval</i> argument.
<i>restart-interval</i>	(Optional) Time interval (in minutes) that a peering session is reestablished. The range is from 1 to 65535 minutes.
<b>warning-only</b>	(optional) Allows the router to generate a sys-log message when the <i>maximum-prefix</i> limit is exceeded, instead of terminating the peering session.

### Command Default

This command is disabled by default. Peering sessions are disabled when the maximum number of prefixes is exceeded. If the *restart-interval* argument is not configured, a disabled session will stay down after the maximum-prefix limit is exceeded.

*threshold* : 75 percent

### Command Modes

Router configuration (config-router)

### Command History

**Table 121:**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **neighbor maximum-prefix** command allows you to configure a maximum number of prefixes that a Border Gateway Protocol (BGP) routing process will accept from the specified peer. This feature provides a mechanism (in addition to distribute lists, filter lists, and route maps) to control prefixes received from a peer.

When the number of received prefixes exceeds the maximum number configured, BGP disables the peering session (by default). If the **restart** keyword is configured, BGP will automatically reestablish the peering

session at the configured time interval. If the **restart** keyword is not configured and a peering session is terminated because the maximum prefix limit has been exceeded, the peering session will not be reestablished until the **clear ip bgp** command is entered. If the **warning-only** keyword is configured, BGP sends only a log message and continues to peer with the sender.

There is no default limit on the number of prefixes that can be configured with this command. Limitations on the number of prefixes that can be configured are determined by the amount of available system resources.

## Examples

In the following example, the maximum prefixes that will be accepted from the 192.168.1.1 neighbor is set to 1000:

```
Device(config)#router bgp 40000
Device(config-router)#network 192.168.0.0
Device(config-router)#neighbor 192.168.1.1 maximum-prefix 1000
```

In the following example, the maximum number of prefixes that will be accepted from the 192.168.2.2 neighbor is set to 5000. The router is also configured to display warning messages when 50 percent of the maximum-prefix limit (2500 prefixes) has been reached.

```
Device(config)#router bgp 40000
Device(config-router)#network 192.168.0.0
Device(config-router)#neighbor 192.168.2.2 maximum-prefix 5000 50
```

In the following example, the maximum number of prefixes that will be accepted from the 192.168.3.3 neighbor is set to 2000. The router is also configured to reestablish a disabled peering session after 30 minutes.

```
Device(config)#router bgp 40000
Device(config-router) network 192.168.0.0
Device(config-router)#neighbor 192.168.3.3 maximum-prefix 2000 restart 30
```

In the following example, warning messages will be displayed when the threshold of the maximum-prefix limit ( $500 \times 0.75 = 375$ ) for the 192.168.4.4 neighbor is exceeded:

```
Device(config)#router bgp 40000
Device(config-router)#network 192.168.0.0
Device(config-router)#neighbor 192.168.4.4 maximum-prefix 500 warning-only
```

## Related Commands

Command	Description
<b>clear ip bgp</b>	Resets a BGP connection using BGP soft reconfiguration.

## neighbor peer-group (assigning members)

To configure a BGP neighbor to be a member of a peer group, use the **neighbor peer-group** command in address family or router configuration mode. To remove the neighbor from the peer group, use the **no** form of this command.

**neighbor** *ip-address**ipv6-address* **peer-group** *peer-group-name*  
**no neighbor** *ip-address**ipv6-address* **peer-group** *peer-group-name*

### Syntax Description

<i>ip-address</i>	IP address of the BGP neighbor that belongs to the peer group specified by the <i>peer-group-name</i> argument.
<i>ipv6-address</i>	IPv6 address of the BGP neighbor that belongs to the peer group specified by the <i>peer-group-name</i> argument.
<i>peer-group-name</i>	Name of the BGP peer group to which this neighbor belongs.

### Command Default

There are no BGP neighbors in a peer group.

### Command Modes

Address family configuration (config-router-af)  
 Router configuration (config-router)

### Command History

Table 122:

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The neighbor at the IP address indicated inherits all the configured options of the peer group.



#### Note

Using the **no** form of the **neighbor peer-group** command removes all of the BGP configuration for that neighbor, not just the peer group association.

### Examples

The following router configuration mode example assigns three neighbors to the peer group named internal:

```
Device(config)#router bgp 100
Device(config-router)#neighbor internal peer-group
Device(config-router)#neighbor internal remote-as 100
Device(config-router)#neighbor internal update-source loopback 0
Device(config-router)#neighbor internal route-map set-med out
Device(config-router)#neighbor internal filter-list 1 out
Device(config-router)#neighbor internal filter-list 2 in
Device(config-router)#neighbor 172.16.232.53 peer-group internal
Device(config-router)#neighbor 172.16.232.54 peer-group internal
```



```
Device(config-router)#neighbor 172.16.232.55 peer-group internal
Device(config-router)#neighbor 172.16.232.55 filter-list 3 in
```

The following address family configuration mode example assigns three neighbors to the peer group named internal:

```
Device(config)#router bgp 100
Device(config-router)#address-family ipv4 unicast
Device(config-router)#neighbor internal peer-group
Device(config-router)#neighbor internal remote-as 100
Device(config-router)#neighbor internal update-source loopback 0
Device(config-router)#neighbor internal route-map set-med out
Device(config-router)#neighbor internal filter-list 1 out
Device(config-router)#neighbor internal filter-list 2 in
Device(config-router)#neighbor 172.16.232.53 peer-group internal
Device(config-router)#neighbor 172.16.232.54 peer-group internal
Device(config-router)#neighbor 172.16.232.55 peer-group internal
Device(config-router)#neighbor 172.16.232.55 filter-list 3 in
```

#### Related Commands

Command	Description
<b>address-family ipv4 (BGP)</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard IPv4 address prefixes.
<b>address-family vpv4</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard VPNv4 address prefixes.
<b>neighbor peer-group (creating)</b>	Creates a BGP peer group.
<b>neighbor shutdown</b>	Disables a neighbor or peer group.

## neighbor peer-group (creating)

To create a BGP or multiprotocol BGP peer group, use the **neighbor peer-group** command in address family or router configuration mode. To remove the peer group and all of its members, use the **no** form of this command.

**neighbor** *peer-group-name* **peer-group**  
**no neighbor** *peer-group-name* **peer-group**

Syntax Description	
	<i>peer-group-name</i> Name of the BGP peer group.

**Command Default** There is no BGP peer group.

**Command Modes** Address family configuration (config-router-af)  
 Router configuration (config-router)

**Command History** *Table 123:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Often in a BGP or multiprotocol BGP speaker, many neighbors are configured with the same update policies (that is, same outbound route maps, distribute lists, filter lists, update source, and so on). Neighbors with the same update policies can be grouped into peer groups to simplify configuration and make update calculation more efficient.



**Note** Peer group members can span multiple logical IP subnets, and can transmit, or pass along, routes from one peer group member to another.

Once a peer group is created with the **neighbor peer-group** command, it can be configured with the **neighbor** commands. By default, members of the peer group inherit all the configuration options of the peer group. Members also can be configured to override the options that do not affect outbound updates.

All the peer group members will inherit the current configuration as well as changes made to the peer group. Peer group members will always inherit the following configuration options by default:

- remote-as (if configured)
- version
- update-source
- outbound route-maps
- outbound filter-lists
- outbound distribute-lists

- minimum-advertisement-interval
- next-hop-self

If a peer group is not configured with a remote-as option, the members can be configured with the **neighbor** *{ip-address | peer-group-name}* **remote-as** command. This command allows you to create peer groups containing external BGP (eBGP) neighbors.

## Examples

The following example configurations show how to create these types of neighbor peer group:

- internal Border Gateway Protocol (iBGP) peer group
- eBGP peer group
- Multiprotocol BGP peer group

In the following example, the peer group named internal configures the members of the peer group to be iBGP neighbors. By definition, this is an iBGP peer group because the **router bgp** command and the **neighbor remote-as** command indicate the same autonomous system (in this case, autonomous system 100). All the peer group members use loopback 0 as the update source and use set-med as the outbound route map. The **neighbor internal filter-list 2 in** command shows that, except for 172.16.232.55, all the neighbors have filter list 2 as the inbound filter list.

```
router bgp 100
neighbor internal peer-group
neighbor internal remote-as 100
neighbor internal update-source loopback 0
neighbor internal route-map set-med out
neighbor internal filter-list 1 out
neighbor internal filter-list 2 in
neighbor 172.16.232.53 peer-group internal
neighbor 172.16.232.54 peer-group internal
neighbor 172.16.232.55 peer-group internal
neighbor 172.16.232.55 filter-list 3 in
```

The following example defines the peer group named external-peers without the **neighbor remote-as** command. By definition, this is an eBGP peer group because each individual member of the peer group is configured with its respective autonomous system number separately. Thus the peer group consists of members from autonomous systems 200, 300, and 400. All the peer group members have the set-metric route map as an outbound route map and filter list 99 as an outbound filter list. Except for neighbor 172.16.232.110, all of them have 101 as the inbound filter list.

```
router bgp 100
neighbor external-peers peer-group
neighbor external-peers route-map set-metric out
neighbor external-peers filter-list 99 out
neighbor external-peers filter-list 101 in
neighbor 172.16.232.90 remote-as 200
neighbor 172.16.232.90 peer-group external-peers
neighbor 172.16.232.100 remote-as 300
neighbor 172.16.232.100 peer-group external-peers
neighbor 172.16.232.110 remote-as 400
neighbor 172.16.232.110 peer-group external-peers
neighbor 172.16.232.110 filter-list 400 in
```

In the following example, all members of the peer group are multicast-capable:

```

router bgp 100
neighbor 10.1.1.1 remote-as 1
neighbor 172.16.2.2 remote-as 2
address-family ipv4 multicast
neighbor mygroup peer-group
neighbor 10.1.1.1 peer-group mygroup
neighbor 172.16.2.2 peer-group mygroup
neighbor 10.1.1.1 activate
neighbor 172.16.2.2 activate

```

**Related Commands**

Command	Description
<b>address-family ipv4 (BGP)</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard IPv4 address prefixes.
<b>address-family vpnv4</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard VPNv4 address prefixes.
<b>clear ip bgp peer-group</b>	Removes all the members of a BGP peer group.
<b>show ip bgp peer-group</b>	Displays information about BGP peer groups.

# neighbor route-map

To apply a route map to incoming or outgoing routes, use the **neighbor route-map** command in address family or router configuration mode. To remove a route map, use the **no** form of this command.

**neighbor***ip-address**peer-group-name* | *ipv6-address*[%]**route-map** *map-name***in** | **out**  
**no neighbor***ip-address**peer-group-name* | *ipv6-address*[%]**route-map** *map-name***in** | **out**

## Syntax Description

<i>ip-address</i>	IP address of the neighbor.
<i>peer-group-name</i>	Name of a BGP or multiprotocol BGP peer group.
<i>ipv6-address</i>	IPv6 address of the neighbor.
%	(Optional) IPv6 link-local address identifier. This keyword needs to be added whenever a link-local IPv6 address is used outside the context of its interface.
<i>map-name</i>	Name of a route map.
<b>in</b>	Applies route map to incoming routes.
<b>out</b>	Applies route map to outgoing routes.

## Command Default

No route maps are applied to a peer.

## Command Modes

Router configuration (config-router)

## Command History

**Table 124:**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

When specified in address family configuration mode, this command applies a route map to that particular address family only. When specified in router configuration mode, this command applies a route map to IPv4 or IPv6 unicast routes only.

If an outbound route map is specified, it is proper behavior to only advertise routes that match at least one section of the route map.

If you specify a BGP or multiprotocol BGP peer group by using the *peer-group-name* argument, all the members of the peer group will inherit the characteristic configured with this command. Specifying the command for a neighbor overrides the inbound policy that is inherited from the peer group.

The % keyword is used whenever link-local IPv6 addresses are used outside the context of their interfaces. This keyword does not need to be used for non-link-local IPv6 addresses.

## Examples

The following router configuration mode example applies a route map named internal-map to a BGP incoming route from 172.16.70.24:

```
router bgp 5
```

```
neighbor 172.16.70.24 route-map internal-map in
route-map internal-map
match as-path 1
set local-preference 100
```

The following address family configuration mode example applies a route map named internal-map to a multiprotocol BGP incoming route from 172.16.70.24:

```
router bgp 5
address-family ipv4 multicast
neighbor 172.16.70.24 route-map internal-map in
route-map internal-map
match as-path 1
set local-preference 100
```

### Related Commands

Command	Description
<b>address-family ipv4 (BGP)</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard IP Version 4 address prefixes.
<b>address-family ipv6</b>	Enters address family configuration mode for configuring routing sessions such as BGP that use standard IPv6 address prefixes.
<b>address-family vpnv4</b>	Places the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard VPN Version 4 address prefixes.
<b>address-family vpnv6</b>	Places the router in address family configuration mode for configuring routing sessions that use standard VPNv6 address prefixes.
<b>neighbor remote-as</b>	Creates a BGP peer group.

## neighbor update-source

To have the Cisco software allow Border Gateway Protocol (BGP) sessions to use any operational interface for TCP connections, use the **neighbor update-source** command in router configuration mode. To restore the interface assignment to the closest interface, which is called the best local address, use the **no** form of this command.

```
neighbor ip-address | ipv6-address[%]peer-group-name update-source interface-type interface-number
neighbor ip-address | ipv6-address[%]peer-group-name update-source interface-type interface-number
```

### Syntax Description

<i>ip-address</i>	IPv4 address of the BGP-speaking neighbor.
<i>ipv6-address</i>	IPv6 address of the BGP-speaking neighbor.
<b>%</b>	(Optional) IPv6 link-local address identifier. This keyword needs to be added whenever a link-local IPv6 address is used outside the context of its interface.
<i>peer-group-name</i>	Name of a BGP peer group.
<i>interface-type</i>	Interface type.
<i>interface-number</i>	Interface number.

### Command Default

Best local address

### Command Modes

Router configuration (config-router)

### Command History

*Table 125:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

This command can work in conjunction with the loopback interface feature described in the “Interface Configuration Overview” chapter of the Cisco IOS Interface and Hardware Component Configuration Guide.

If you specify a BGP peer group by using the *peer-group-name* argument, all the members of the peer group will inherit the characteristic configured with this command.

The **neighbor update-source** command must be used to enable IPv6 link-local peering for internal or external BGP sessions.

The **%** keyword is used whenever link-local IPv6 addresses are used outside the context of their interfaces and for these link-local IPv6 addresses you must specify the interface they are on. The syntax becomes <IPv6 local-link address>%<interface name>, for example, FE80::1%Ethernet1/0. Note that the interface type and number must not contain any spaces, and be used in full-length form because name shortening is not supported in this situation. The **%** keyword and subsequent interface syntax is not used for non-link-local IPv6 addresses.

### Examples

The following example sources BGP TCP connections for the specified neighbor with the IP address of the loopback interface rather than the best local address:

```

Device(config)#router bgp 65000
Device(config-router)#network 172.16.0.0
Device(config-router)#neighbor 172.16.2.3 remote-as 110
Device(config-router)#neighbor 172.16.2.3 update-source Loopback0

```

The following example sources IPv6 BGP TCP connections for the specified neighbor in autonomous system 65000 with the global IPv6 address of loopback interface 0 and the specified neighbor in autonomous system 65400 with the link-local IPv6 address of Fast Ethernet interface 0/0. Note that the link-local IPv6 address of FE80::2 is on Ethernet interface 1/0.

```

Device(config)#router bgp 65000
Device(config-router)#neighbor 3ffe::3 remote-as 65000
Device(config-router)#neighbor 3ffe::3 update-source Loopback0
Device(config-router)#neighbor fe80::2%Ethernet1/0 remote-as 65400
Device(config-router)#neighbor fe80::2%Ethernet1/0 update-source FastEthernet 0/0
Device(config-router)#address-family ipv6
Device(config-router)#neighbor 3ffe::3 activate
Device(config-router)#neighbor fe80::2%Ethernet1/0 activate
Device(config-router)#exit-address-family

```

#### Related Commands

Command	Description
<b>neighbor activate</b>	Enables the exchange of information with a BGP neighboring router.
<b>neighbor remote-as</b>	Adds an entry to the BGP or multiprotocol BGP neighbor table.



## network (BGP and multiprotocol BGP)

To specify the networks to be advertised by the Border Gateway Protocol (BGP) and multiprotocol BGP routing processes, use the **network** command in address family or router configuration mode. To remove an entry from the routing table, use the **no** form of this command.

**network** *network-number* [**mask** *network-mask*]*nsap-prefix* [**route-map** *map-tag*]  
**no network** *network-number* [**mask** *network-mask*]*nsap-prefix* [**route-map** *map-tag*]

Syntax Description		
<i>network-number</i>		Network that BGP or multiprotocol BGP will advertise.
<b>mask</b> <i>network-mask</i>		(Optional) Network or subnetwork mask with mask address.
<i>nsap-prefix</i>		Network service access point (NSAP) prefix of the Connectionless Network Service (CLNS) network that BGP or multiprotocol BGP will advertise. This argument is used only under NSAP address family configuration mode.
<b>route-map</b> <i>map-tag</i>		(Optional) Identifier of a configured route map. The route map should be examined to filter the networks to be advertised. If not specified, all networks are advertised. If the keyword is specified, but no route map tags are listed, no networks will be advertised.

**Command Default** No networks are specified.

**Command Modes** Address family configuration (config-router-af)  
 Router configuration (config-router)

**Command History** *Table 126:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** BGP and multiprotocol BGP networks can be learned from connected routes, from dynamic routing, and from static route sources.

The maximum number of **network** commands you can use is determined by the resources of the router, such as the configured NVRAM or RAM.

### Examples

The following example sets up network 10.108.0.0 to be included in the BGP updates:

```
Device(config)#router bgp 65100
Device(config-router)#network 10.108.0.0
```

The following example sets up network 10.108.0.0 to be included in the multiprotocol BGP updates:

```
Device(config)#router bgp 64800
```

```
Device(config-router)#address family ipv4 multicast
Device(config-router)#network 10.108.0.0
```

The following example advertises NSAP prefix 49.6001 in the multiprotocol BGP updates:

```
Device(config)#router bgp 64500
Device(config-router)#address-family nsap
Device(config-router)#network 49.6001
```

#### Related Commands

Command	Description
<b>address-family ipv4 (BGP)</b>	Enters the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard IP Version 4 address prefixes.
<b>address-family vpnv4</b>	Enters the router in address family configuration mode for configuring routing sessions such as BGP, RIP, or static routing sessions that use standard VPNv4 address prefixes.
<b>default-information originate (BGP)</b>	Allows the redistribution of network 0.0.0.0 into BGP.
<b>route-map (IP)</b>	Defines the conditions for redistributing routes from one routing protocol into another.
<b>router bgp</b>	Configures the BGP routing process.

## network (EIGRP)

To specify the network for an Enhanced Interior Gateway Routing Protocol (EIGRP) routing process, use the **network** command in router configuration mode or address-family configuration mode. To remove an entry, use the **no** form of this command.

```
network ip-address [wildcard-mask]
no network ip-address [wildcard-mask]
```

Syntax Description	
<i>ip-address</i>	IP address of the directly connected network.
<i>wildcard-mask</i>	(Optional) EIGRP wildcard bits. Wildcard mask indicates a subnetwork, bitwise complement of the subnet mask.

**Command Default** No networks are specified.

**Command Modes** Router configuration (config-router) Address-family configuration (config-router-af)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** When the **network** command is configured for an EIGRP routing process, the router matches one or more local interfaces. The **network** command matches only local interfaces that are configured with addresses that are within the same subnet as the address that has been configured with the **network** command. The router then establishes neighbors through the matched interfaces. There is no limit to the number of network statements (**network** commands) that can be configured on a router.

Use a wildcard mask as a shortcut to group networks together. A wildcard mask matches everything in the network part of an IP address with a zero. Wildcard masks target a specific host/IP address, entire network, subnet, or even a range of IP addresses.

When entered in address-family configuration mode, this command applies only to named EIGRP IPv4 configurations. Named IPv6 and Service Advertisement Framework (SAF) configurations do not support this command in address-family configuration mode.

### Examples

The following example configures EIGRP autonomous system 1 and establishes neighbors through network 172.16.0.0 and 192.168.0.0:

```
Device(config)#router eigrp 1
Device(config-router)#network 172.16.0.0
Device(config-router)#network 192.168.0.0
Device(config-router)#network 192.168.0.0 0.0.255.255
```

The following example configures EIGRP address-family autonomous system 4453 and establishes neighbors through network 172.16.0.0 and 192.168.0.0:

```
Device(config)#router eigrp virtual-name
Device(config-router)#address-family ipv4 autonomous-system 4453
```

```
Device(config-router-af)#network 172.16.0.0  
Device(config-router-af)#network 192.168.0.0
```

**Related Commands**

Command	Description
<b>address-family (EIGRP)</b>	Enters address-family configuration mode to configure an EIGRP routing instance.
<b>router eigrp</b>	Configures the EIGRP address-family process.

## nsf (EIGRP)

To enable Cisco nonstop forwarding (NSF) operations for the Enhanced Interior Gateway Routing Protocol (EIGRP), use the **nsf** command in router configuration or address family configuration mode. To disable EIGRP NSF and to remove the EIGRP NSF configuration from the running-configuration file, use the **no** form of this command.

**nsf**  
**no nsf**

**Syntax Description** This command has no arguments or keywords.

**Command Default** EIGRP NSF is disabled.

**Command Modes** Router configuration (config-router)  
Address family configuration (config-router-af)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **nsf** command is used to enable or disable EIGRP NSF support on an NSF-capable router. NSF is supported only on platforms that support High Availability.

**Examples** The following example shows how to disable NSF:

```
Device#configure terminal
Device(config)#router eigrp 101
Device(config-router)#no nsf
Device(config-router)#end
```

The following example shows how to enable EIGRP IPv6 NSF:

```
Device#configure terminal
Device(config)#router eigrp virtual-name-1
Device(config-router)#address-family ipv6 autonomous-system 10
Device(config-router-af)#nsf
Device(config-router-af)#end
```

Related Commands	Command	Description
	<b>debug eigrp address-family ipv6 notifications</b>	Displays information about EIGRP address family IPv6 event notifications.
	<b>debug eigrp nsf</b>	Displays notifications and information about NSF events for an EIGRP routing process.
	<b>debug ip eigrp notifications</b>	Displays information and notifications for an EIGRP routing process.

Command	Description
<b>show ip protocols</b>	Displays the parameters and the current state of the active routing protocol process.
<b>show ipv6 protocols</b>	Displays the parameters and the current state of the active IPv6 routing protocol process.
<b>timers graceful-restart purge-time</b>	Sets the graceful-restart purge-time timer to determine how long an NSF-aware router that is running EIGRP must hold routes for an inactive peer.
<b>timers nsf converge</b>	Sets the maximum time that the restarting router must wait for the end-of-table notification from an NSF-capable or NSF-aware peer.
<b>timers nsf signal</b>	Sets the maximum time for the initial restart period.

## offset-list (EIGRP)

To add an offset to incoming and outgoing metrics to routes learned via Enhanced Interior Gateway Routing Protocol (EIGRP), use the **offset-list** command in router configuration mode or address family topology configuration mode. To remove an offset list, use the **no** form of this command.

**offset-list** *access-list-number**access-list-name* **in** | **out** *offset* [*interface-type* *interface-number*]  
**no offset-list** *access-list-number**access-list-name* **in** | **out** *offset* [*interface-type* *interface-number*]

Syntax Description		
<i>access-list-number</i>   <i>access-list-name</i>		Standard access list number or name to be applied. Access list number 0 indicates all networks (networks, prefixes, or routes). If the <i>offset</i> value is 0, no action is taken.
<b>in</b>		Applies the access list to incoming metrics.
<b>out</b>		Applies the access list to outgoing metrics.
<i>offset</i>		Positive offset to be applied to metrics for networks matching the access list. If the offset is 0, no action is taken.
<i>interface-type</i>		(Optional) Interface type to which the offset list is applied.
<i>interface-number</i>		(Optional) Interface number to which the offset list is applied.

**Command Default** No offset values are added to incoming or outgoing metrics to routes learned via EIGRP.

**Command Modes** Router configuration (config-router) Address family topology configuration (config-router-af-topology)

**Command History** *Table 127:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The offset value is added to the routing metric. An offset list with an interface type and interface number is considered extended and takes precedence over an offset list that is not extended. Therefore, if an entry passes the extended offset list and the normal offset list, the offset of the extended offset list is added to the metric.

### Examples

In the following example, the router applies an offset of 10 to the delay component of the router only to access list 21:

```
Device(config-router)#offset-list 21 out 10
```

In the following example, the router applies an offset of 10 to routes learned from Ethernet interface 0:

```
Device(config-router)#offset-list 21 in 10 ethernet 0
```

In the following example, the router applies an offset of 10 to routes learned from Ethernet interface 0 in an EIGRP named configuration:

```
Device(config)#router eigrp virtual-name  
Device(config-router)#address-family ipv4 autonomous-system 1  
Device(config-router-af)#topology base  
Device(config-router-af-topology)#offset-list 21 in 10 ethernet0
```



## redistribute (IP)

To redistribute routes from one routing domain into another routing domain, use the **redistribute** command in the appropriate configuration mode. To disable all or some part of the redistribution (depending on the protocol), use the **no** form of this command. See the “Usage Guidelines” section for detailed, protocol-specific behaviors.

**redistribute** *protocol* [*process-id*] **level-1** | **level-1-2** | **level-2** [*autonomous-system-number*] [**metric** *metric-value* | **transparent**] [**metric-type** *type-value*] [**match** **internal** | **external 1** | **external 2**] [**tag** *tag-value*] [**route-map** *map-tag*] [**subnets**] [**nssa-only**]

**no redistribute** *protocol* [*process-id*] **level-1** | **level-1-2** | **level-2** [*autonomous-system-number*] [**metric** *metric-value* | **transparent**] [**metric-type** *type-value*] [**match** **internal** | **external 1** | **external 2**] [**tag** *tag-value*] [**route-map** *map-tag*] [**subnets**] [**nssa-only**]

### Syntax Description

<i>protocol</i>	<p>Source protocol from which routes are being redistributed. It can be one of the following keywords: <b>application</b>, <b>bgp</b>, <b>connected</b>, <b>eigrp</b>, <b>isis</b>, <b>mobile</b>, <b>ospf</b>, <b>rip</b>, or <b>static [ip]</b>.</p> <p>The <b>static [ip]</b> keyword is used to redistribute IP static routes. The optional <b>ip</b> keyword is used when redistributing into the Intermediate System-to-Intermediate System (IS-IS) protocol.</p> <p>The <b>application</b> keyword is used to redistribute an application from one routing domain to another. You can redistribute more than one application to different routing protocols such as IS-IS, OSPF, Border Gateway Protocol (BGP), Enhanced Interior Gateway Routing Protocol (EIGRP) and Routing Information Protocol (RIP).</p> <p>The <b>connected</b> keyword refers to routes that are established automatically by virtue of having enabled IP on an interface. For routing protocols such as Open Shortest Path First (OSPF) and IS-IS, these routes will be redistributed as external to the autonomous system.</p>
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<i>process-id</i>	<p>(Optional) For the <b>application</b> keyword, this is the name of an application.</p> <p>For the <b>bgp</b> or <b>eigrp</b> keyword, this is an autonomous system number, which is a 16-bit decimal number.</p> <p>For the <b>isis</b> keyword, this is an optional <i>tag</i> value that defines a meaningful name for a routing process. Creating a name for a routing process means that you use names when configuring routing. You can configure a router in two routing domains and redistribute routing information between these two domains.</p> <p>For the <b>ospf</b> keyword, this is an appropriate OSPF process ID from which routes are to be redistributed. This identifies the routing process. This value takes the form of a nonzero decimal number.</p> <p>For the <b>rip</b> keyword, no <i>process-id</i> value is needed.</p> <p>For the <b>application</b> keyword, this is the name of an application.</p> <p>By default, no process ID is defined.</p>
<b>level-1</b>	Specifies that, for IS-IS, Level 1 routes are redistributed into other IP routing protocols independently.
<b>level-1-2</b>	Specifies that, for IS-IS, both Level 1 and Level 2 routes are redistributed into other IP routing protocols.
<b>level-2</b>	Specifies that, for IS-IS, Level 2 routes are redistributed into other IP routing protocols independently.
<i>autonomous-system-number</i>	<p>(Optional) Autonomous system number for the redistributed route. The range is from 1 to 65535.</p> <ul style="list-style-type: none"> <li>4-byte autonomous system numbers are supported in the range from 1.0 to 65535.65535 in asdot notation only.</li> </ul> <p>For more details about autonomous system number formats, see the <b>router bgp</b> command.</p>
<b>metric</b> <i>metric-value</i>	(Optional) When redistributing from one OSPF process to another OSPF process on the same router, the metric will be carried through from one process to the other if no metric value is specified. When redistributing other processes to an OSPF process, the default metric is 20 when no metric value is specified. The default value is 0.
<b>metric transparent</b>	(Optional) Causes RIP to use the routing table metric for redistributed routes as the RIP metric.

<b>metric-type</b> <i>type value</i>	<p>(Optional) For OSPF, specifies the external link type associated with the default route advertised into the OSPF routing domain. It can be one of two values:</p> <ul style="list-style-type: none"> <li>• <b>1</b>—Type 1 external route</li> <li>• <b>2</b>—Type 2 external route</li> </ul> <p>If a <b>metric-type</b> is not specified, the Cisco IOS software adopts a Type 2 external route.</p> <p>For IS-IS, it can be one of two values:</p> <ul style="list-style-type: none"> <li>• <b>internal</b>—IS-IS metric that is &lt; 63.</li> <li>• <b>external</b>—IS-IS metric that is &gt; 64 &lt; 128.</li> </ul> <p>The default is <b>internal</b>.</p>
<b>match</b> { <b>internal</b>   <b>external1</b>   <b>external2</b> }	<p>(Optional) Specifies the criteria by which OSPF routes are redistributed into other routing domains. It can be one of the following:</p> <ul style="list-style-type: none"> <li>• <b>internal</b>—Routes that are internal to a specific autonomous system.</li> <li>• <b>external 1</b>—Routes that are external to the autonomous system, but are imported into OSPF as Type 1 external routes.</li> <li>• <b>external 2</b>—Routes that are external to the autonomous system, but are imported into OSPF as Type 2 external routes.</li> </ul> <p>The default is <b>internal</b>.</p>
<b>tag</b> <i>tag-value</i>	<p>(Optional) Specifies the 32-bit decimal value attached to each external route. This is not used by OSPF itself. It may be used to communicate information between Autonomous System Boundary Routers (ASBRs). If none is specified, the remote autonomous system number is used for routes from BGP and Exterior Gateway Protocol (EGP); for other protocols, zero (0) is used.</p>
<b>route-map</b>	<p>(Optional) Specifies the route map that should be interrogated to filter the importation of routes from this source routing protocol to the current routing protocol. If not specified, all routes are redistributed. If this keyword is specified, but no route map tags are listed, no routes will be imported.</p>
<i>map-tag</i>	<p>(Optional) Identifier of a configured route map.</p>
<b>subnets</b>	<p>(Optional) For redistributing routes into OSPF, the scope of redistribution for the specified protocol. By default, no subnets are defined.</p>

<b>nssa-only</b>	(Optional) Sets the nssa-only attribute for all routes redistributed into OSPF.
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**Command Default**

Route redistribution is disabled.

**Command Modes**

Router configuration (config-router)

Address family configuration (config-af)

Address family topology configuration (config-router-af-topology)

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Using the no Form of the redistribute Command****Caution**

Removing options that you have configured for the **redistribute** command requires careful use of the **no** form of the **redistribute** command to ensure that you obtain the result that you are expecting. Changing or disabling any keyword may or may not affect the state of other keywords, depending on the protocol.

It is important to understand that different protocols implement the **no** form of the **redistribute** command differently:

- In BGP, OSPF, and RIP configurations, the **no redistribute** command removes only the specified keywords from the **redistribute** commands in the running configuration. They use the *subtractive keyword* method when redistributing from other protocols. For example, in the case of BGP, if you configure **no redistribute static route-map interior**, *only the route map* is removed from the redistribution, leaving **redistribute static** in place with no filter.
- The **no redistribute isis** command removes the IS-IS redistribution from the running configuration. IS-IS removes the entire command, regardless of whether IS-IS is the redistributed or redistributing protocol.
- EIGRP used the subtractive keyword method prior to EIGRP component version rel5. Starting with EIGRP component version rel5, the **no redistribute** command removes the entire **redistribute** command when redistributing from any other protocol.
- An EIGRP routing process is configured when you issue the **router eigrp** command and then specify a network for the process using the **network** sub-command. Suppose that you have not configured an EIGRP routing process, and that you have configured redistribution of routes from such an EIGRP process into BGP, OSPF, or RIP. If you use the **no redistribute eigrp** command to change or disable a parameter in the **redistribute eigrp** command, the **no redistribute eigrp** command removes the entire **redistribute eigrp** command instead of changing or disabling a specific parameter.

**Additional Usage Guidelines for the redistribute Command**

A router receiving a link-state protocol with an internal metric will consider the cost of the route from itself to the redistributing router plus the advertised cost to reach the destination. An external metric only considers the advertised metric to reach the destination.

Routes learned from IP routing protocols can be redistributed at Level 1 into an attached area or at Level 2. The **level-1-2** keyword allows both Level 1 and Level 2 routes in a single command.

Redistributed routing information must be filtered by the **distribute-list out** router configuration command. This guideline ensures that only those routes intended by the administrator are passed along to the receiving routing protocol.

Whenever you use the **redistribute** or the **default-information** router configuration commands to redistribute routes into an OSPF routing domain, the router automatically becomes an ASBR. However, an ASBR does not, by default, generate a default route into the OSPF routing domain.

When routes are redistributed into OSPF from protocols other than OSPF or BGP, and no metric has been specified with the **metric-type** keyword and *type-value* argument, OSPF will use 20 as the default metric. When routes are redistributed into OSPF from BGP, OSPF will use 1 as the default metric. When routes are redistributed from one OSPF process to another OSPF process, autonomous system external and not-so-stubby-area (NSSA) routes will use 20 as the default metric. When intra-area and inter-area routes are redistributed between OSPF processes, the internal OSPF metric from the redistribution source process is advertised as the external metric in the redistribution destination process. (This is the only case in which the routing table metric will be preserved when routes are redistributed into OSPF.)

When routes are redistributed into OSPF, only routes that are not subnetted are redistributed if the **subnets** keyword is not specified.



---

**Note** Depending on your release the **subnets** keyword is automatically appended when you use the **redistribute** *ospf* command. This automatic addition results in the redistribution of classless OSPF routes.

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On a router internal to an NSSA area, the **nssa-only** keyword causes the originated type-7 NSSA LSAs to have their propagate (P) bit set to zero, which prevents area border routers from translating these LSAs into type-5 external LSAs. On an area border router that is connected to an NSSA and normal areas, the **nssa-only** keyword causes the routes to be redistributed only into the NSSA areas.

Routes configured with the **connected** keyword affected by this **redistribute** command are the routes not specified by the **network** router configuration command.

You cannot use the **default-metric** command to affect the metric used to advertise connected routes.



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**Note** The **metric** value specified in the **redistribute** command supersedes the **metric** value specified in the **default-metric** command.

---

The default redistribution of Interior Gateway Protocol (IGP) or Exterior Gateway Protocol (EGP) into BGP is not allowed unless the **default-information originate** router configuration command is specified.

#### 4-Byte Autonomous System Number Support

The Cisco implementation of 4-byte autonomous system numbers uses asplain—65538 for example—as the default regular expression match and output display format for autonomous system numbers, but you can configure 4-byte autonomous system numbers in both the asplain format and the asdot format as described in RFC 5396. To change the default regular expression match and output display of 4-byte autonomous system numbers to asdot format, use the **bgp asnotation dot** command.

## Examples

The following example shows how OSPF routes are redistributed into a BGP domain:

```
Device(config)# router bgp 109
Device(config-router)# redistribute ospf
```

The following example shows how to redistribute EIGRP routes into an OSPF domain:

```
Device(config)# router ospf 110
Device(config-router)# redistribute eigrp
```

The following example shows how to redistribute the specified EIGRP process routes into an OSPF domain. The EIGRP-derived metric will be remapped to 100 and RIP routes to 200.

```
Device(config)# router ospf 109
Device(config-router)# redistribute eigrp 108 metric 100 subnets
Device(config-router)# redistribute rip metric 200 subnets
```

The following example shows how to configure BGP routes to be redistributed into IS-IS. The link-state cost is specified as 5, and the metric type is set to external, indicating that it has lower priority than internal metrics.

```
Device(config)# router isis
Device(config-router)# redistribute bgp 120 metric 5 metric-type external
```

The following example shows how to redistribute an application into an OSPF domain and specify a metric value of 5:

```
Device(config)# router ospf 4
Device(config-router)# redistribute application am metric 5
```

In the following example, network 172.16.0.0 will appear as an external LSA in OSPF 1 with a cost of 100 (the cost is preserved):

```
Device(config)# interface ethernet 0
Device(config-if)# ip address 172.16.0.1 255.0.0.0
Device(config-if)# exit
Device(config)# ip ospf cost 100
Device(config)# interface ethernet 1
Device(config-if)# ip address 10.0.0.1 255.0.0.0
!
Device(config)# router ospf 1
Device(config-router)# network 10.0.0.0 0.255.255.255 area 0
Device(config-router)# exit
Device(config-router)# redistribute ospf 2 subnet
Device(config)# router ospf 2
Device(config-router)# network 172.16.0.0 0.255.255.255 area 0
```

The following example shows how BGP routes are redistributed into OSPF and assigned the local 4-byte autonomous system number in asplain format.

```
Device(config)# router ospf 2
Device(config-router)# redistribute bgp 65538
```

The following example shows how to remove the **connected metric 1000 subnets** options from the **redistribute connected metric 1000 subnets** command and leave the **redistribute connected** command in the configuration:

```
Device(config-router)# no redistribute connected metric 1000 subnets
```

The following example shows how to remove the **metric 1000** options from the **redistribute connected metric 1000 subnets** command and leave the **redistribute connected subnets** command in the configuration:

```
Device(config-router)# no redistribute connected metric 1000
```

The following example shows how to remove the **subnets** option from the **redistribute connected metric 1000 subnets** command and leave the **redistribute connected metric 1000** command in the configuration:

```
Device(config-router)# no redistribute connected subnets
```

The following example shows how to remove the **redistribute connected** command, and any of the options that were configured for the **redistribute connected** command, from the configuration:

```
Device(config-router)# no redistribute connected
```

The following example shows how EIGRP routes are redistributed into an EIGRP process in a named EIGRP configuration:

```
Device(config)# router eigrp virtual-name
Device(config-router)# address-family ipv4 autonomous-system 1
Device(config-router-af)# topology base
Device(config-router-af-topology)# redistribute eigrp 6473 metric 1 1 1 1 1
```

The following example shows how to set and disable the redistributions in EIGRP configuration. Note that, in the case of EIGRP, the **no** form of the commands removes the entire set of **redistribute** commands from the running configuration.

```
Device(config)# router eigrp 1
Device(config-router)# network 0.0.0.0
Device(config-router)# redistribute eigrp 2 route-map x
Device(config-router)# redistribute ospf 1 route-map x
Device(config-router)# redistribute bgp 1 route-map x
Device(config-router)# redistribute isis level-2 route-map x
Device(config-router)# redistribute rip route-map x

Device(config)# router eigrp 1
Device(config-router)# no redistribute eigrp 2 route-map x
Device(config-router)# no redistribute ospf 1 route-map x
Device(config-router)# no redistribute bgp 1 route-map x
Device(config-router)# no redistribute isis level-2 route-map x
Device(config-router)# no redistribute rip route-map x
Device(config-router)# end
```

```
Device# show running-config | section router eigrp 1
```

```
router eigrp 1
 network 0.0.0.0
```

The following example shows how to set and disable the redistributions in OSPF configuration. Note that the **no** form of the commands removes only the specified keywords from the **redistribute** command in the running configuration.

```

Device(config)# router ospf 1
Device(config-router)# network 0.0.0.0
Device(config-router)# redistribute eigrp 2 route-map x
Device(config-router)# redistribute ospf 1 route-map x
Device(config-router)# redistribute bgp 1 route-map x
Device(config-router)# redistribute isis level-2 route-map x
Device(config-router)# redistribute rip route-map x

Device(config)# router ospf 1
Device(config-router)# no redistribute eigrp 2 route-map x
Device(config-router)# no redistribute ospf 1 route-map x
Device(config-router)# no redistribute bgp 1 route-map x
Device(config-router)# no redistribute isis level-2 route-map x
Device(config-router)# no redistribute rip route-map x
Device(config-router)# end

Device# show running-config | section router ospf 1

router ospf 1
 redistribute eigrp 2
 redistribute ospf 1
 redistribute bgp 1
 redistribute rip
 network 0.0.0.0

```

The following example shows how to remove only the route map filter from the redistribution in BGP; redistribution itself remains in force without a filter:

```

Device(config)# router bgp 65000
Device(config-router)# no redistribute eigrp 2 route-map x

```

The following example shows how to remove the EIGRP redistribution to BGP:

```

Device(config)# router bgp 65000
Device(config-router)# no redistribute eigrp 2

```

## Related Commands

Command	Description
<b>default-information originate (OSPF)</b>	Generates a default route into an OSPF routing domain.
<b>router bgp</b>	Configures the BGP routing process.
<b>router eigrp</b>	Configures the EIGRP address-family process.



# route-map

To define conditions for redistributing routes from one routing protocol to another routing protocol, or to enable policy routing, use the **route-map** command in global configuration mode. To delete an entry, use the **no** form of this command.

```
route-map map-tag [permit | deny] [sequence-number] ordering-seq sequence-name
no route-map map-tag [permit | deny] [sequence-number] ordering-seq sequence-name
```

Syntax Description		
<i>map-tag</i>		Name for the route map.
<b>permit</b>		(Optional) Permits only the routes matching the route map to be forwarded or redistributed.
<b>deny</b>		(Optional) Blocks routes matching the route map from being forwarded or redistributed.
<i>sequence-number</i>		(Optional) Number that indicates the position a new route map will have in the list of route maps already configured with the same name.
<b>ordering-seq</b> <i>sequence-name</i>		(Optional) Orders the route maps based on the string provided.

**Command Default** Policy routing is not enabled, and conditions for redistributing routes from one routing protocol to another routing protocol are not configured.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **route-map** command to enter route-map configuration mode.

Use route maps to redistribute routes, or to subject packets to policy routing. Both these purposes are described here.

## Redistribution

Use the **route-map** global configuration command and the **match** and **set** route-map configuration commands to define the conditions for redistributing routes from one routing protocol to another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria*, that is, the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions*, that is, the redistribution actions to be performed if the criteria enforced by the **match** commands are met. If the **route-map** command is enabled and the user does not specify any action, then the **permit** action is applied by default. The **no route-map** command deletes the route map.

The **match** route-map configuration command has multiple formats. The **match** commands can be run in any order, and all the **match** commands must match to cause the route to be redistributed according to the *set actions* specified with the **set** commands. The **no** forms of the **match** commands remove the specified match criteria.

Use route maps when you want detailed control over how routes are redistributed between routing processes. The destination routing protocol is the one you specify with the **router** global configuration command. The source routing protocol is the one you specify with the **redistribute** router configuration command. See the examples section for an illustration of how route maps are configured.

When passing routes through a route map, the route map can have several parts. Any route that does not match at least one **match** clause relating to a **route-map** command is ignored, that is, the route is not advertised for outbound route maps, and is not accepted for inbound route maps. If you want to modify only some data, configure a second route map section with an explicit match specified.

The **redistribute** router configuration command uses the name specified by the *map-tag* argument to reference a route map. Multiple route maps can share the same map tag name.

If the match criteria are met for this route map, and the **permit** keyword is specified, the route is redistributed as controlled by the set actions. In the case of policy routing, the packet is policy routed. If the match criteria are not met, and the **permit** keyword is specified, the next route map with the same map tag is tested. If a route passes none of the match criteria for the set of route maps sharing the same name, it is not redistributed by that set.

If the match criteria are met for the route map, and the **deny** keyword is specified, the route is not redistributed. In the case of policy routing, the packet is not policy routed, and no other route maps sharing the same map tag name are examined. If the packet is not policy routed, the normal forwarding algorithm is used.

### Policy Routing

Another purpose of route maps is to enable policy routing. Use the **ip policy route-map** or **ipv6 policy route-map** command in addition to the **route-map** command, and the **match** and **set** commands to define the conditions for policy-routing packets. The **match** commands specify the conditions under which policy routing occurs. The **set** commands specify the routing actions to be performed if the criteria enforced by the **match** commands are met. We recommend that you policy route packets some way other than the obvious shortest path.

The *sequence-number* argument works as follows:

- If no entry is defined with the supplied tag, an entry is created with the *sequence-number* argument set to 10.
- If only one entry is defined with the supplied tag, that entry becomes the default entry for the **route-map** command. The *sequence-number* argument of this entry is unchanged.
- If more than one entry is defined with the supplied tag, an error message is displayed to indicate that the *sequence-number* argument is required.

If the **no route-map map-tag** command is specified (without the *sequence-number* argument), the entire route map is deleted.

### Examples

The following example shows how to redistribute Routing Information Protocol (RIP) routes with a hop count equal to 1 to the Open Shortest Path First (OSPF). These routes will be redistributed to the OSPF as external link-state advertisements (LSAs) with a metric of 5, metric type of type1, and a tag equal to 1.

```
Device> enable
Device# configure terminal
Device(config)# router ospf 109
Device(config-router)# redistribute rip route-map rip-to-ospf
Device(config-router)# exit
Device(config)# route-map rip-to-ospf permit
```

```
Device(config-route-map)# match metric 1
Device(config-route-map)# set metric 5
Device(config-route-map)# set metric-type type1
Device(config-route-map)# set tag 1
```

The following example for IPv6 shows how to redistribute RIP routes with a hop count equal to 1 to the OSPF. These routes will be redistributed to the OSPF as external LSAs, with a tag equal to 42, and a metric type equal to type1.

```
Device> enable
Device# configure terminal
Device(config)# ipv6 router ospf 1
Device(config-router)# redistribute rip one route-map rip-to-ospfv3
Device(config-router)# exit
Device(config)# route-map rip-to-ospfv3
Device(config-route-map)# match tag 42
Device(config-route-map)# set metric-type type1
```

The following named configuration example shows how to redistribute Enhanced Interior Gateway Routing Protocol (EIGRP) addresses with a hop count equal to 1. These addresses are redistributed to the EIGRP as external, with a metric of 5, and a tag equal to 1:

```
Device> enable
Device# configure terminal
Device(config)# router eigrp virtual-name1
Device(config-router)# address-family ipv4 autonomous-system 4453
Device(config-router-af)# topology base
Device(config-router-af-topology)# redistribute eigrp 6473 route-map
virtual-name1-to-virtual-name2
Device(config-router-af-topology)# exit-address-topology
Device(config-router-af)# exit-address-family
Device(config-router)# router eigrp virtual-name2
Device(config-router)# address-family ipv4 autonomous-system 6473
Device(config-router-af)# topology base
Device(config-router-af-topology)# exit-af-topology
Device(config-router-af)# exit-address-family
Device(config)# route-map virtual-name1-to-virtual-name2
Device(config-route-map)# match tag 42
Device(config-route-map)# set metric 5
Device(config-route-map)# set tag 1
```

#### Related Commands

Command	Description
<b>ip policy route-map</b>	Identifies a route map to use for policy routing on an interface.
<b>ipv6 policy route-map</b>	Configures IPv6 PBR on an interface.
<b>match</b>	Matches values from the routing table.
<b>router eigrp</b>	Configures the EIGRP address-family process.
<b>set</b>	Sets values in the destination routing protocol
<b>show route-map</b>	Displays all route maps configured or only the one specified.

# router-id

To use a fixed router ID, use the **router-id** command in router configuration mode. To force Open Shortest Path First (OSPF) to use the previous OSPF router ID behavior, use the **no** form of this command.

**router-id** *ip-address*

**no router-id** *ip-address*

## Syntax Description

<i>ip-address</i>	Router ID in IP address format.
-------------------	---------------------------------

## Command Default

No OSPF routing process is defined.

## Command Modes

Router configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

You can configure an arbitrary value in the IP address format for each router. However, each router ID must be unique.

If this command is used on an OSPF router process which is already active (has neighbors), the new router-ID is used at the next reload or at a manual OSPF process restart. To manually restart the OSPF process, use the clear ip ospf command.

## Examples

The following example specifies a fixed router-id:

```
router-id 10.1.1.1
```

## Related Commands

Command	Description
<b>clear ip ospf</b>	Clears redistribution based on the OSPF routing process ID.
<b>router ospf</b>	Configures the OSPF routing process.

# router bgp

To configure the Border Gateway Protocol (BGP) routing process, use the **router bgp** command in global configuration mode. To remove a BGP routing process, use the **no** form of this command.

**router bgp** *autonomous-system-number*  
**no router bgp** *autonomous-system-number*

## Syntax Description

<i>autonomous-system-number</i>	Number of an autonomous system that identifies the router to other BGP routers and tags the routing information that is passed along. Number in the range from 1 to 65535.
---------------------------------	--

## Command Default

No BGP routing process is enabled by default.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Gibraltar 16.12.1	This command was introduced.

## Usage Guidelines

This command allows you to set up a distributed routing core that automatically guarantees the loop-free exchange of routing information between autonomous systems.

Cisco has implemented the following two methods of representing autonomous system numbers:

- **Asplain**—Decimal value notation where both 2-byte and 4-byte autonomous system numbers are represented by their decimal value. For example, 65526 is a 2-byte autonomous system number and 234567 is a 4-byte autonomous system number.
- **Asdot**—Autonomous system dot notation where 2-byte autonomous system numbers are represented by their decimal value and 4-byte autonomous system numbers are represented by a dot notation. For example, 65526 is a 2-byte autonomous system number and 1.169031 is a 4-byte autonomous system number (this is dot notation for the 234567 decimal number).

For details about the third method of representing autonomous system numbers, see [RFC 5396](#).



### Note

In Cisco IOS releases that include 4-byte ASN support, command accounting and command authorization that include a 4-byte ASN number are sent in the asplain notation irrespective of the format that is used on the command-line interface.

### Asplain as Default Autonomous System Number Formatting

The Cisco implementation of 4-byte autonomous system numbers uses asplain as the default display format for autonomous system numbers, but you can configure 4-byte autonomous system numbers in both the asplain and asdot format. In addition, the default format for matching 4-byte autonomous system numbers in regular expressions is asplain, so you must ensure that any regular expressions to match 4-byte autonomous system numbers are written in the asplain format. If you want to change the default **show** command output to display 4-byte autonomous system numbers in the asdot format, use the **bgp asnotation dot** command under router

configuration mode. When the asdot format is enabled as the default, any regular expressions to match 4-byte autonomous system numbers must be written using the asdot format, or the regular expression match will fail. The tables below show that although you can configure 4-byte autonomous system numbers in either asplain or asdot format, only one format is used to display **show** command output and control 4-byte autonomous system number matching for regular expressions, and the default is asplain format. To display 4-byte autonomous system numbers in **show** command output and to control matching for regular expressions in the asdot format, you must configure the **bgp asnotation dot** command. After enabling the **bgp asnotation dot** command, a hard reset must be initiated for all BGP sessions by entering the **clear ip bgp \*** command.



**Note** If you are upgrading to an image that supports 4-byte autonomous system numbers, you can still use 2-byte autonomous system numbers. The **show** command output and regular expression match are not changed and remain in asplain (decimal value) format for 2-byte autonomous system numbers regardless of the format configured for 4-byte autonomous system numbers.

**Table 129: Default Asplain 4-Byte Autonomous System Number Format**

Format	Configuration Format	Show Command Output and Regular Expression Match Format
asplain	2-byte: 1 to 65535 4-byte: 65536 to 4294967295	2-byte: 1 to 65535 4-byte: 65536 to 4294967295
asdot	2-byte: 1 to 65535 4-byte: 1.0 to 65535.65535	2-byte: 1 to 65535 4-byte: 65536 to 4294967295

**Table 130: Asdot 4-Byte Autonomous System Number Format**

Format	Configuration Format	Show Command Output and Regular Expression Match Format
asplain	2-byte: 1 to 65535 4-byte: 65536 to 4294967295	2-byte: 1 to 65535 4-byte: 1.0 to 65535.65535
asdot	2-byte: 1 to 65535 4-byte: 1.0 to 65535.65535	2-byte: 1 to 65535 4-byte: 1.0 to 65535.65535

### Reserved and Private Autonomous System Numbers

The Cisco implementation of BGP supports [RFC 4893](#). RFC 4893 was developed to allow BGP to support a gradual transition from 2-byte autonomous system numbers to 4-byte autonomous system numbers. A new reserved (private) autonomous system number, 23456, was created by RFC 4893 and this number cannot be configured as an autonomous system number in the Cisco IOS CLI.

[RFC 5398](#), *Autonomous System (AS) Number Reservation for Documentation Use*, describes new reserved autonomous system numbers for documentation purposes. Use of the reserved numbers allow configuration examples to be accurately documented and avoids conflict with production networks if these configurations are literally copied. The reserved numbers are documented in the IANA autonomous system number registry. Reserved 2-byte autonomous system numbers are in the contiguous block, 64496 to 64511 and reserved 4-byte autonomous system numbers are from 65536 to 65551 inclusive.

Private 2-byte autonomous system numbers are still valid in the range from 64512 to 65534 with 65535 being reserved for special use. Private autonomous system numbers can be used for internal routing domains but must be translated for traffic that is routed out to the Internet. BGP should not be configured to advertise

private autonomous system numbers to external networks. Cisco IOS software does not remove private autonomous system numbers from routing updates by default. Cisco recommends that ISPs filter private autonomous system numbers.



**Note** Autonomous system number assignment for public and private networks is governed by the IANA. For information about autonomous system numbers, including reserved number assignment, or to apply to register an autonomous system number, see the following URL: <http://www.iana.org/>.

## Examples

The following example shows how to configure a BGP process for autonomous system 45000 and configures two external BGP neighbors in different autonomous systems using 2-byte autonomous system numbers:

```
Device> enable
Device# configure terminal
Device(config)# router bgp 45000
Device(config-router)# neighbor 192.168.1.2 remote-as 40000
Device(config-router)# neighbor 192.168.3.2 remote-as 50000
Device(config-router)# neighbor 192.168.3.2 description finance
Device(config-router)# address-family ipv4
Device(config-router-af)# neighbor 192.168.1.2 activate
Device(config-router-af)# neighbor 192.168.3.2 activate
Device(config-router-af)# no auto-summary
Device(config-router-af)# no synchronization
Device(config-router-af)# network 172.17.1.0 mask 255.255.255.0
Device(config-router-af)# exit-address-family
```

The following example shows how to configure a BGP process for autonomous system 65538 and configures two external BGP neighbors in different autonomous systems using 4-byte autonomous system numbers in asplain notation. This example is supported in Cisco IOS Release 12.0(32)SY8, 12.0(33)S3, 12.2(33)SRE, 12.2(33)XNE, 12.2(33)SXH, Cisco IOS XE Release 2.4, and later releases.

```
Device> enable
Device# configure terminal
Device(config)# router bgp 65538
Device(config-router)# neighbor 192.168.1.2 remote-as 65536
Device(config-router)# neighbor 192.168.3.2 remote-as 65550
Device(config-router)# neighbor 192.168.3.2 description finance
Device(config-router)# address-family ipv4
Device(config-router-af)# neighbor 192.168.1.2 activate
Device(config-router-af)# neighbor 192.168.3.2 activate
Device(config-router-af)# no auto-summary
Device(config-router-af)# no synchronization
Device(config-router-af)# network 172.17.1.0 mask 255.255.255.0
Device(config-router-af)# exit-address-family
```

## Related Commands

Command	Description
<b>neighbor remote-as</b>	Adds an entry to the BGP or multiprotocol BGP neighbor table.
<b>network (BGP and multiprotocol BGP)</b>	Specifies the list of networks for the BGP routing process.

# router eigrp

To configure the EIGRP routing process, use the **router eigrp** command in global configuration mode. To remove an EIGRP routing process, use the **no** form of this command.

**router eigrp** *autonomous-system-number**virtual-instance-name*  
**no router eigrp** *autonomous-system-number**virtual-instance-name*

## Syntax Description

<i>autonomous-system-number</i>	Autonomous system number that identifies the EIGRP services to the other EIGRP address-family routers. It is also used to tag routing information. Valid range is from 1 to 65535.
<i>virtual-instance-name</i>	EIGRP virtual instance name. This name must be unique among all the address-family router processes on a single router, but need not be unique among routers.

## Command Default

No EIGRP processes are configured.

## Command Modes

Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Configuring the **router eigrp** command with the *autonomous-system-number* argument creates an EIGRP configuration referred to as autonomous system (AS) configuration. An EIGRP AS configuration creates an EIGRP routing instance that can be used for tagging routing information.

Configuring the **router eigrp** command with the *virtual-instance-name* argument creates an EIGRP configuration referred to as EIGRP named configuration. An EIGRP named configuration does not create an EIGRP routing instance by itself. An EIGRP named configuration is a base configuration that is required to define address-family configurations under it that are used for routing.

## Examples

The following example shows how to configure EIGRP process 109:

```
Device> enable
Device# configure terminal
Device(config)# router eigrp 109
```

The following example configures an EIGRP address-family routing process and assigns it the name *virtual-name*:

```
Device> enable
Device# configure terminal
Device(config)# router eigrp virtual-name
```



# router ospf

To configure an OSPF routing process, use the **router ospf** command in global configuration mode. To terminate an OSPF routing process, use the **no** form of this command.

```
router ospf process-id [vrf vrf-name]
no router ospf process-id [vrf vrf-name]
```

Syntax Description	
<i>process-id</i>	Internally used identification parameter for an OSPF routing process. It is locally assigned, and can be a positive integer. A unique value is assigned for each OSPF routing process.
<b>vrf</b> <i>vrf-name</i>	(Optional) Specifies the name of the VPN routing and forwarding (VRF) instance to associate with the OSPF VRF processes.

**Command Default** No OSPF routing process is defined.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You can specify multiple OSPF routing processes in each router.

After you enter the **router ospf** command, you can enter the maximum number of paths. There can be between 1 and 32 paths.

## Examples

The following example shows how to configure an OSPF routing process and assign a process number of 109:

```
Device(config)# router ospf 109
```

The following example shows a basic OSPF configuration using the **router ospf** command to configure the OSPF VRF instance processes for the first, second, and third VRFs:

```
Device> enable
Device# configure terminal
Device(config)# router ospf 12 vrf first
Device(config)# router ospf 13 vrf second
Device(config)# router ospf 14 vrf third
Device(config)# exit
```

The following example shows how to use the **maximum-paths** option:

```
Device> enable
Device# configure terminal
Device(config)# router ospf
Device(config-router)# maximum-paths 2
Device(config-router)# exit
```

---

**Related Commands**

Command	Description
<b>network area</b>	Defines the interfaces on which OSPF runs, and defines the area ID for those interfaces.

# send-lifetime

To set the time period during which an authentication key on a key chain is valid to be sent, use the **send-lifetime** command in key chain key configuration mode. To revert to the default value, use the **no** form of this command.

```
send-lifetime [ local ] start-time infinite end-time | duration seconds
no send-lifetime
```

Syntax Description	local	Specifies the time in local timezone.
	<i>start-time</i>	Beginning time that the key specified by the <b>key</b> command is valid to be sent. The syntax can be either of the following:  <i>hh : mm : ss month date year</i> <i>hh : mm : ss date month year</i> <ul style="list-style-type: none"> <li>• <i>hh</i>: Hours</li> <li>• <i>mm</i>: Minutes</li> <li>• <i>ss</i>: Seconds</li> <li>• <i>month</i>: First three letters of the month</li> <li>• <i>date</i>: Date (1-31)</li> <li>• <i>year</i>: Year (four digits)</li> </ul> <p>The default start time and the earliest acceptable date is January 1, 1993.</p>
	<b>infinite</b>	Key is valid to be sent from the <i>start-time</i> value on.
	<i>end-time</i>	Key is valid to be sent from the <i>start-time</i> value until the <i>end-time</i> value. The syntax is the same as that for the <i>start-time</i> value. The <i>end-time</i> value must be after the <i>start-time</i> value. The default end time is an infinite time period.
	<b>duration</b> <i>seconds</i>	Length of time (in seconds) that the key is valid to be sent. The range is from 1 to 864000.

**Command Default** Forever (the starting time is January 1, 1993, and the ending time is infinite)

**Command Modes** Key chain key configuration (config-keychain-key)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Specify a *start-time* value and one of the following values: **infinite**, *end-time*, or **duration** *seconds*.

We recommend running Network Time Protocol (NTP) or some other time synchronization method if you intend to set lifetimes on keys.

If the last key expires, authentication will continue and an error message will be generated. To disable authentication, you must manually delete the last valid key.

## Examples

The following example configures a key chain named chain1. The key named key1 will be accepted from 1:30 p.m. to 3:30 p.m. and be sent from 2:00 p.m. to 3:00 p.m. The key named key2 will be accepted from 2:30 p.m. to 4:30 p.m. and be sent from 3:00 p.m. to 4:00 p.m. The overlap allows for migration of keys or a discrepancy in the set time of the router. There is a 30-minute leeway on each side to handle time differences.

```
Device(config)# interface GigabitEthernet1/0/1
Device(config-if)# ip rip authentication key-chain chain1
Device(config-if)# ip rip authentication mode md5
Device(config-if)# exit
Device(config)# router rip
Device(config-router)# network 172.19.0.0
Device(config-router)# version 2
Device(config-router)# exit
Device(config)# key chain chain1
Device(config-keychain)# key 1
Device(config-keychain-key)# key-string key1
Device(config-keychain-key)# accept-lifetime 13:30:00 Jan 25 1996 duration 7200
Device(config-keychain-key)# send-lifetime 14:00:00 Jan 25 1996 duration 3600
Device(config-keychain-key)# exit
Device(config-keychain)# key 2
Device(config-keychain)# key-string key2
Device(config-keychain)# accept-lifetime 14:30:00 Jan 25 1996 duration 7200
Device(config-keychain)# send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

The following example configures a key chain named chain1 for EIGRP address-family. The key named key1 will be accepted from 1:30 p.m. to 3:30 p.m. and be sent from 2:00 p.m. to 3:00 p.m. The key named key2 will be accepted from 2:30 p.m. to 4:30 p.m. and be sent from 3:00 p.m. to 4:00 p.m. The overlap allows for migration of keys or a discrepancy in the set time of the router. There is a 30-minute leeway on each side to handle time differences.

```
Device(config)# router eigrp 10
Device(config-router)# address-family ipv4 autonomous-system 4453
Device(config-router-af)# network 10.0.0.0
Device(config-router-af)# af-interface ethernet0/0
Device(config-router-af-interface)# authentication key-chain trees
Device(config-router-af-interface)# authentication mode md5
Device(config-router-af-interface)# exit
Device(config-router-af)# exit
Device(config-router)# exit
Device(config)# key chain chain1
Device(config-keychain)# key 1
Device(config-keychain-key)# key-string key1
Device(config-keychain-key)# accept-lifetime 13:30:00 Jan 25 1996 duration 7200
Device(config-keychain-key)# send-lifetime 14:00:00 Jan 25 1996 duration 3600
Device(config-keychain-key)# exit
Device(config-keychain)# key 2
Device(config-keychain-key)# key-string key2
Device(config-keychain-key)# accept-lifetime 14:30:00 Jan 25 1996 duration 7200
Device(config-keychain-key)# send-lifetime 15:00:00 Jan 25 1996 duration 3600
```

## Related Commands

Command	Description
<b>accept-lifetime</b>	Sets the time period during which the authentication key on a key chain is received as valid.

<b>Command</b>	<b>Description</b>
<b>key</b>	Identifies an authentication key on a key chain.
<b>key chain</b>	Defines an authentication key chain needed to enable authentication for routing protocols.
<b>key-string (authentication)</b>	Specifies the authentication string for a key.
<b>show key chain</b>	Displays authentication key information.

# set community

To set the BGP communities attribute, use the **set community** route map configuration command. To delete the entry, use the **no** form of this command.

**set community** *community-number* [**additive**] [*well-known-community*] | **none**  
**no set community**

## Syntax Description

<i>community-number</i>	Specifies that community number. Valid values are from 1 to 4294967200, <b>no-export</b> , or <b>no-advertise</b> .
<b>additive</b>	(Optional) Adds the community to the already existing communities.
<i>well-known-community</i>	(Optional) Well know communities can be specified by using the following keywords: <ul style="list-style-type: none"> <li>• internet</li> <li>• local-as</li> <li>• no-advertise</li> <li>• no-export</li> </ul>
<b>none</b>	(Optional) Removes the community attribute from the prefixes that pass the route map.

## Command Default

No BGP communities attributes exist.

## Command Modes

Route-map configuration (config-route-map)

## Command History

*Table 131:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

You must have a match clause (even if it points to a “permit everything” list) if you want to set tags.

Use the **route-map** global configuration command, and the **match** and **set** route map configuration commands, to define the conditions for redistributing routes from one routing protocol into another. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria* --the conditions under which redistribution is allowed for the current **route-map** command. The **set** commands specify the *set actions* --the particular redistribution actions to perform if the criteria enforced by the **match** commands are met. The **no route-map** command deletes the route map.

The **set** route map configuration commands specify the redistribution *set actions* to be performed when all of the match criteria of a route map are met. When all match criteria are met, all set actions are performed.

## Examples

In the following example, routes that pass the autonomous system path access list 1 have the community set to 109. Routes that pass the autonomous system path access list 2 have the community set to no-export (these routes will not be advertised to any external BGP [eBGP] peers).

```
route-map set_community 10 permit
match as-path 1
set community 109
route-map set_community 20 permit
match as-path 2
set community no-export
```

In the following similar example, routes that pass the autonomous system path access list 1 have the community set to 109. Routes that pass the autonomous system path access list 2 have the community set to local-as (the router will not advertise this route to peers outside the local autonomous system).

```
route-map set_community 10 permit
match as-path 1
set community 109
route-map set_community 20 permit
match as-path 2
set community local-as
```

## Related Commands

Command	Description
<b>ip community-list</b>	Creates a community list for BGP and control access to it.
<b>match community</b>	Matches a BGP community.
<b>route-map (IP)</b>	Defines the conditions for redistributing routes from one routing protocol into another, or enables policy routing.
<b>set comm-list delete</b>	Removes communities from the community attribute of an inbound or outbound update.
<b>show ip bgp community</b>	Displays routes that belong to specified BGP communities.

## set ip next-hop (BGP)

To indicate where to output packets that pass a match clause of a route map for policy routing, use the **set ip next-hop** command in route-map configuration mode. To delete an entry, use the **no** form of this command.

```
set ip next-hop ip-address[...ip-address][peer-address]
no set ip next-hop ip-address[...ip-address][peer-address]
```

### Syntax Description

<i>ip-address</i>	IP address of the next hop to which packets are output. It need not be an adjacent router.
<b>peer-address</b>	(Optional) Sets the next hop to be the BGP peering address.

### Command Default

This command is disabled by default.

### Command Modes

Route-map configuration (config-route-map)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

An ellipsis (...) in the command syntax indicates that your command input can include multiple values for the *ip-address* argument.

Use the **ip policy route-map** interface configuration command, the **route-map** global configuration command, and the **match** and **set** route-map configuration commands to define the conditions for policy routing packets. The **ip policy route-map** command identifies a route map by name. Each **route-map** command has a list of **match** and **set** commands associated with it. The **match** commands specify the *match criteria* --the conditions under which policy routing occurs. The **set** commands specify the *set actions* --the particular routing actions to perform if the criteria enforced by the **match** commands are met.

If the first next hop specified with the **set ip next-hop** command is down, the optionally specified IP addresses are tried in turn.

When the **set ip next-hop** command is used with the **peer-address** keyword in an inbound route map of a BGP peer, the next hop of the received matching routes will be set to be the neighbor peering address, overriding any third-party next hops. So the same route map can be applied to multiple BGP peers to override third-party next hops.

When the **set ip next-hop** command is used with the **peer-address** keyword in an outbound route map of a BGP peer, the next hop of the advertised matching routes will be set to be the peering address of the local router, thus disabling the next hop calculation. The **set ip next-hop** command has finer granularity than the (per-neighbor) **neighbor next-hop-self** command, because you can set the next hop for some routes, but not others. The **neighbor next-hop-self** command sets the next hop for all routes sent to that neighbor.

The set clauses can be used in conjunction with one another. They are evaluated in the following order:

1. **set ip next-hop**
2. **set interface**
3. **set ip default next-hop**



#### 4. set default interface



**Note** To avoid a common configuration error for reflected routes, do not use the **set ip next-hop** command in a route map to be applied to BGP route reflector clients.

Configuring the **set ip next-hop ...ip-address** command on a VRF interface allows the next hop to be looked up in a specified VRF address family. In this context, the *...ip-address* argument matches that of the specified VRF instance.

#### Examples

In the following example, three routers are on the same FDDI LAN (with IP addresses 10.1.1.1, 10.1.1.2, and 10.1.1.3). Each is in a different autonomous system. The **set ip next-hop peer-address** command specifies that traffic from the router (10.1.1.3) in remote autonomous system 300 for the router (10.1.1.1) in remote autonomous system 100 that matches the route map is passed through the router `bgp 200`, rather than sent directly to the router (10.1.1.1) in autonomous system 100 over their mutual connection to the LAN.

```
Device(config)#router bgp 200
Device(config)#neighbor 10.1.1.3 remote-as 300
Device(config)#neighbor 10.1.1.3 route-map set-peer-address out
Device(config)#neighbor 10.1.1.1 remote-as 100
Device(config)#route-map set-peer-address permit 10
Device(config)#set ip next-hop peer-address
```

#### Related Commands

Command	Description
<b>ip policy route-map</b>	Identifies a route map to use for policy routing on an interface.
<b>match ip address</b>	Distributes any routes that have a destination network number address that is permitted by a standard or extended access list, and performs policy routing on packets.
<b>match length</b>	Bases policy routing on the Level 3 length of a packet.
<b>neighbor next-hop-self</b>	Disables next hop processing of BGP updates on the router.
<b>route-map (IP)</b>	Defines the conditions for redistributing routes from one routing protocol to another, or enables policy routing.
<b>set default interface</b>	Indicates where to output packets that pass a match clause of a route map for policy routing and that have no explicit route to the destination.
<b>set interface</b>	Indicates where to output packets that pass a match clause of a route map for policy routing.
<b>set ip default next-hop</b>	Indicates where to output packets that pass a match clause of a route map for policy routing and for which the Cisco IOS software has no explicit route to a destination.

## show ip bgp

To display entries in the Border Gateway Protocol (BGP) routing table, use the **show ip bgp** command in user EXEC or privileged EXEC mode.

**show ip bgp** [*ip-address* [*mask* [**longer-prefixes** [**injected**] | **shorter-prefixes** [*length*] | **bestpath** | **multipaths** | **subnets**] | **bestpath** | **multipaths**] | **all** | **oer-paths** | **prefix-list** *name* | **pending-prefixes** | **route-map** *name* | **version** *version-number* | **recent** *offset-value*]

### Syntax Description

<i>ip-address</i>	(Optional) IP address entered to filter the output to display only a particular host or network in the BGP routing table.
<i>mask</i>	(Optional) Mask to filter or match hosts that are part of the specified network.
<b>longer-prefixes</b>	(Optional) Displays the specified route and all more-specific routes.
<b>injected</b>	(Optional) Displays more-specific prefixes injected into the BGP routing table.
<b>shorter-prefixes</b>	(Optional) Displays the specified route and all less-specific routes.
<i>length</i>	(Optional) The prefix length. The range is a number from 0 to 32.
<b>bestpath</b>	(Optional) Displays the best path for this prefix.
<b>multipaths</b>	(Optional) Displays multipaths for this prefix.
<b>subnets</b>	(Optional) Displays the subnet routes for the specified prefix.
<b>all</b>	(Optional) Displays all address family information in the BGP routing table.
<b>oer-paths</b>	(Optional) Displays Optimized Edge Routing (OER) controlled prefixes in the BGP routing table.
<b>prefix-list</b> <i>name</i>	(Optional) Filters the output based on the specified prefix list.
<b>pending-prefixes</b>	(Optional) Displays prefixes that are pending deletion from the BGP routing table.
<b>route-map</b> <i>name</i>	(Optional) Filters the output based on the specified route map.
<b>version</b> <i>version-number</i>	(Optional) Displays all prefixes with network versions greater than or equal to the specified version number. The range is from 1 to 4294967295.
<b>recent</b> <i>offset-value</i>	(Optional) Displays the offset from the current routing table version. The range is from 1 to 4294967295.

### Command Modes

User EXEC (>)

Privileged EXEC (#)

**Command History****Table 132:**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

The **show ip bgp** command is used to display the contents of the BGP routing table. The output can be filtered to display entries for a specific prefix, prefix length, and prefixes injected through a prefix list, route map, or conditional advertisement.

When changes are made to the network address, the network version number is incremented. Use the **version** keyword to view a specific network version.

In Cisco IOS Release 12.0(32)SY8, 12.0(33)S3, 12.2(33)SRE, 12.2(33)XNE, 12.2(33)SX11, Cisco IOS XE Release 2.4, and later releases, the Cisco implementation of 4-byte autonomous system numbers uses `asplain`—65538, for example—as the default regular expression match and output display format for autonomous system numbers, but you can configure 4-byte autonomous system numbers in both the `asplain` format and the `asdot` format as described in RFC 5396. To change the default regular expression match and output display of 4-byte autonomous system numbers to `asdot` format, use the **bgp asnotation dot** command followed by the **clear ip bgp \*** command to perform a hard reset of all current BGP sessions.

In Cisco IOS Release 12.0(32)S12, 12.4(24)T, and Cisco IOS XE Release 2.3, the Cisco implementation of 4-byte autonomous system numbers uses `asdot`—1.2, for example—as the only configuration format, regular expression match, and output display, with no `asplain` support.

**oer-paths Keyword**

In Cisco IOS Release 12.3(8)T and later releases, BGP prefixes that are monitored and controlled by OER are displayed by entering the **show ip bgp** command with the **oer-paths** keyword.

**show ip bgp: Example**

The following sample output displays the BGP routing table:

```
Device# show ip bgp
```

```
BGP table version is 6, local router ID is 10.0.96.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale, m multipath, b backup-path, x best-external, f
RT-Filter, a additional-path
Origin codes: i - IGP, e - EGP, ? - incomplete
RPKI validation codes: V valid, I invalid, N Not found
```

	Network	Next Hop	Metric	LocPrf	Weight	Path
N*	10.0.0.1	10.0.0.3	0		0	3 ?
N*>		10.0.3.5	0		0	4 ?
Nr	10.0.0.0/8	10.0.0.3	0		0	3 ?
Nr>		10.0.3.5	0		0	4 ?
Nr>	10.0.0.0/24	10.0.0.3	0		0	3 ?
V*>	10.0.2.0/24	0.0.0.0	0		32768	i
Vr>	10.0.3.0/24	10.0.3.5	0		0	4 ?

The table below describes the significant fields shown in the display.

**Table 133: show ip bgp Field Descriptions**

Field	Description
BGP table version	Internal version number of the table. This number is incremented whenever the table changes.
local router ID	IP address of the router.
Status codes	Status of the table entry. The status is displayed at the beginning of each line in the table. It can be one of the following values: <ul style="list-style-type: none"> <li>• s—The table entry is suppressed.</li> <li>• d—The table entry is dampened.</li> <li>• h—The table entry history.</li> <li>• *—The table entry is valid.</li> <li>• &gt;—The table entry is the best entry to use for that network.</li> <li>• i—The table entry was learned via an internal BGP (iBGP) session.</li> <li>• r—The table entry is a RIB-failure.</li> <li>• S—The table entry is stale.</li> <li>• m—The table entry has multipath to use for that network.</li> <li>• b—The table entry has a backup path to use for that network.</li> <li>• x—The table entry has a best external route to use for the network.</li> </ul>
Origin codes	Origin of the entry. The origin code is placed at the end of each line in the table. It can be one of the following values: <ul style="list-style-type: none"> <li>• a—Path is selected as an additional path.</li> <li>• i—Entry originated from an Interior Gateway Protocol (IGP) and was advertised with a <b>network</b> router configuration command.</li> <li>• e—Entry originated from an Exterior Gateway Protocol (EGP).</li> <li>• ?—Origin of the path is not clear. Usually, this is a router that is redistributed into BGP from an IGP.</li> </ul>
RPKI validation codes	If shown, the RPKI validation state for the network prefix, which is downloaded from the RPKI server. The codes are shown only if the <b>bgp rpki server</b> or <b>neighbor announce rpki state</b> command is configured.
Network	IP address of a network entity.

Field	Description
Next Hop	IP address of the next system that is used when forwarding a packet to the destination network. An entry of 0.0.0.0 indicates that the router has some non-BGP routes to this network.
Metric	If shown, the value of the interautonomous system metric.
LocPrf	Local preference value as set with the <b>set local-preference</b> route-map configuration command. The default value is 100.
Weight	Weight of the route as set via autonomous system filters.
Path	Autonomous system paths to the destination network. There can be one entry in this field for each autonomous system in the path.
(stale)	Indicates that the following path for the specified autonomous system is marked as “stale” during a graceful restart process.

#### show ip bgp (4-Byte Autonomous System Numbers): Example

The following sample output shows the BGP routing table with 4-byte autonomous system numbers, 65536 and 65550, shown under the Path field. This example requires Cisco IOS Release 12.0(32)SY8, 12.0(33)S3, 12.2(33)SRE, 12.2(33)XNE, 12.2(33)SX11, Cisco IOS XE Release 2.4, or a later release.

```
Device# show ip bgp

BGP table version is 4, local router ID is 172.16.1.99
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure, S Stale
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network        Next Hop           Metric LocPrf Weight Path
*> 10.1.1.0/24    192.168.1.2         0           0 65536 i
*> 10.2.2.0/24    192.168.3.2         0           0 65550 i
*> 172.16.1.0/24  0.0.0.0             0           32768 i
```

#### show ip bgp network: Example

The following sample output displays information about the 192.168.1.0 entry in the BGP routing table:

```
Device# show ip bgp 192.168.1.0

BGP routing table entry for 192.168.1.0/24, version 22
Paths: (2 available, best #2, table default)
  Additional-path
  Advertised to update-groups:
    3
  10 10
    192.168.3.2 from 172.16.1.2 (10.2.2.2)
      Origin IGP, metric 0, localpref 100, valid, internal, backup/repair
  10 10
    192.168.1.2 from 192.168.1.2 (10.3.3.3)
      Origin IGP, localpref 100, valid, external, best , recursive-via-connected
```

The following sample output displays information about the 10.3.3.3 255.255.255.255 entry in the BGP routing table:

```
Device# show ip bgp 10.3.3.3 255.255.255.255

BGP routing table entry for 10.3.3.3/32, version 35
Paths: (3 available, best #2, table default)
Multipath: eBGP
Flag: 0x860
  Advertised to update-groups:
    1
  200
    10.71.8.165 from 10.71.8.165 (192.168.0.102)
      Origin incomplete, localpref 100, valid, external, backup/repair
      Only allowed to recurse through connected route
  200
    10.71.11.165 from 10.71.11.165 (192.168.0.102)
      Origin incomplete, localpref 100, weight 100, valid, external, best
      Only allowed to recurse through connected route
  200
    10.71.10.165 from 10.71.10.165 (192.168.0.104)
      Origin incomplete, localpref 100, valid, external,
      Only allowed to recurse through connected route
```

The table below describes the significant fields shown in the display.

**Table 134: show ip bgp ip-address Field Descriptions**

Field	Description
BGP routing table entry for	IP address or network number of the routing table entry.
version	Internal version number of the table. This number is incremented whenever the table changes.
Paths	The number of available paths, and the number of installed best paths. This line displays “Default-IP-Routing-Table” when the best path is installed in the IP routing table.
Multipath	This field is displayed when multipath load sharing is enabled. This field will indicate if the multipaths are iBGP or eBGP.
Advertised to update-groups	The number of each update group for which advertisements are processed.
Origin	Origin of the entry. The origin can be IGP, EGP, or incomplete. This line displays the configured metric (0 if no metric is configured), the local preference value (100 is default), and the status and type of route (internal, external, multipath, best).
Extended Community	This field is displayed if the route carries an extended community attribute. The attribute code is displayed on this line. Information about the extended community is displayed on a subsequent line.

**show ip bgp all: Example**

The following is sample output from the **show ip bgp** command entered with the **all** keyword. Information about all configured address families is displayed.

```
Device# show ip bgp all

For address family: IPv4 Unicast *****
BGP table version is 27, local router ID is 10.1.1.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network        Next Hop           Metric LocPrf Weight Path
*> 10.1.1.0/24    0.0.0.0             0         32768 ?
*> 10.13.13.0/24  0.0.0.0             0         32768 ?
*> 10.15.15.0/24  0.0.0.0             0         32768 ?
*>i10.18.18.0/24  172.16.14.105      1388    91351     0 100 e
*>i10.100.0.0/16  172.16.14.107      262     272         0 1 2 3 i
*>i10.100.0.0/16  172.16.14.105      1388    91351     0 100 e
*>i10.101.0.0/16  172.16.14.105      1388    91351     0 100 e
*>i10.103.0.0/16  172.16.14.101      1388     173     173 100 e
*>i10.104.0.0/16  172.16.14.101      1388     173     173 100 e
*>i10.100.0.0/16  172.16.14.106      2219   20889     0 53285 33299 51178 47751 e
*>i10.101.0.0/16  172.16.14.106      2219   20889     0 53285 33299 51178 47751 e
* 10.100.0.0/16   172.16.14.109      2309         0 200 300 e
*>                172.16.14.108      1388         0 100 e
* 10.101.0.0/16   172.16.14.109      2309         0 200 300 e
*>                172.16.14.108      1388         0 100 e
*> 10.102.0.0/16  172.16.14.108      1388         0 100 e
*> 172.16.14.0/24 0.0.0.0             0         32768 ?
*> 192.168.5.0    0.0.0.0             0         32768 ?
*> 10.80.0.0/16   172.16.14.108      1388         0 50 e
*> 10.80.0.0/16   172.16.14.108      1388         0 50 e

For address family: VPNv4 Unicast *****
BGP table version is 21, local router ID is 10.1.1.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network        Next Hop           Metric LocPrf Weight Path
Route Distinguisher: 1:1 (default for vrf vpn1)
*> 10.1.1.0/24    192.168.4.3        1622         0 100 53285 33299 51178
{27016,57039,16690} e
*> 10.1.2.0/24    192.168.4.3        1622         0 100 53285 33299 51178
{27016,57039,16690} e
*> 10.1.3.0/24    192.168.4.3        1622         0 100 53285 33299 51178
{27016,57039,16690} e
*> 10.1.4.0/24    192.168.4.3        1622         0 100 53285 33299 51178
{27016,57039,16690} e
*> 10.1.5.0/24    192.168.4.3        1622         0 100 53285 33299 51178
{27016,57039,16690} e
*>i172.17.1.0/24  10.3.3.3           10         30     0 53285 33299 51178 47751 ?
*>i172.17.2.0/24  10.3.3.3           10         30     0 53285 33299 51178 47751 ?
*>i172.17.3.0/24  10.3.3.3           10         30     0 53285 33299 51178 47751 ?
*>i172.17.4.0/24  10.3.3.3           10         30     0 53285 33299 51178 47751 ?
*>i172.17.5.0/24  10.3.3.3           10         30     0 53285 33299 51178 47751 ?

For address family: IPv4 Multicast *****
BGP table version is 11, local router ID is 10.1.1.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
               r RIB-failure
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network        Next Hop           Metric LocPrf Weight Path
*> 10.40.40.0/26  172.16.14.110      2219         0 21 22 {51178,47751,27016} e
*                10.1.1.1            1622         0 15 20 1 {2} e
```

```

*> 10.40.40.64/26 172.16.14.110 2219 0 21 22 {51178,47751,27016} e
* 10.1.1.1 1622 0 15 20 1 {2} e
*> 10.40.40.128/26 172.16.14.110 2219 0 21 22 {51178,47751,27016} e
* 10.1.1.1 2563 0 15 20 1 {2} e
*> 10.40.40.192/26 10.1.1.1 2563 0 15 20 1 {2} e
*> 10.40.41.0/26 10.1.1.1 1209 0 15 20 1 {2} e
*>i10.102.0.0/16 10.1.1.1 300 500 0 5 4 {101,102} e
*>i10.103.0.0/16 10.1.1.1 300 500 0 5 4 {101,102} e
For address family: NSAP Unicast *****
BGP table version is 1, local router ID is 10.1.1.1
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure
Origin codes: i - IGP, e - EGP, ? - incomplete
Network Next Hop Metric LocPrf Weight Path
* i45.0000.0002.0001.000c.00 49.0001.0000.0000.0a00 100 0 ?
* i46.0001.0000.0000.0000.0a00 49.0001.0000.0000.0a00 100 0 ?
* i47.0001.0000.0000.000b.00 49.0001.0000.0000.0a00 100 0 ?
* i47.0001.0000.0000.000e.00 49.0001.0000.0000.0a00

```

### show ip bgp longer-prefixes: Example

The following is sample output from the **show ip bgp longer-prefixes** command:

```

Device# show ip bgp 10.92.0.0 255.255.0.0 longer-prefixes

BGP table version is 1738, local router ID is 192.168.72.24
Status codes: s suppressed, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
Network Next Hop Metric LocPrf Weight Path
*> 10.92.0.0 10.92.72.30 8896 32768 ?
* 10.92.0.0 10.92.72.30 0 109 108 ?
*> 10.92.1.0 10.92.72.30 8796 32768 ?
* 10.92.1.0 10.92.72.30 0 109 108 ?
*> 10.92.11.0 10.92.72.30 42482 32768 ?
* 10.92.11.0 10.92.72.30 0 109 108 ?
*> 10.92.14.0 10.92.72.30 8796 32768 ?
* 10.92.14.0 10.92.72.30 0 109 108 ?
*> 10.92.15.0 10.92.72.30 8696 32768 ?
* 10.92.15.0 10.92.72.30 0 109 108 ?
*> 10.92.16.0 10.92.72.30 1400 32768 ?
* 10.92.16.0 10.92.72.30 0 109 108 ?
*> 10.92.17.0 10.92.72.30 1400 32768 ?
* 10.92.17.0 10.92.72.30 0 109 108 ?
*> 10.92.18.0 10.92.72.30 8876 32768 ?
* 10.92.18.0 10.92.72.30 0 109 108 ?
*> 10.92.19.0 10.92.72.30 8876 32768 ?
* 10.92.19.0 10.92.72.30 0 109 108 ?

```

### show ip bgp shorter-prefixes: Example

The following is sample output from the **show ip bgp shorter-prefixes** command. An 8-bit prefix length is specified.

```

Device# show ip bgp 172.16.0.0/16 shorter-prefixes 8

*> 172.16.0.0 10.0.0.2 0 ?
* 172.16.0.0 10.0.0.2 0 0 200 ?

```



**show ip bgp prefix-list: Example**

The following is sample output from the **show ip bgp prefix-list** command:

```
Device# show ip bgp prefix-list ROUTE

BGP table version is 39, local router ID is 10.0.0.1
Status codes:s suppressed, d damped, h history, * valid, > best, i -
internal
Origin codes:i - IGP, e - EGP, ? - incomplete
   Network      Next Hop          Metric LocPrf Weight Path
*> 192.168.1.0  10.0.0.2          0         0 ?
*                10.0.0.2          0         0 200 ?
```

**show ip bgp route-map: Example**

The following is sample output from the **show ip bgp route-map** command:

```
Device# show ip bgp route-map LEARNED_PATH

BGP table version is 40, local router ID is 10.0.0.1
Status codes:s suppressed, d damped, h history, * valid, > best, i -
internal
Origin codes:i - IGP, e - EGP, ? - incomplete
   Network      Next Hop          Metric LocPrf Weight Path
*> 192.168.1.0  10.0.0.2          0         0 ?
*                10.0.0.2          0         0 200 ?
```

**show ip bgp (Additional Paths): Example**

The following output indicates (for each neighbor) whether any of the additional path tags (group-best, all, best 2 or best 3) are applied to the path. A line of output indicates rx pathid (received from neighbor) and tx pathid (announcing to neighbors). Note that the “Path advertised to update-groups:” is now per-path when the BGP Additional Paths feature is enabled.

```
Device# show ip bgp 10.0.0.1 255.255.255.224

BGP routing table entry for 10.0.0.1/28, version 82
Paths: (10 available, best #5, table default)
  Path advertised to update-groups:
    21          25
  Refresh Epoch 1
  20 50, (Received from a RR-client)
    192.0.2.1 from 192.0.2.1 (192.0.2.1)
      Origin IGP, metric 200, localpref 100, valid, internal, all
      Originator: 192.0.2.1, Cluster list: 2.2.2.2
      mpls labels in/out 16/nolabel
      rx pathid: 0, tx pathid: 0x9
  Path advertised to update-groups:
    18          21
  Refresh Epoch 1
  30
    192.0.2.2 from 192.0.2.2 (192.0.2.2)
      Origin IGP, metric 200, localpref 100, valid, internal, group-best, all
      Originator: 192.0.2.2, Cluster list: 4.4.4.4
      mpls labels in/out 16/nolabel
      rx pathid: 0x1, tx pathid: 0x8
  Path advertised to update-groups:
    16          18          19          20          21          22          24
```

```

    25          27
Refresh Epoch 1
10
  192.0.2.3 from 192.0.2.3 (192.0.2.3)
    Origin IGP, metric 200, localpref 100, valid, external, best2, all
    mpls labels in/out 16/nolabel
    rx pathid: 0, tx pathid: 0x7
Path advertised to update-groups:
  20          21          22          24          25
Refresh Epoch 1
10
  192.0.2.4 from 192.0.2.4 (192.0.2.4)
    Origin IGP, metric 300, localpref 100, valid, external, best3, all
    mpls labels in/out 16/nolabel
    rx pathid: 0, tx pathid: 0x6
Path advertised to update-groups:
  10          13          17          18          19          20          21
  22          23          24          25          26          27          28
Refresh Epoch 1
10
  192.0.2.5 from 192.0.2.5 (192.0.2.5)
    Origin IGP, metric 100, localpref 100, valid, external, best
    mpls labels in/out 16/nolabel
    rx pathid: 0, tx pathid: 0x0
Path advertised to update-groups:
  21
Refresh Epoch 1
30
  192.0.2.6 from 192.0.2.6 (192.0.2.6)
    Origin IGP, metric 200, localpref 100, valid, internal, all
    Originator: 192.0.2.6, Cluster list: 5.5.5.5
    mpls labels in/out 16/nolabel
    rx pathid: 0x1, tx pathid: 0x5
Path advertised to update-groups:
  18          23          24          26          28
Refresh Epoch 1
60 40, (Received from a RR-client)
  192.0.2.7 from 192.0.2.7 (192.0.2.7)
    Origin IGP, metric 250, localpref 100, valid, internal, group-best
    Originator: 192.0.2.7, Cluster list: 3.3.3.3
    mpls labels in/out 16/nolabel
    rx pathid: 0x2, tx pathid: 0x2
Path advertised to update-groups:
  25
Refresh Epoch 1
30 40, (Received from a RR-client)
  192.0.2.8 from 192.0.2.8 (192.0.2.8)
    Origin IGP, metric 200, localpref 100, valid, internal, all
    Originator: 192.0.2.8, Cluster list: 2.2.2.2
    mpls labels in/out 16/nolabel
    rx pathid: 0x1, tx pathid: 0x3
Path advertised to update-groups:
  18          21          23          24          25          26          28
Refresh Epoch 1
20 40, (Received from a RR-client)
  192.0.2.9 from 192.0.2.9 (192.0.2.9)
    Origin IGP, metric 200, localpref 100, valid, internal, group-best, all
    Originator: 192.0.2.9, Cluster list: 2.2.2.2
    mpls labels in/out 16/nolabel
    rx pathid: 0x1, tx pathid: 0x4
Path advertised to update-groups:
  21
Refresh Epoch 1
30 40

```

```

192.0.2.9 from 192.0.2.9 (192.0.2.9)
  Origin IGP, metric 100, localpref 100, valid, internal, all
  Originator: 192.0.2.9, Cluster list: 4.4.4.4
  mpls labels in/out 16/nolabel
  rx pathid: 0x1, tx pathid: 0x1

```

### show ip bgp network (BGP Attribute Filter): Example

The following is sample output from the **show ip bgp** command that displays unknown and discarded path attributes:

```

Device# show ip bgp 192.0.2.0/32

BGP routing table entry for 192.0.2.0/32, version 0
Paths: (1 available, no best path)
  Refresh Epoch 1
  Local
    192.168.101.2 from 192.168.101.2 (192.168.101.2)
      Origin IGP, localpref 100, valid, internal
      unknown transitive attribute: flag 0xE0 type 0x81 length 0x20
        value 0000 0000 0000 0000 0000 0000 0000 0000
              0000 0000 0000 0000 0000 0000 0000 0000

      unknown transitive attribute: flag 0xE0 type 0x83 length 0x20
        value 0000 0000 0000 0000 0000 0000 0000 0000
              0000 0000 0000 0000 0000 0000 0000 0000

      discarded unknown attribute: flag 0x40 type 0x63 length 0x64
        value 0000 0000 0000 0000 0000 0000 0000 0000
              0000 0000 0000 0000 0000 0000 0000 0000

```

### show ip bgp version: Example

The following is sample output from the **show ip bgp version** command:

```

Device# show ip bgp version

BGP table version is 5, local router ID is 10.2.4.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath, b backup-path, x best-external
Origin codes: i - IGP, e - EGP, ? - incomplete
Network Next Hop Metric LocPrf Weight Path
*> 192.168.34.2/24 10.0.0.1 0 0 1 ?
*> 192.168.35.2/24 10.0.0.1 0 0 1 ?

```

The following example shows how to display the network version:

```

Device# show ip bgp 192.168.34.2 | include version

BGP routing table entry for 192.168.34.2/24, version 5

```

The following sample output from the **show ip bgp version recent** command displays the prefix changes in the specified version:

```

Device# show ip bgp version recent 2

BGP table version is 5, local router ID is 10.2.4.2
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal,
r RIB-failure, S Stale, m multipath, b backup-path, x best-external

```

Origin codes: i - IGP, e - EGP, ? - incomplete

```

Network          Next Hop      Metric LocPrf  Weight  Path
*> 192.168.134.1/28  10.0.0.1      0         0         0      1 ?
*> 192.168.134.19/28 10.0.0.1      0         0         0      1 ?
*> 192.168.134.34/28 10.0.0.1      0         0         0      1 ?

```

## Related Commands

Command	Description
<b>bgp asnotation dot</b>	Changes the default display and the regular expression match format of BGP 4-byte autonomous system numbers from asplain (decimal values) to dot notation.
<b>clear ip bgp</b>	Resets BGP connections using hard or soft reconfiguration.
<b>ip bgp community new-format</b>	Configures BGP to display communities in the format AA:NN.
<b>ip prefix-list</b>	Creates a prefix list or adds a prefix-list entry.
<b>route-map</b>	Defines the conditions for redistributing routes from one routing protocol into another routing protocol.
<b>router bgp</b>	Configures the BGP routing process.

## show ip bgp neighbors

To display information about Border Gateway Protocol (BGP) and TCP connections to neighbors, use the **show ip bgp neighbors** command in user or privileged EXEC mode.

```
show ip bgp [ipv4 multicast | unicast | vpnv4 all | vpnv6 unicast all] neighbors [slow ip-address |
ipv6-address [advertised-routes | dampened-routes | flap-statistics | paths [reg-exp] | policy [detail] |
received prefix-filter | received-routes | routes]]
```

### Syntax Description

<b>ipv4</b>	(Optional) Displays peers in the IPv4 address family.
<b>multicast</b>	(Optional) Specifies IPv4 multicast address prefixes.
<b>unicast</b>	(Optional) Specifies IPv4 unicast address prefixes.
<b>vpnv4 all</b>	(Optional) Displays peers in the VPNv4 address family.
<b>vpnv6 unicast all</b>	(Optional) Displays peers in the VPNv6 address family.
<b>slow</b>	(Optional) Displays information about dynamically configured slow peers.
<i>ip-address</i>	(Optional) IP address of the IPv4 neighbor. If this argument is omitted, information about all neighbors is displayed.
<i>ipv6-address</i>	(Optional) IP address of the IPv6 neighbor.
<b>advertised-routes</b>	(Optional) Displays all routes that have been advertised to neighbors.
<b>dampened-routes</b>	(Optional) Displays the dampened routes received from the specified neighbor.
<b>flap-statistics</b>	(Optional) Displays the flap statistics of the routes learned from the specified neighbor (for external BGP peers only).
<b>paths</b> <i>reg-exp</i>	(Optional) Displays autonomous system paths learned from the specified neighbor. An optional regular expression can be used to filter the output.
<b>policy</b>	(Optional) Displays the policies applied to this neighbor per address family.
<b>detail</b>	(Optional) Displays detailed policy information such as route maps, prefix lists, community lists, access control lists (ACLs), and autonomous system path filter lists.
<b>received prefix-filter</b>	(Optional) Displays the prefix list (outbound route filter [ORF]) sent from the specified neighbor.
<b>received-routes</b>	(Optional) Displays all received routes (both accepted and rejected) from the specified neighbor.
<b>routes</b>	(Optional) Displays all routes that are received and accepted. The output displayed when this keyword is entered is a subset of the output displayed by the <b>received-routes</b> keyword.

**Command Default** The output of this command displays information for all neighbors.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

**Command History** *Table 135:*

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

Mainline and T Release	Modification
10.0	This command was introduced.
11.2	This command was modified. The <b>received-routes</b> keyword was added.
12.2(4)T	This command was modified. The <b>received</b> and <b>prefix-filter</b> keywords were added.
12.2(15)T	This command was modified. Support for the display of BGP graceful restart capability information was added.
12.3(7)T	This command was modified. The command output was modified to support the BGP TTL Security Check feature and to display explicit-null label information.
12.4(4)T	This command was modified. Support for the display of Bidirectional Forwarding Detection (BFD) information was added.
12.4(11)T	This command was modified. Support for the <b>policy</b> and <b>detail</b> keywords was added.
12.4(20)T	This command was modified. The output was modified to support BGP TCP path MTU discovery.
12.4(24)T	This command was modified. Support for displaying 4-byte autonomous system numbers in asdot notation was added.

S Release	Modification
12.0(18)S	This command was modified. The output was modified to display the no-prepend configuration option.
12.0(21)ST	This command was modified. The output was modified to display Multiprotocol Label Switching (MPLS) label information.
12.0(22)S	This command was modified. Support for the display of BGP graceful restart capability information was added. Support for the Cisco 12000 series routers (Engine 0 and Engine 2) was also added.
12.0(25)S	This command was modified. The <b>policy</b> and <b>detail</b> keywords were added.
12.0(27)S	This command was modified. The command output was modified to support the BGP TTL Security Check feature and to display explicit-null label information.

S Release	Modification
12.0(31)S	This command was modified. Support for the display of BFD information was added.
12.0(32)S12	This command was modified. Support for displaying 4-byte autonomous system numbers in asdot notation was added.
12.0(32)SY8	This command was modified. Support for displaying 4-byte autonomous system numbers in asplain and asdot notation was added.
12.0(33)S3	This command was modified. Support for displaying 4-byte autonomous system numbers in asplain notation was added and the default display format became asplain.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(17b)SXA	This command was integrated into Cisco IOS Release 12.2(17b)SXA.
12.2(18)SXE	This command was modified. Support for the display of BFD information was added.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was modified. The output was modified to support BGP TCP path Maximum Transmission Unit (MTU) discovery.
12.2(33)SRB	This command was modified. Support for the <b>policy</b> and <b>detail</b> keywords was added.
12.2(33)SXH	This command was modified. Support for displaying BGP dynamic neighbor information was added.
12.2(33)SRC	This command was modified. Support for displaying BGP graceful restart information was added.
12.2(33)SB	This command was modified. Support for displaying BFD and the BGP graceful restart per peer information was added, and support for the <b>policy</b> and <b>detail</b> keywords was integrated into Cisco IOS Release 12.2(33)SB.
12.2(33)SXII	This command was modified. Support for displaying 4-byte autonomous system numbers in asplain and asdot notation was added.
12.2(33)SRE	This command was modified. Support for displaying BGP best external and BGP additional path features information was added. Support for displaying 4-byte autonomous system numbers in asplain and asdot notation was added.
12.2(33)XNE	This command was modified. Support for 4-byte autonomous system numbers in asplain and asdot notation was added.
15.0(1)S	This command was modified. The <b>slow</b> keyword was added.
15.0(1)SY	This command was integrated into Cisco IOS Release 15.0(1)SY.
15.1(1)S	This command was modified. The Layer 2 VPN address family is displayed if graceful restart or nonstop forwarding (NSF) is enabled.
15.1(1)SG	This command was modified. Support for displaying 4-byte autonomous system numbers in asplain notation was added and the default display format became asplain.

S Release	Modification
15.2(4)S	This command was modified and implemented on the Cisco 7200 series router. The configured discard and treat-as-withdraw attributes are displayed, along with counts of incoming Updates with a matching discard attribute or treat-as-withdraw attribute, and number of times a malformed Update is treat-as-withdraw. The capabilities of the neighbor to send and receive additional paths that are advertised or received are added.
15.1(2)SNG	This command was implemented on the Cisco ASR 901 Series Aggregation Services Routers.
15.2(1)E	This command was integrated into Cisco IOS Release 15.2(1)E.

Cisco IOS XE	Modification
Cisco IOS XE Release 2.1	This command was integrated into Cisco IOS XE Release 2.1.
Cisco IOS XE Release 2.4	This command was modified. Support for displaying 4-byte autonomous system numbers in asplain notation was added and the default display format became asplain.
Cisco IOS XE Release 3.1S	This command was modified. The <b>slow</b> keyword was added.
Cisco IOS XE Release 3.6S	This command was modified. Support for displaying BGP BFD multihop and C-bit information was added.
Cisco IOS XE Release 3.3SG	This command was modified. Support for displaying 4-byte autonomous system numbers in asplain notation was added and the default display format became asplain.
Cisco IOS XE Release 3.7S	This command was implemented on the Cisco ASR 903 router and the output modified. The configured discard and treat-as-withdraw attributes are displayed, along with counts of incoming Updates with a matching discard attribute or treat-as-withdraw attribute, and number of times a malformed Update is treat-as-withdraw. The capabilities of the neighbor to send and receive additional paths that are advertised or received are added.
Cisco IOS XE Release 3.8S	This command was modified. In support of the BGP Multi-Cluster ID feature, the cluster ID of a neighbor is displayed if the neighbor is assigned a cluster.

### Usage Guidelines

Use the **show ip bgp neighbors** command to display BGP and TCP connection information for neighbor sessions. For BGP, this includes detailed neighbor attribute, capability, path, and prefix information. For TCP, this includes statistics related to BGP neighbor session establishment and maintenance.

Prefix activity is displayed based on the number of prefixes that are advertised and withdrawn. Policy denials display the number of routes that were advertised but then ignored based on the function or attribute that is displayed in the output.

In Cisco IOS Release 12.0(32)SY8, 12.0(33)S3, 12.2(33)SRE, 12.2(33)XNE, 12.2(33)SXII, Cisco IOS XE Release 2.4, and later releases, the Cisco implementation of 4-byte autonomous system numbers uses asplain—65538, for example—as the default regular expression match and output display format for autonomous system numbers, but you can configure 4-byte autonomous system numbers in both the asplain format and the asdot format as described in RFC 5396. To change the default regular expression match and output display



of 4-byte autonomous system numbers to asdot format, use the **bgp asnotation dot** command followed by the **clear ip bgp \*** command to perform a hard reset of all current BGP sessions.

In Cisco IOS Release 12.0(32)S12, 12.4(24)T, and Cisco IOS XE Release 2.3, the Cisco implementation of 4-byte autonomous system numbers uses asdot—1.2 for example—as the only configuration format, regular expression match, and output display, with no asplain support.

### Cisco IOS Releases 12.0(25)S, 12.4(11)T, 12.2(33)SRB, 12.2(33)SB, and Later Releases

When BGP neighbors use multiple levels of peer templates, determining which policies are applied to the neighbor can be difficult.

In Cisco IOS Release 12.0(25)S, 12.4(11)T, 12.2(33)SRB, 12.2(33)SB, and later releases, the **policy** and **detail** keywords were added to display the inherited policies and the policies configured directly on the specified neighbor. Inherited policies are policies that the neighbor inherits from a peer group or a peer policy template.

## Examples

Example output is different for the various keywords available for the **show ip bgp neighbors** command. Examples using the various keywords appear in the following sections.

### show ip bgp neighbors: Example

The following example shows output for the BGP neighbor at 10.108.50.2. This neighbor is an internal BGP (iBGP) peer. This neighbor supports the route refresh and graceful restart capabilities.

```
Device# show ip bgp neighbors 10.108.50.2

BGP neighbor is 10.108.50.2, remote AS 1, internal link
  BGP version 4, remote router ID 192.168.252.252
  BGP state = Established, up for 00:24:25
  Last read 00:00:24, last write 00:00:24, hold time is 180, keepalive interval is
    60 seconds
  Neighbor capabilities:
    Route refresh: advertised and received(old & new)
    MPLS Label capability: advertised and received
    Graceful Restart Capability: advertised
    Address family IPv4 Unicast: advertised and received
  Message statistics:
    InQ depth is 0
    OutQ depth is 0

      Sent      Rcvd
  Opens:          3         3
  Notifications:  0         0
  Updates:        0         0
  Keepalives:    113       112
  Route Refresh:  0         0
  Total:         116       115

  Default minimum time between advertisement runs is 5 seconds
  For address family: IPv4 Unicast
  BGP additional-paths computation is enabled
  BGP advertise-best-external is enabled
  BGP table version 1, neighbor version 1/0
  Output queue size : 0
  Index 1, Offset 0, Mask 0x2
  1 update-group member

      Sent      Rcvd
  Prefix activity:  ----  ----
```

## show ip bgp neighbors

```

Prefixes Current:          0          0
Prefixes Total:           0          0
Implicit Withdraw:        0          0
Explicit Withdraw:        0          0
Used as bestpath:         n/a        0
Used as multipath:        n/a        0
                          Outbound   Inbound
Local Policy Denied Prefixes:  -----
Total:                    0          0
Number of NLRI in the update sent: max 0, min 0
Connections established 3; dropped 2
Last reset 00:24:26, due to Peer closed the session
External BGP neighbor may be up to 2 hops away.
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled
Local host: 10.108.50.1, Local port: 179
Foreign host: 10.108.50.2, Foreign port: 42698
Enqueued packets for retransmit: 0, input: 0 mis-ordered: 0 (0 bytes)
Event Timers (current time is 0x68B944):
Timer           Starts    Wakeups          Next
Retrans         27         0                0x0
TimeWait        0          0                0x0
AckHold         27         18               0x0
SendWnd         0          0                0x0
KeepAlive       0          0                0x0
GiveUp          0          0                0x0
PmtuAger        0          0                0x0
DeadWait        0          0                0x0
iss: 3915509457  snduna: 3915510016  sndnxt: 3915510016   sndwnd: 15826
irs: 233567076  rcvnxt: 233567616   rcvwnd: 15845   delrcvwnd: 539
SRTT: 292 ms, RTTO: 359 ms, RTV: 67 ms, KRTT: 0 ms
minRTT: 12 ms, maxRTT: 300 ms, ACK hold: 200 ms
Flags: passive open, nagle, gen tcbs
IP Precedence value : 6
Datagrams (max data segment is 1460 bytes):
Rcvd: 38 (out of order: 0), with data: 27, total data bytes: 539
Sent: 45 (retransmit: 0, fastretransmit: 0, partialack: 0, Second Congestion: 08

```

The table below describes the significant fields shown in the display. Fields that are preceded by the asterisk character (\*) are displayed only when the counter has a nonzero value.

**Table 136: show ip bgp neighbors Field Descriptions**

Field	Description
BGP neighbor	IP address of the BGP neighbor and its autonomous system number.
remote AS	Autonomous system number of the neighbor.
local AS 300 no-prepend (not shown in display)	Verifies that the local autonomous system number is not prepended to received external routes. This output supports the hiding of the local autonomous systems when a network administrator is migrating autonomous systems.
internal link	“internal link” is displayed for iBGP neighbors; “external link” is displayed for external BGP (eBGP) neighbors.
BGP version	BGP version being used to communicate with the remote router.
remote router ID	IP address of the neighbor.

Field	Description
BGP state	Finite state machine (FSM) stage of session negotiation.
up for	Time, in hh:mm:ss, that the underlying TCP connection has been in existence.
Last read	Time, in hh:mm:ss, since BGP last received a message from this neighbor.
last write	Time, in hh:mm:ss, since BGP last sent a message to this neighbor.
hold time	Time, in seconds, that BGP will maintain the session with this neighbor without receiving messages.
keepalive interval	Time interval, in seconds, at which keepalive messages are transmitted to this neighbor.
Neighbor capabilities	BGP capabilities advertised and received from this neighbor. "advertised and received" is displayed when a capability is successfully exchanged between two routers.
Route refresh	Status of the route refresh capability.
MPLS Label capability	Indicates that MPLS labels are both sent and received by the eBGP peer.
Graceful Restart Capability	Status of the graceful restart capability.
Address family IPv4 Unicast	IP Version 4 unicast-specific properties of this neighbor.
Message statistics	Statistics organized by message type.
InQ depth is	Number of messages in the input queue.
OutQ depth is	Number of messages in the output queue.
Sent	Total number of transmitted messages.
Revd	Total number of received messages.
Opens	Number of open messages sent and received.
Notifications	Number of notification (error) messages sent and received.
Updates	Number of update messages sent and received.
Keepalives	Number of keepalive messages sent and received.
Route Refresh	Number of route refresh request messages sent and received.
Total	Total number of messages sent and received.
Default minimum time between...	Time, in seconds, between advertisement transmissions.
For address family:	Address family to which the following fields refer.

Field	Description
BGP table version	Internal version number of the table. This is the primary routing table with which the neighbor has been updated. The number increments when the table changes.
neighbor version	Number used by the software to track prefixes that have been sent and those that need to be sent.
1 update-group member	Number of the update-group member for this address family.
Prefix activity	Prefix statistics for this address family.
Prefixes Current	Number of prefixes accepted for this address family.
Prefixes Total	Total number of received prefixes.
Implicit Withdraw	Number of times that a prefix has been withdrawn and readvertised.
Explicit Withdraw	Number of times that a prefix has been withdrawn because it is no longer feasible.
Used as bestpath	Number of received prefixes installed as best paths.
Used as multipath	Number of received prefixes installed as multipaths.
* Saved (soft-reconfig)	Number of soft resets performed with a neighbor that supports soft reconfiguration. This field is displayed only if the counter has a nonzero value.
* History paths	This field is displayed only if the counter has a nonzero value.
* Invalid paths	Number of invalid paths. This field is displayed only if the counter has a nonzero value.
Local Policy Denied Prefixes	Prefixes denied due to local policy configuration. Counters are updated for inbound and outbound policy denials. The fields under this heading are displayed only if the counter has a nonzero value.
* route-map	Displays inbound and outbound route-map policy denials.
* filter-list	Displays inbound and outbound filter-list policy denials.
* prefix-list	Displays inbound and outbound prefix-list policy denials.
* Ext Community	Displays only outbound extended community policy denials.
* AS_PATH too long	Displays outbound AS_PATH length policy denials.
* AS_PATH loop	Displays outbound AS_PATH loop policy denials.
* AS_PATH confed info	Displays outbound confederation policy denials.
* AS_PATH contains AS 0	Displays outbound denials of autonomous system 0.
* NEXT_HOP Martian	Displays outbound martian denials.

Field	Description
* NEXT_HOP non-local	Displays outbound nonlocal next-hop denials.
* NEXT_HOP is us	Displays outbound next-hop-self denials.
* CLUSTER_LIST loop	Displays outbound cluster-list loop denials.
* ORIGINATOR loop	Displays outbound denials of local originated routes.
* unsuppress-map	Displays inbound denials due to an unsuppress map.
* advertise-map	Displays inbound denials due to an advertise map.
* VPN Imported prefix	Displays inbound denials of VPN prefixes.
* Well-known Community	Displays inbound denials of well-known communities.
* SOO loop	Displays inbound denials due to site-of-origin.
* Bestpath from this peer	Displays inbound denials because the best path came from the local router.
* Suppressed due to dampening	Displays inbound denials because the neighbor or link is in a dampening state.
* Bestpath from iBGP peer	Displays inbound denials because the best path came from an iBGP neighbor.
* Incorrect RIB for CE	Displays inbound denials due to RIB errors for a customer edge (CE) router.
* BGP distribute-list	Displays inbound denials due to a distribute list.
Number of NLRIs...	Number of network layer reachability attributes in updates.
Connections established	Number of times a TCP and BGP connection has been successfully established.
dropped	Number of times that a valid session has failed or been taken down.
Last reset	Time, in hh:mm:ss, since this peering session was last reset. The reason for the reset is displayed on this line.
External BGP neighbor may be...	Indicates that the BGP time to live (TTL) security check is enabled. The maximum number of hops that can separate the local and remote peer is displayed on this line.
Connection state	Connection status of the BGP peer.
unread input bytes	Number of bytes of packets still to be processed.
Connection is ECN Disabled	Explicit congestion notification status (enabled or disabled).
Local host: 10.108.50.1, Local port: 179	IP address of the local BGP speaker. BGP port number 179.

Field	Description
Foreign host: 10.108.50.2, Foreign port: 42698	Neighbor address and BGP destination port number.
Enqueued packets for retransmit:	Packets queued for retransmission by TCP.
Event Timers	TCP event timers. Counters are provided for starts and wakeups (expired timers).
Retrans	Number of times a packet has been retransmitted.
TimeWait	Time waiting for the retransmission timers to expire.
AckHold	Acknowledgment hold timer.
SendWnd	Transmission (send) window.
KeepAlive	Number of keepalive packets.
GiveUp	Number of times a packet is dropped due to no acknowledgment.
PmtuAger	Path MTU discovery timer.
DeadWait	Expiration timer for dead segments.
iss:	Initial packet transmission sequence number.
snduna:	Last transmission sequence number that has not been acknowledged.
sndnxt:	Next packet sequence number to be transmitted.
sndwnd:	TCP window size of the remote neighbor.
irs:	Initial packet receive sequence number.
rcvnxt:	Last receive sequence number that has been locally acknowledged.
rcvwnd:	TCP window size of the local host.
delrcvwnd:	Delayed receive window—data the local host has read from the connection, but has not yet subtracted from the receive window the host has advertised to the remote host. The value in this field gradually increases until it is higher than a full-sized packet, at which point it is applied to the rcvwnd field.
SRTT:	A calculated smoothed round-trip timeout.
RTTO:	Round-trip timeout.
RTV:	Variance of the round-trip time.
KRTT:	New round-trip timeout (using the Karn algorithm). This field separately tracks the round-trip time of packets that have been re-sent.

Field	Description
minRTT:	Shortest recorded round-trip timeout (hard-wire value used for calculation).
maxRTT:	Longest recorded round-trip timeout.
ACK hold:	Length of time the local host will delay an acknowledgment to carry (piggyback) additional data.
IP Precedence value:	IP precedence of the BGP packets.
Datagrams	Number of update packets received from a neighbor.
Rcvd:	Number of received packets.
out of order:	Number of packets received out of sequence.
with data	Number of update packets sent with data.
total data bytes	Total amount of data received, in bytes.
Sent	Number of update packets sent.
Second Congestion	Number of update packets with data sent.
Datagrams: Rcvd	Number of update packets received from a neighbor.
retransmit	Number of packets retransmitted.
fastretransmit	Number of duplicate acknowledgments retransmitted for an out of order segment before the retransmission timer expires.
partialack	Number of retransmissions for partial acknowledgments (transmissions before or without subsequent acknowledgments).
Second Congestion	Number of second retransmissions sent due to congestion.

#### show ip bgp neighbors (4-Byte Autonomous System Numbers)

The following partial example shows output for several external BGP neighbors in autonomous systems with 4-byte autonomous system numbers, 65536 and 65550. This example requires Cisco IOS Release 12.0(32)SY8, 12.0(33)S3, 12.2(33)SRE, 12.2(33)XNE, 12.2(33)SX11, Cisco IOS XE Release 2.4, or a later release.

```
Device# show ip bgp neighbors
```

```
BGP neighbor is 192.168.1.2, remote AS 65536, external link
  BGP version 4, remote router ID 0.0.0.0
  BGP state = Idle
  Last read 02:03:38, last write 02:03:38, hold time is 120, keepalive interval is 70
seconds
  Configured hold time is 120, keepalive interval is 70 seconds
  Minimum holdtime from neighbor is 0 seconds
.
```

```

.
.
BGP neighbor is 192.168.3.2, remote AS 65550, external link
  Description: finance
    BGP version 4, remote router ID 0.0.0.0
    BGP state = Idle
    Last read 02:03:48, last write 02:03:48, hold time is 120, keepalive interval is 70
seconds
    Configured hold time is 120, keepalive interval is 70 seconds
    Minimum holdtime from neighbor is 0 seconds

```

### show ip bgp neighbors advertised-routes

The following example displays routes advertised for only the 172.16.232.178 neighbor:

```

Device# show ip bgp neighbors 172.16.232.178 advertised-routes

BGP table version is 27, local router ID is 172.16.232.181
Status codes: s suppressed, d damped, h history, * valid, > best, i - internal
Origin codes: i - IGP, e - EGP, ? - incomplete
Network          Next Hop          Metric LocPrf Weight Path
*>i10.0.0.0      172.16.232.179    0      100     0  ?
*> 10.20.2.0     10.0.0.0          0              32768 i

```

The table below describes the significant fields shown in the display.

**Table 137: show ip bgp neighbors advertised-routes Field Descriptions**

Field	Description
BGP table version	Internal version number of the table. This is the primary routing table with which the neighbor has been updated. The number increments when the table changes.
local router ID	IP address of the local BGP speaker.
Status codes	Status of the table entry. The status is displayed at the beginning of each line in the table. It can be one of the following values: <ul style="list-style-type: none"> <li>• s—The table entry is suppressed.</li> <li>• d—The table entry is dampened and will not be advertised to BGP neighbors.</li> <li>• h—The table entry does not contain the best path based on historical information.</li> <li>• *—The table entry is valid.</li> <li>• &gt;—The table entry is the best entry to use for that network.</li> <li>• i—The table entry was learned via an internal BGP (iBGP) session.</li> </ul>



Field	Description
Origin codes	Origin of the entry. The origin code is placed at the end of each line in the table. It can be one of the following values: <ul style="list-style-type: none"> <li>• i—Entry originated from Interior Gateway Protocol (IGP) and was advertised with a <b>network</b> router configuration command.</li> <li>• e—Entry originated from Exterior Gateway Protocol (EGP).</li> <li>• ?—Origin of the path is not clear. Usually, this is a route that is redistributed into BGP from an IGP.</li> </ul>
Network	IP address of a network entity.
Next Hop	IP address of the next system used to forward a packet to the destination network. An entry of 0.0.0.0 indicates that there are non-BGP routes in the path to the destination network.
Metric	If shown, this is the value of the interautonomous system metric. This field is not used frequently.
LocPrf	Local preference value as set with the <b>set local-preference</b> route-map configuration command. The default value is 100.
Weight	Weight of the route as set via autonomous system filters.
Path	Autonomous system paths to the destination network. There can be one entry in this field for each autonomous system in the path.

### show ip bgp neighbors check-control-plane-failure

The following is sample output from the **show ip bgp neighbors** command entered with the **check-control-plane-failure** option configured:

```
Device# show ip bgp neighbors 10.10.10.1

BGP neighbor is 10.10.10.1, remote AS 10, internal link
  Fall over configured for session
  BFD is configured. BFD peer is Up. Using BFD to detect fast fallover (single-hop) with
c-bit check-control-plane-failure.
  Inherits from template cbit-tps for session parameters
  BGP version 4, remote router ID 10.7.7.7
  BGP state = Established, up for 00:03:55
  Last read 00:00:02, last write 00:00:21, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:
  1 active, is not multisession capable (disabled)
Neighbor capabilities:
  Route refresh: advertised and received(new)
  Four-octets ASN Capability: advertised and received
  Address family IPv4 Unicast: advertised and received
  Enhanced Refresh Capability: advertised and received
  Multisession Capability:
  Stateful switchover support enabled: NO for session 1
```

### show ip bgp neighbors paths

The following is sample output from the **show ip bgp neighbors** command entered with the **paths** keyword:

```
Device# show ip bgp neighbors 172.29.232.178 paths 10

Address      Refcount Metric Path
0x60E577B0      2      40 10 ?
```

The table below describes the significant fields shown in the display.

**Table 138: show ip bgp neighbors paths Field Descriptions**

Field	Description
Address	Internal address where the path is stored.
Refcount	Number of routes using that path.
Metric	Multi Exit Discriminator (MED) metric for the path. (The name of this metric for BGP versions 2 and 3 is INTER_AS.)
Path	Autonomous system path for that route, followed by the origin code for that route.

### show ip bgp neighbors received prefix-filter

The following example shows that a prefix list that filters all routes in the 10.0.0.0 network has been received from the 192.168.20.72 neighbor:

```
Device# show ip bgp neighbors 192.168.20.72 received prefix-filter

Address family:IPv4 Unicast
ip prefix-list 192.168.20.72:1 entries
  seq 5 deny 10.0.0.0/8 le 32
```

The table below describes the significant fields shown in the display.

**Table 139: show ip bgp neighbors received prefix-filter Field Descriptions**

Field	Description
Address family	Address family mode in which the prefix filter is received.
ip prefix-list	Prefix list sent from the specified neighbor.

### show ip bgp neighbors policy

The following sample output shows the policies applied to the neighbor at 192.168.1.2. The output displays both inherited policies and policies configured on the neighbor device. Inherited policies are policies that the neighbor inherits from a peer group or a peer-policy template.

```
Device# show ip bgp neighbors 192.168.1.2 policy

Neighbor: 192.168.1.2, Address-Family: IPv4 Unicast
Locally configured policies:
  route-map ROUTE in
Inherited polices:
  prefix-list NO-MARKETING in
  route-map ROUTE in
  weight 300
  maximum-prefix 10000
```

### Cisco IOS Release 12.0(31)S, 12.4(4)T, 12.2(18)SXE, and 12.2(33)SB

The following is sample output from the **show ip bgp neighbors** command that verifies that Bidirectional Forwarding Detection (BFD) is being used to detect fast fallover for the BGP neighbor that is a BFD peer:

```
Device# show ip bgp neighbors

BGP neighbor is 172.16.10.2, remote AS 45000, external link
.
.
.
Using BFD to detect fast fallover
```

### Cisco IOS Release 12.2(33)SRA and 12.4(20)T

The following is sample output from the **show ip bgp neighbors** command that verifies that BGP TCP path maximum transmission unit (MTU) discovery is enabled for the BGP neighbor at 172.16.1.2:

```
Device# show ip bgp neighbors 172.16.1.2

BGP neighbor is 172.16.1.2, remote AS 45000, internal link
  BGP version 4, remote router ID 172.16.1.99
.
.
.
For address family: IPv4 Unicast
  BGP table version 5, neighbor version 5/0
.
.
.
  Address tracking is enabled, the RIB does have a route to 172.16.1.2
  Address tracking requires at least a /24 route to the peer
  Connections established 3; dropped 2
  Last reset 00:00:35, due to Router ID changed
  Transport(tcp) path-mtu-discovery is enabled
.
.
.
SRTT: 146 ms, RTTO: 1283 ms, RTV: 1137 ms, KRRT: 0 ms
minRTT: 8 ms, maxRTT: 300 ms, ACK hold: 200 ms
Flags: higher precedence, retransmission timeout, nagle, path mtu capable
```

### Cisco IOS Release 12.2(33)SXH

The following is sample output from the **show ip bgp neighbors** command that verifies that the neighbor 192.168.3.2 is a member of the peer group group192 and belongs to the subnet range group 192.168.0.0/16, which shows that this BGP neighbor was dynamically created:

```
Device# show ip bgp neighbors 192.168.3.2

BGP neighbor is *192.168.3.2, remote AS 50000, external link
Member of peer-group group192 for session parameters
Belongs to the subnet range group: 192.168.0.0/16
BGP version 4, remote router ID 192.168.3.2
BGP state = Established, up for 00:06:35
Last read 00:00:33, last write 00:00:25, hold time is 180, keepalive intervals
Neighbor capabilities:
  Route refresh: advertised and received(new)
  Address family IPv4 Unicast: advertised and received
Message statistics:
  InQ depth is 0
  OutQ depth is 0

                Sent          Rcvd
Opens:           1             1
Notifications:  0             0
Updates:         0             0
Keepalives:      7             7
Route Refresh:  0             0
Total:           8             8

Default minimum time between advertisement runs is 30 seconds
For address family: IPv4 Unicast
BGP table version 1, neighbor version 1/0
Output queue size : 0
Index 1, Offset 0, Mask 0x2
1 update-group member
group192 peer-group member
.
.
.
```

### Cisco IOS Releases 12.2(33)SRC and 12.2(33)SB

The following is partial output from the **show ip bgp neighbors** command that verifies the status of the BGP graceful restart capability for the external BGP peer at 192.168.3.2. Graceful restart is shown as disabled for this BGP peer.

```
Device# show ip bgp neighbors 192.168.3.2

BGP neighbor is 192.168.3.2, remote AS 50000, external link
Inherits from template S2 for session parameters
BGP version 4, remote router ID 192.168.3.2
BGP state = Established, up for 00:01:41
Last read 00:00:45, last write 00:00:45, hold time is 180, keepalive intervals
Neighbor sessions:
  1 active, is multisession capable
Neighbor capabilities:
  Route refresh: advertised and received(new)
  Address family IPv4 Unicast: advertised and received
.
```

```

.
.
Address tracking is enabled, the RIB does have a route to 192.168.3.2
Connections established 1; dropped 0
Last reset never
Transport(tcp) path-mtu-discovery is enabled
Graceful-Restart is disabled
Connection state is ESTAB, I/O status: 1, unread input bytes: 0

```

### Cisco IOS Release 15.1(1)S: Example

The following is partial output from the **show ip bgp neighbors** command. For this release, the display includes the Layer 2 VFN address family information if graceful restart or NSF is enabled.

```

Device# show ip bgp neighbors

Load for five secs: 2%/0%; one minute: 0%; five minutes: 0%
Time source is hardware calendar, *21:49:17.034 GMT Wed Sep 22 2010
BGP neighbor is 10.1.1.3, remote AS 2, internal link
  BGP version 4, remote router ID 10.1.1.3
  BGP state = Established, up for 00:14:32
  Last read 00:00:30, last write 00:00:43, hold time is 180, keepalive interval is 60 seconds

Neighbor sessions:
  1 active, is not multisession capable (disabled)
Neighbor capabilities:
  Route refresh: advertised and received(new)
  Four-octets ASN Capability: advertised and received
  Address family IPv4 Unicast: advertised and received
  Address family L2VPN Vpls: advertised and received
  Graceful Restart Capability: advertised and received
    Remote Restart timer is 120 seconds
  Address families advertised by peer:
    IPv4 Unicast (was not preserved), L2VPN Vpls (was not preserved)
  Multisession Capability:
Message statistics:
  InQ depth is 0
  OutQ depth is 0

                Sent          Rcvd
Opens:           1             1
Notifications:  0             0
Updates:         4            16
Keepalives:     16            16
Route Refresh:  0             0
Total:          21            33

Default minimum time between advertisement runs is 0 seconds
For address family: IPv4 Unicast
Session: 10.1.1.3
BGP table version 34, neighbor version 34/0
Output queue size : 0
Index 1, Advertise bit 0
1 update-group member
Slow-peer detection is disabled
Slow-peer split-update-group dynamic is disabled

                Sent          Rcvd
Prefix activity: ----          ----
Prefixes Current:    2             11 (Consumes 572 bytes)
Prefixes Total:     4             19
Implicit Withdraw:   2             6
Explicit Withdraw:  0             2

```

## show ip bgp neighbors

```

Used as bestpath:          n/a          7
Used as multipath:         n/a          0
                          Outbound      Inbound
Local Policy Denied Prefixes: -----
NEXT_HOP is us:           n/a          1
Bestpath from this peer:  20          n/a
Bestpath from iBGP peer:  8          n/a
Invalid Path:             10          n/a
Total:                    38          1
Number of NLRIs in the update sent: max 2, min 0
Last detected as dynamic slow peer: never
Dynamic slow peer recovered: never
For address family: L2VPN Vpls
Session: 10.1.1.3
BGP table version 8, neighbor version 8/0
Output queue size : 0
Index 1, Advertise bit 0
1 update-group member
Slow-peer detection is disabled
Slow-peer split-update-group dynamic is disabled

Prefix activity:          Sent          Rcvd
-----
Prefixes Current:         1            1 (Consumes 68 bytes)
Prefixes Total:           2            1
Implicit Withdraw:        1            0
Explicit Withdraw:        0            0
Used as bestpath:         n/a          1
Used as multipath:         n/a          0
                          Outbound      Inbound
Local Policy Denied Prefixes: -----
Bestpath from this peer:  4            n/a
Bestpath from iBGP peer:  1            n/a
Invalid Path:             2            n/a
Total:                    7            0
Number of NLRIs in the update sent: max 1, min 0
Last detected as dynamic slow peer: never
Dynamic slow peer recovered: never
Address tracking is enabled, the RIB does have a route to 10.1.1.3
Connections established 1; dropped 0
Last reset never
Transport(tcp) path-mtu-discovery is enabled
Graceful-Restart is enabled, restart-time 120 seconds, stalepath-time 360 seconds
Connection state is ESTAB, I/O status: 1, unread input bytes: 0
Connection is ECN Disabled
Minimum incoming TTL 0, Outgoing TTL 255
Local host: 10.1.1.1, Local port: 179
Foreign host: 10.1.1.3, Foreign port: 48485
Connection tableid (VRF): 0
Enqueued packets for retransmit: 0, input: 0 mis-ordered: 0 (0 bytes)
Event Timers (current time is 0xE750C):
Timer           Starts      Wakeups          Next
Retrans         18          0                0x0
TimeWait        0           0                0x0
AckHold         22          20               0x0
SendWnd         0           0                0x0
KeepAlive       0           0                0x0
GiveUp          0           0                0x0
PmtuAger        0           0                0x0
DeadWait        0           0                0x0
Linger          0           0                0x0
iss: 3196633674  snduna: 3196634254  sndnxt: 3196634254  sndwnd: 15805
irs: 1633793063  rcvnxt: 1633794411  rcwnd: 15037  delrcwnd: 1347
SRTT: 273 ms, RTTO: 490 ms, RTV: 217 ms, KRTT: 0 ms
minRTT: 2 ms, maxRTT: 300 ms, ACK hold: 200 ms

```

```
Status Flags: passive open, gen tcbs
Option Flags: nagle, path mtu capable
Datagrams (max data segment is 1436 bytes):
Rcvd: 42 (out of order: 0), with data: 24, total data bytes: 1347
Sent: 40 (retransmit: 0 fastretransmit: 0),with data: 19, total data bytes: 579
```

### BGP Attribute Filter and Enhanced Attribute Error Handling

The following is sample output from the **show ip bgp neighbors** command that indicates the discard attribute values and treat-as-withdraw attribute values configured. It also provides a count of received Updates matching a treat-as-withdraw attribute, a count of received Updates matching a discard attribute, and a count of received malformed Updates that are treat-as-withdraw.

```
Device# show ip bgp vpnv4 all neighbors 10.0.103.1

BGP neighbor is 10.0.103.1, remote AS 100, internal link
Path-attribute treat-as-withdraw inbound
Path-attribute treat-as-withdraw value 128
Path-attribute treat-as-withdraw 128 in: count 2
Path-attribute discard 128 inbound
Path-attribute discard 128 in: count 2

      Outbound   Inbound
Local Policy Denied Prefixes:  -----  -----
MALFORM treat as withdraw:      0          1
Total:                          0          1
```

### BGP Additional Paths

The following output indicates that the neighbor is capable of advertising additional paths and sending additional paths it receives. It is also capable of receiving additional paths and advertised paths.

```
Device# show ip bgp neighbors 10.108.50.2

BGP neighbor is 10.108.50.2, remote AS 1, internal link
BGP version 4, remote router ID 192.168.252.252
BGP state = Established, up for 00:24:25
Last read 00:00:24, last write 00:00:24, hold time is 180, keepalive interval is 60 seconds

Neighbor capabilities:
Additional paths Send: advertised and received
Additional paths Receive: advertised and received
Route refresh: advertised and received(old & new)
Graceful Restart Capabilty: advertised and received
Address family IPv4 Unicast: advertised and received
```

### BGP—Multiple Cluster IDs

In the following output, the cluster ID of the neighbor is displayed. (The vertical bar and letter “i” for “include” cause the device to display only lines that include the user’s input after the “i”, in this case, “cluster-id.”) The cluster ID displayed is the one directly configured through a neighbor or a template.

```
Device# show ip bgp neighbors 192.168.2.2 | i cluster-id
```

Configured with the cluster-id 192.168.15.6

### Related Commands

Command	Description
<b>bgp asnotation dot</b>	Changes the default display and the regular expression match format of BGP 4-byte autonomous system numbers from asplain (decimal values) to dot notation.
<b>bgp enhanced-error</b>	Restores the default behavior of treating Update messages that have a malformed attribute as withdrawn, or includes iBGP peers in the Enhanced Attribute Error Handling feature.
<b>neighbor path-attribute discard</b>	Configures the device to discard unwanted Update messages from the specified neighbor that contain a specified path attribute.
<b>neighbor path-attribute treat-as-withdraw</b>	Configures the device to withdraw from the specified neighbor unwanted Update messages that contain a specified attribute.
<b>neighbor send-label</b>	Enables a BGP router to send MPLS labels with BGP routes to a neighboring BGP router.
<b>neighbor send-label explicit-null</b>	Enables a BGP router to send MPLS labels with explicit-null information for a CSC-CE router and BGP routes to a neighboring CSC-PE router.
<b>router bgp</b>	Configures the BGP routing process.



## show ip eigrp interfaces

To display information about interfaces that are configured for the Enhanced Interior Gateway Routing Protocol (EIGRP), use the **show ip eigrp interfaces** command in user EXEC or privileged EXEC mode.

```
show ip eigrp [vrf vrf-name] [autonomous-system-number] interfaces [type number] [detail]
```

Syntax Description		
<b>vrf</b> <i>vrf-name</i>	(Optional) Displays information about the specified virtual routing and forwarding (VRF) instance.	
<i>autonomous-system-number</i>	(Optional) Autonomous system number whose output needs to be filtered.	
<i>type</i>	(Optional) Interface type. For more information, use the question mark (?) online help function.	
<i>number</i>	(Optional) Interface or subinterface number. For more information about the numbering syntax for your networking device, use the question mark (?) online help function.	
<b>detail</b>	(Optional) Displays detailed information about EIGRP interfaces for a specific EIGRP process.	

Command Modes	
	User EXEC (>)
	Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

Use the **show ip eigrp interfaces** command to display active EIGRP interfaces and EIGRP-specific interface settings and statistics. The optional *type number* argument and the **detail** keyword can be entered in any order.

If an interface is specified, only information about that interface is displayed. Otherwise, information about all interfaces on which EIGRP is running is displayed.

If an autonomous system is specified, only the routing process for the specified autonomous system is displayed. Otherwise, all EIGRP processes are displayed.

This command can be used to display information about EIGRP named and EIGRP autonomous system configurations.

This command displays the same information as the **show eigrp address-family interfaces** command. Cisco recommends using the **show eigrp address-family interfaces** command.

### Examples

The following is sample output from the **show ip eigrp interfaces** command:

```
Device#show ip eigrp interfaces
EIGRP-IPv4 Interfaces for AS(60)
      Xmit Queue   Mean   Pacing Time   Multicast   Pending
```

```

Interface    Peers    Un/Reliable    SRTT    Un/Reliable    Flow Timer    Routes
Di0          0        0/0            0       11/434         0             0
Et0          1        0/0            337     0/10          0             0
SE0:1.16    1        0/0            10      1/63          103           0
Tu0          1        0/0            330     0/16          0             0

```

The following sample output from the **show ip eigrp interfaces detail** command displays detailed information about all active EIGRP interfaces:

```

Device#show ip eigrp interfaces detail

EIGRP-IPv4 Interfaces for AS(1)
          Xmit Queue    PeerQ          Mean    Pacing Time    Multicast    Pending

Interface    Peers  Un/Reliable  Un/Reliable  SRTT    Un/Reliable    Flow Timer    Routes
Et0/0        1      0/0          0/0          525     0/2            3264          0
Hello-interval is 5, Hold-time is 15
  Split-horizon is enabled
  Next xmit serial <none>
  Packetized sent/expedited: 3/0
  Hello's sent/expedited: 6/2
  Un/reliable mcasts: 0/6  Un/reliable ucasts: 7/4
  Mcast exceptions: 1  CR packets: 1  ACKs suppressed: 0
  Retransmissions sent: 1  Out-of-sequence rcvd: 0
  Topology-ids on interface - 0
  Authentication mode is not set

```

The following sample output from the **show ip eigrp interfaces detail** command displays detailed information about a specific interface on which the **no ip next-hop self** command is configured along with the **no-ecmp-mode** option:

```

Device#show ip eigrp interfaces detail tunnel 0

EIGRP-IPv4 Interfaces for AS(1)
          Xmit Queue    PeerQ          Mean    Pacing Time    Multicast    Pending

Interface    Peers  Un/Reliable  Un/Reliable  SRTT    Un/Reliable    Flow Timer    Routes
Tu0/0        2      0/0          0/0          2       0/0            50            0
Hello-interval is 5, Hold-time is 15
  Split-horizon is disabled
  Next xmit serial <none>
  Packetized sent/expedited: 24/3
  Hello's sent/expedited: 28083/9
  Un/reliable mcasts: 0/19  Un/reliable ucasts: 18/64
  Mcast exceptions: 5  CR packets: 5  ACKs suppressed: 0
  Retransmissions sent: 52  Out-of-sequence rcvd: 2
  Next-hop-self disabled, next-hop info forwarded, ECMP mode Enabled
  Topology-ids on interface - 0
  Authentication mode is not set

```

The table below describes the significant fields shown in the displays.

**Table 140: show ip eigrp interfaces Field Descriptions**

Field	Description
Interface	Interface on which EIGRP is configured.
Peers	Number of directly connected EIGRP neighbors.

Field	Description
PeerQ Un/Reliable	Number of unreliable and reliable packets queued for transmission to specific peers on the interface.
Xmit Queue Un/Reliable	Number of packets remaining in the Unreliable and Reliable transmit queues.
Mean SRTT	Mean smooth round-trip time (SRTT) interval (in seconds).
Pacing Time Un/Reliable	Pacing time (in seconds) used to determine when EIGRP packets (unreliable and reliable) should be sent out of the interface .
Multicast Flow Timer	Maximum number of seconds for which the device will send multicast EIGRP packets.
Pending Routes	Number of routes in the transmit queue waiting to be sent.
Packetized sent/expedited	Number of EIGRP routes that have been prepared for sending packets to neighbors on an interface, and the number of times multiple routes were stored in a single packet.
Hello's sent/expedited	Number of EIGRP hello packets that have been sent on an interface and packets that were expedited.

**Related Commands**

Command	Description
<b>show eigrp address-family interfaces</b>	Displays information about address family interfaces configured for EIGRP.
<b>show ip eigrp neighbors</b>	Displays neighbors discovered by EIGRP.

# show ip eigrp neighbors

To display neighbors discovered by the Enhanced Interior Gateway Routing Protocol (EIGRP), use the **show ip eigrp neighbors** command in privileged EXEC mode.

**show ip eigrp** [**vrf** *vrf-name*] [*autonomous-system-number*] **neighbors** [**static** | **detail**] [*interface-type interface-number*]

Syntax Description		
<b>vrf</b> <i>vrf-name</i>	(Optional) Displays information about the specified VPN Routing and Forwarding (VRF) instance.	
<i>autonomous-system-number</i>	(Optional) Autonomous-system-number-specific output is displayed.	
<b>static</b>	(Optional) Displays static neighbors.	
<b>detail</b>	(Optional) Displays detailed neighbor information.	
<i>interface-type interface-number</i>	(Optional) Interface-specific output is displayed.	

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **show ip eigrp neighbors** command can be used to display information about EIGRP named and EIGRP autonomous-system configurations. Use the **show ip eigrp neighbors** command to display dynamic and static neighbor states. You can use this command for also debugging certain types of transport problems.

This command displays the same information as the **show eigrp address-family neighbors** command. Cisco recommends that you use the **show eigrp address-family neighbors** command.

## Examples

The following is sample output from the **show ip eigrp neighbors** command:

```
Device#show ip eigrp neighbors
H   Address                Interface          Hold Uptime    SRTT  RTO  Q  Seq
   (sec)                  (ms)              (ms)          Cnt  Num
0   10.1.1.2                 Et0/0             13 00:00:03 1996  5000 0  5
2   10.1.1.9                 Et0/0             14 00:02:24  206  5000 0  5
1   10.1.1.2.3              Et0/1             11 00:20:39 2202  5000 0  5
```

The table below describes the significant fields shown in the display.

**Table 141: show ip eigrp neighbors Field Descriptions**

Field	Description
Address	IP address of the EIGRP peer.
Interface	Interface on which the router is receiving hello packets from the peer.

Field	Description
Hold	Time in seconds for which EIGRP waits to hear from the peer before declaring it down.
Uptime	Elapsed time (in hours:minutes: seconds) since the local router first heard from this neighbor.
SRTT	Smooth round-trip time. This is the number of milliseconds required for an EIGRP packet to be sent to this neighbor and for the local router to receive an acknowledgment of that packet.
RTO	Retransmission timeout (in milliseconds). This is the amount of time the software waits before resending a packet from the retransmission queue to a neighbor.
Q Cnt	Number of EIGRP packets (update, query, and reply) that the software is waiting to send.
Seq Num	Sequence number of the last update, query, or reply packet that was received from this neighbor.

The following is sample output from the **show ip eigrp neighbors detail** command:

```
Device#show ip eigrp neighbors detail
EIGRP-IPv4 VR(foo) Address-Family Neighbors for AS(1)
H   Address                Interface      Hold Uptime    SRTT   RTO   Q   Seq
   (sec)                (ms)          Cnt Num
0   192.168.10.1           Gi2/0         12 00:00:21 1600  5000  0  3
  Static neighbor (Lisp Encap)
  Version 8.0/2.0, Retrans: 0, Retries: 0, Prefixes: 1
  Topology-ids from peer - 0
```

The table below describes the significant fields shown in the display.

**Table 142: show ip eigrp neighbors detail Field Descriptions**

Field	Description
H	This column lists the order in which a peering session was established with the specified neighbor. The order is specified with sequential numbering starting with 0.
Address	IP address of the EIGRP peer.
Interface	Interface on which the router is receiving hello packets from the peer.
Hold	Time in seconds for which EIGRP waits to hear from the peer before declaring it down.
Lisp Encap	Indicates that routes from this neighbor are LISP encapsulated.
Uptime	Elapsed time (in hours:minutes: seconds) since the local router first heard from this neighbor.
SRTT	Smooth round-trip time. This is the number of milliseconds required for an EIGRP packet to be sent to this neighbor and for the local router to receive an acknowledgment of that packet.
RTO	Retransmission timeout (in milliseconds). This is the amount of time the software waits before resending a packet from the retransmission queue to a neighbor.
Q Cnt	Number of EIGRP packets (update, query, and reply) that the software is waiting to send.

Field	Description
Seq Num	Sequence number of the last update, query, or reply packet that was received from this neighbor.
Version	The software version that the specified peer is running.
Retrans	Number of times that a packet has been retransmitted.
Retries	Number of times an attempt was made to retransmit a packet.

**Related Commands**

Command	Description
<b>show eigrp address-family neighbors</b>	Displays neighbors discovered by EIGRP.

# show ip eigrp topology

To display Enhanced Interior Gateway Routing Protocol (EIGRP) topology table entries, use the **show ip eigrp topology** command in user EXEC or privileged EXEC mode.

**show ip eigrp topology** [ *network* [ *mask* ] *prefix* | **active** | **all-links** | **detail-links** | **pending** | **secondary-paths** | **summary** | **zero-successors** ]

Syntax Description		
	<i>network</i>	(Optional) Network address.
	<i>mask</i>	(Optional) Network mask.
	<i>prefix</i>	(Optional) Network prefix in the format <i>&lt;network&gt;/&lt;length&gt;</i> , for example, 192.168.0.0/16.
	<b>active</b>	(Optional) Displays all topology entries that are in the active state.
	<b>all-links</b>	(Optional) Displays all the entries in the EIGRP topology table (including nonfeasible successor sources).
	<b>detail-links</b>	(Optional) Displays all the topology entries with additional details.
	<b>pending</b>	(Optional) Displays all the entries in the EIGRP topology table that are either waiting for an update from a neighbor or to reply to a neighbor.
	<b>secondary-paths</b>	(Optional) Displays the secondary paths in the topology.
	<b>summary</b>	(Optional) Displays a summary of the EIGRP topology table.
	<b>zero-successors</b>	(Optional) Displays the available routes that have zero successors.

**Command Default** If this command is used without any of the optional keywords, only topology entries with feasible successors are displayed and only feasible paths are shown.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **show ip eigrp topology** command to display topology entries, feasible and nonfeasible paths, metrics, and states. This command can be used without any arguments or keywords to display only topology entries with feasible successors and feasible paths. The **all-links** keyword displays all the paths, whether feasible or not, and the **detail-links** keyword displays additional details about these paths.

Use this command to display information about EIGRP named and EIGRP autonomous system configurations. This command displays the same information as the **show eigrp address-family topology** command. We recommend that you use the **show eigrp address-family topology** command.

## Examples

The following is a sample output from the **show ip eigrp topology** command:

```
Device# show ip eigrp topology

EIGRP-IPv4 Topology Table for AS(1)/ID(10.0.0.1)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - Reply status, s - sia status
P 10.0.0.0/8, 1 successors, FD is 409600
   via 192.0.2.1 (409600/128256), Ethernet0/0
P 192.16.1.0/24, 1 successors, FD is 409600
   via 192.0.2.1 (409600/128256), Ethernet0/0
P 10.0.0.0/8, 1 successors, FD is 281600
   via Summary (281600/0), Null0
P 10.0.1.0/24, 1 successors, FD is 281600
   via Connected, Ethernet0/0
```

The following is a sample output from the **show ip eigrp topology prefix** command, and displays detailed information about a single prefix. The prefix shown is an EIGRP internal route.

```
Device# show ip eigrp topology 10.0.0.0/8

EIGRP-IPv4 VR(vr1) Topology Entry for AS(1)/ID(10.1.1.2) for 10.0.0.0/8
  State is Passive, Query origin flag is 1, 1 Successor(s), FD is 82329600, RIB is 643200
  Descriptor Blocks:
  10.1.1.1 (Ethernet2/0), from 10.1.1.1, Send flag is 0x0
    Composite metric is (82329600/163840), route is Internal
  Vector metric:
    Minimum bandwidth is 16000 Kbit
    Total delay is 631250000 picoseconds
    Reliability is 255/255
    Load is 1/5
    Minimum MTU is 1500
    Hop count is 1
    Originating router is 10.1.1.1
```

The following is a sample output from the **show ip eigrp topology prefix** command, and displays detailed information about a single prefix. The prefix shown is an EIGRP external route.

```
Device# show ip eigrp topology 192.16.1.0/24

EIGRP-IPv4 Topology Entry for AS(1)/ID(10.0.0.1) for 192.16.1.0/24
  State is Passive, Query origin flag is 1, 1 Successor(s), FD is 409600, RIB is 643200
  Descriptor Blocks:
  172.16.1.0/24 (Ethernet0/0), from 10.0.1.2, Send flag is 0x0
    Composite metric is (409600/128256), route is External
  Vector metric:
    Minimum bandwidth is 10000 Kbit
    Total delay is 6000 picoseconds
    Reliability is 255/255
    Load is 1/5
    Minimum MTU is 1500
    Hop count is 1
    Originating router is 192.16.1.0/24
  External data:
    AS number of route is 0
    External protocol is Connected, external metric is 0
    Administrator tag is 0 (0x00000000)
```

The following is a sample output from the **show ip eigrp topology prefix** command displays Equal Cost Multipath (ECMP) mode information when the **no ip next-hop-self** command is configured without the **no-ecmp-mode** keyword in an EIGRP topology. The ECMP mode provides information



about the path that is being advertised. If there is more than one successor, the top-most path is advertised as the default path over all the interfaces, and ECMP Mode: Advertise by default is displayed in the output. If any path other than the default path is advertised, ECMP Mode: Advertise out <Interface name> is displayed.

The topology table displays entries of routes for a particular prefix. The routes are sorted based on metric, next-hop, and infosource. In a Dynamic Multipoint VPN (DMVPN) scenario, routes with the same metric and next hop are sorted based on infosource. The top route in the ECMP is always advertised.

```
Device# show ip eigrp topology 192.168.10.0/24

EIGRP-IPv4 Topology Entry for AS(1)/ID(10.10.100.100) for 192.168.10.0/24
State is Passive, Query origin flag is 1, 2 Successor(s), FD is 284160
Descriptor Blocks:
 10.100.1.0 (Tunnel0), from 10.100.0.1, Send flag is 0x0
   Composite metric is (284160/281600), route is Internal
   Vector metric:
     Minimum bandwidth is 10000 Kbit
     Total delay is 1100 microseconds
     Reliability is 255/255
     Load is 1/55
     Minimum MTU is 1400
     Hop count is 1
     Originating router is 10.10.1.1
     ECMP Mode: Advertise by default
 10.100.0.2 (Tunnel1), from 10.100.0.2, Send flag is 0X0
   Composite metric is (284160/281600), route is Internal
   Vector metric:
     Minimum bandwidth is 10000 Kbit
     Total delay is 1100 microseconds
     Reliability is 255/255
     Load is 1/55
     Minimum MTU is 1400
     Hop count is 1
     Originating router is 10.10.2.2
     ECMP Mode: Advertise out Tunnel1
```

The following is a sample output from the **show ip eigrp topology all-links** command, and displays all the paths, including those that are not feasible:

```
Device# show ip eigrp topology all-links

EIGRP-IPv4 Topology Table for AS(1)/ID(10.0.0.1)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status
P 172.16.1.0/24, 1 successors, FD is 409600, serno 14
   via 10.10.1.2 (409600/128256), Ethernet0/0
   via 10.1.4.3 (2586111744/2585599744), Serial3/0, serno 18
```

The following is a sample output from the **show ip eigrp topology detail-links** command, and displays additional details about routes:

```
Device# show ip eigrp topology detail-links

EIGRP-IPv4 Topology Table for AS(1)/ID(10.0.0.1)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status
P 10.0.0.0/8, 1 successors, FD is 409600, serno 6
   via 10.10.1.2 (409600/128256), Ethernet0/0
P 172.16.1.0/24, 1 successors, FD is 409600, serno 14
   via 10.10.1.2 (409600/128256), Ethernet0/0
P 10.0.0.0/8, 1 successors, FD is 281600, serno 3
```

```

    via Summary (281600/0), Null0
P 10.1.1.0/24, 1 successors, FD is 281600, serno 1
    via Connected, Ethernet0/0

```

The following table describes the significant fields shown in the above examples:

**Table 143: show ip eigrp topology Field Descriptions**

Field	Description
Codes	<p>State of this topology table entry. Passive and Active refer to the EIGRP state with respect to the destination. Update, Query, and Reply refer to the type of packet that is being sent.</p> <ul style="list-style-type: none"> <li>• P - Passive: Indicates that no EIGRP computations are being performed for this route.</li> <li>• A - Active: Indicates that EIGRP computations are being performed for this route.</li> <li>• U - Update: Indicates that a pending update packet is waiting to be sent for this route.</li> <li>• Q - Query: Indicates that a pending query packet is waiting to be sent for this route.</li> <li>• R - Reply: Indicates that a pending reply packet is waiting to be sent for this route.</li> <li>• r - Reply status: Indicates that EIGRP has sent a query for the route and is waiting for a reply from the specified path.</li> <li>• s - sia status: Indicates that the EIGRP query packet is in stuck-in-active (SIA) status.</li> </ul>
successors	Number of successors. This number corresponds to the number of next hops in the IP routing table. If successors is capitalized, then the route or the next hop is in a transition state.
serno	Serial number.
FD	Feasible distance. This is the best metric to reach the destination or the best metric that was known when the route became active. This value is used in the feasibility condition check. If the reported distance of the device is less than the feasible distance, the feasibility condition is met and that route becomes a feasible successor. After the software determines that it has a feasible successor, the software need not send a query for that destination.
via	Next-hop address that advertises the passive route.

**Related Commands**

Command	Description
show eigrp address-family topology	Displays entries in the EIGRP address-family topology table.

## show ip eigrp traffic

To display the number of Enhanced Interior Gateway Routing Protocol (EIGRP) packets sent and received, use the **show ip eigrp traffic** command in privileged EXEC mode.

**show ip eigrp** [**vrf** *vrf-name* | \*] [*autonomous-system-number*] **traffic**

Syntax Description		
<b>vrf</b> <i>vrf-name</i>	(Optional) Displays information about the specified VRF.	
<b>vrf</b> *	(Optional) Displays information about all VRFs.	
<i>autonomous-system-number</i>	(Optional) Autonomous system number.	

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command can be used to display information about EIGRP named configurations and EIGRP autonomous-system (AS) configurations.

This command displays the same information as the **show eigrp address-family traffic** command. Cisco recommends using the **show eigrp address-family traffic** command.

### Examples

The following is sample output from the **show ip eigrp traffic** command:

```
Device#show ip eigrp traffic
EIGRP-IPv4 Traffic Statistics for AS(60)
Hellos sent/received: 21429/2809
Updates sent/received: 22/17
Queries sent/received: 0/0
Replies sent/received: 0/0
Acks sent/received: 16/13
SIA-Queries sent/received: 0/0
SIA-Replies sent/received: 0/0
Hello Process ID: 204
PDM Process ID: 203
Socket Queue: 0/2000/2/0 (current/max/highest/drops)
Input Queue: 0/2000/2/0 (current/max/highest/drops)
```

The table below describes the significant fields shown in the display.

**Table 144: show ip eigrp traffic Field Descriptions**

Field	Description
Hellos sent/received	Number of hello packets sent and received.
Updates sent/received	Number of update packets sent and received.
Queries sent/received	Number of query packets sent and received.

Field	Description
Replies sent/received	Number of reply packets sent and received.
Acks sent/received	Number of acknowledgement packets sent and received.
SIA-Queries sent/received	Number of stuck in active query packets sent and received.
SIA-Replies sent/received	Number of stuck in active reply packets sent and received.
Hello Process ID	Hello process identifier.
PDM Process ID	Protocol-dependent module IOS process identifier.
Socket Queue	The IP to EIGRP Hello Process socket queue counters.
Input queue	The EIGRP Hello Process to EIGRP PDM socket queue counters.

**Related Commands**

Command	Description
<b>show eigrp address-family traffic</b>	Displays the number of EIGRP packets sent and received.

# show ip ospf

To display general information about Open Shortest Path First (OSPF) routing processes, use the **show ip ospf** command in user EXEC or privileged EXEC mode.

**show ip ospf** [*process-id*]

## Syntax Description

<i>process-id</i>	(Optional) Process ID. If this argument is included, only information for the specified routing process is included.
-------------------	--

## Command Modes

User EXEC Privileged EXEC

## Command History

Mainline Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following is sample output from the **show ip ospf** command when entered without a specific OSPF process ID:

```
Device#show ip ospf

Routing Process "ospf 201" with ID 10.0.0.1 and Domain ID 10.20.0.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
Minimum LSA interval 5 secs. Minimum LSA arrival 1 secs
LSA group pacing timer 100 secs
Interface flood pacing timer 55 msec
Retransmission pacing timer 100 msec
Number of external LSA 0. Checksum Sum 0x0
Number of opaque AS LSA 0. Checksum Sum 0x0
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 2. 2 normal 0 stub 0 nssa
External flood list length 0
  Area BACKBONE(0)
    Number of interfaces in this area is 2
    Area has message digest authentication
    SPF algorithm executed 4 times
    Area ranges are
    Number of LSA 4. Checksum Sum 0x29BEB
    Number of opaque link LSA 0. Checksum Sum 0x0
    Number of DCbitless LSA 3
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0
  Area 172.16.26.0
    Number of interfaces in this area is 0
    Area has no authentication
    SPF algorithm executed 1 times
    Area ranges are
      192.168.0.0/16 Passive Advertise
    Number of LSA 1. Checksum Sum 0x44FD
    Number of opaque link LSA 0. Checksum Sum 0x0
    Number of DCbitless LSA 1
```

```

Number of indication LSA 1
Number of DoNotAge LSA 0
Flood list length 0

```

### Cisco IOS Release 12.2(18)SXE, 12.0(31)S, and 12.4(4)T

The following is sample output from the **show ip ospf** command to verify that the BFD feature has been enabled for OSPF process 123. The relevant command output is shown in bold in the output.

Device#**show ip ospf**

```

Routing Process "ospf 123" with ID 172.16.10.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Initial SPF schedule delay 5000 msec
Minimum hold time between two consecutive SPF's 10000 msec
Maximum wait time between two consecutive SPF's 10000 msec
Incremental-SPF disabled
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msec
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msec
Retransmission pacing timer 66 msec
Number of external LSA 0. Checksum Sum 0x000000
Number of opaque AS LSA 0. Checksum Sum 0x000000
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
BFD is enabled
Area BACKBONE(0)
  Number of interfaces in this area is 2
  Area has no authentication
  SPF algorithm last executed 00:00:03.708 ago
  SPF algorithm executed 27 times
  Area ranges are
  Number of LSA 3. Checksum Sum 0x00AEF1
  Number of opaque link LSA 0. Checksum Sum 0x000000
  Number of DCbitless LSA 0
  Number of indication LSA 0
  Number of DoNotAge LSA 0
  Flood list length 0

```

The table below describes the significant fields shown in the display.

**Table 145: show ip ospf Field Descriptions**

Field	Description
Routing process "ospf 201" with ID 10.0.0.1	Process ID and OSPF router ID.
Supports...	Number of types of service supported (Type 0 only).
SPF schedule delay	Delay time (in seconds) of SPF calculations.
Minimum LSA interval	Minimum interval (in seconds) between link-state advertisements.

Field	Description
LSA group pacing timer	Configured LSA group pacing timer (in seconds).
Interface flood pacing timer	Configured LSA flood pacing timer (in milliseconds).
Retransmission pacing timer	Configured LSA retransmission pacing timer (in milliseconds).
Number of external LSA	Number of external link-state advertisements.
Number of opaque AS LSA	Number of opaque link-state advertisements.
Number of DCbitless external and opaque AS LSA	Number of demand circuit external and opaque link-state advertisements.
Number of DoNotAge external and opaque AS LSA	Number of do not age external and opaque link-state advertisements.
Number of areas in this router is	Number of areas configured for the router.
External flood list length	External flood list length.
BFD is enabled	BFD has been enabled on the OSPF process.

The following is an excerpt of output from the **show ip ospf** command when the OSPF Forwarding Address Suppression in Type-5 LSAs feature is configured:

```

Device#show ip ospf
.
.
.
Area 2
  Number of interfaces in this area is 4
  It is a NSSA area
  Perform type-7/type-5 LSA translation, suppress forwarding address
.
.
.
Routing Process "ospf 1" with ID 192.168.0.1
  Supports only single TOS(TOS0) routes
  Supports opaque LSA
  Supports Link-local Signaling (LLS)
  Initial SPF schedule delay 5000 msec
  Minimum hold time between two consecutive SPF's 10000 msec
  Maximum wait time between two consecutive SPF's 10000 msec
  Incremental-SPF disabled
  Minimum LSA interval 5 secs
  Minimum LSA arrival 1000 msec
  LSA group pacing timer 240 secs
  Interface flood pacing timer 33 msec
  Retransmission pacing timer 66 msec
  Number of external LSA 0. Checksum Sum 0x0
  Number of opaque AS LSA 0. Checksum Sum 0x0
  Number of DCbitless external and opaque AS LSA 0
  Number of DoNotAge external and opaque AS LSA 0
  Number of areas in this router is 0. 0 normal 0 stub 0 nssa
  External flood list length 0

```



The table below describes the significant fields shown in the display.

**Table 146: show ip ospf Field Descriptions**

Field	Description
Area	OSPF area and tag.
Number of interfaces...	Number of interfaces configured in the area.
It is...	Possible types are internal, area border, or autonomous system boundary.
Routing process “ospf 1” with ID 192.168.0.1	Process ID and OSPF router ID.
Supports...	Number of types of service supported (Type 0 only).
Initial SPF schedule delay	Delay time of SPF calculations at startup.
Minimum hold time	Minimum hold time (in milliseconds) between consecutive SPF calculations.
Maximum wait time	Maximum wait time (in milliseconds) between consecutive SPF calculations.
Incremental-SPF	Status of incremental SPF calculations.
Minimum LSA...	Minimum time interval (in seconds) between link-state advertisements, and minimum arrival time (in milliseconds) of link-state advertisements,
LSA group pacing timer	Configured LSA group pacing timer (in seconds).
Interface flood pacing timer	Configured LSA flood pacing timer (in milliseconds).
Retransmission pacing timer	Configured LSA retransmission pacing timer (in milliseconds).
Number of...	Number and type of link-state advertisements that have been received.
Number of external LSA	Number of external link-state advertisements.
Number of opaque AS LSA	Number of opaque link-state advertisements.
Number of DCbitless external and opaque AS LSA	Number of demand circuit external and opaque link-state advertisements.
Number of DoNotAge external and opaque AS LSA	Number of do not age external and opaque link-state advertisements.
Number of areas in this router is	Number of areas configured for the router listed by type.
External flood list length	External flood list length.

The following is sample output from the **show ip ospf** command. In this example, the user had configured the **redistribution maximum-prefix** command to set a limit of 2000 redistributed routes. SPF throttling was configured with the **timer throttlespf** command.

```
Device#show ip ospf 1
Routing Process "ospf 1" with ID 10.0.0.1
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
It is an autonomous system boundary router
Redistributing External Routes from,
    static, includes subnets in redistribution
    Maximum limit of redistributed prefixes 2000
    Threshold for warning message 75%
Initial SPF schedule delay 5000 msec
Minimum hold time between two consecutive SPF's 10000 msec
Maximum wait time between two consecutive SPF's 10000 msec
```

The table below describes the significant fields shown in the display.

**Table 147: show ip ospf Field Descriptions**

Field	Description
Routing process "ospf 1" with ID 10.0.0.1	Process ID and OSPF router ID.
Supports ...	Number of Types of Service supported.
It is ...	Possible types are internal, area border, or autonomous system boundary router.
Redistributing External Routes from	Lists of redistributed routes, by protocol.
Maximum limit of redistributed prefixes	Value set in the <b>redistribution maximum-prefix</b> command to set a limit on the number of redistributed routes.
Threshold for warning message	Percentage set in the <b>redistribution maximum-prefix</b> command for the threshold number of redistributed routes needed to cause a warning message. The default is 75 percent of the maximum limit.
Initial SPF schedule delay	Delay (in milliseconds) before initial SPF schedule for SPF throttling. Configured with the <b>timer throttlespf</b> command.
Minimum hold time between two consecutive SPF's	Minimum hold time (in milliseconds) between two consecutive SPF calculations for SPF throttling. Configured with the <b>timer throttlespf</b> command.
Maximum wait time between two consecutive SPF's	Maximum wait time (in milliseconds) between two consecutive SPF calculations for SPF throttling. Configured with the <b>timer throttlespf</b> command.
Number of areas	Number of areas in router, area addresses, and so on.

The following is sample output from the **show ip ospf** command. In this example, the user had configured LSA throttling, and those lines of output are displayed in bold.

```

Device#show ip ospf 1
Routing Process "ospf 4" with ID 10.10.24.4
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
Initial SPF schedule delay 5000 msec
Minimum hold time between two consecutive SPF's 10000 msec
Maximum wait time between two consecutive SPF's 10000 msec
Incremental-SPF disabled
Initial LSA throttle delay 100 msec
Minimum hold time for LSA throttle 10000 msec

Maximum wait time for LSA throttle 45000 msec
Minimum LSA arrival 1000 msec
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msec
Retransmission pacing timer 66 msec
Number of external LSA 0. Checksum Sum 0x0
Number of opaque AS LSA 0. Checksum Sum 0x0
Number of DCbitless external and opaque AS LSA 0
Number of DoNotAge external and opaque AS LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
  Area 24
    Number of interfaces in this area is 2
    Area has no authentication
    SPF algorithm last executed 04:28:18.396 ago
    SPF algorithm executed 8 times
    Area ranges are
    Number of LSA 4. Checksum Sum 0x23EB9
    Number of opaque link LSA 0. Checksum Sum 0x0
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0

```

The following is sample **show ip ospf** command. In this example, the user had configured the **redistribution maximum-prefix** command to set a limit of 2000 redistributed routes. SPF throttling was configured with the **timer throttle spf** command.

```

Device#show ip ospf 1
Routing Process "ospf 1" with ID 192.168.0.0
Supports only single TOS(TOS0) routes
Supports opaque LSA
Supports Link-local Signaling (LLS)
It is an autonomous system boundary router
Redistributing External Routes from,
  static, includes subnets in redistribution
  Maximum limit of redistributed prefixes 2000
  Threshold for warning message 75%
Initial SPF schedule delay 5000 msec
Minimum hold time between two consecutive SPF's 10000 msec
Maximum wait time between two consecutive SPF's 10000 msec

```

The table below describes the significant fields shown in the display.

Table 148: show ip ospf Field Descriptions

Field	Description
Routing process "ospf 1" with ID 192.168.0.0.	Process ID and OSPF router ID.
Supports ...	Number of TOS supported.
It is ...	Possible types are internal, area border, or autonomous system boundary routers.
Redistributing External Routes from	Lists of redistributed routes, by protocol.
Maximum limit of redistributed prefixes	Value set in the <b>redistributionmaximum-prefix</b> command to set a limit on the number of redistributed routes.
Threshold for warning message	Percentage set in the <b>redistributionmaximum-prefix</b> command for the threshold number of redistributed routes needed to cause a warning message. The default is 75 percent of the maximum limit.
Initial SPF schedule delay	Delay (in milliseconds) before the initial SPF schedule for SPF throttling. Configured with the <b>timersthrottlespf</b> command.
Minimum hold time between two consecutive SPF's	Minimum hold time (in milliseconds) between two consecutive SPF calculations for SPF throttling. Configured with the <b>timersthrottlespf</b> command.
Maximum wait time between two consecutive SPF's	Maximum wait time (in milliseconds) between two consecutive SPF calculations for SPF throttling. Configured with the <b>timersthrottlespf</b> command.
Number of areas	Number of areas in router, area addresses, and so on.

The following is sample output from the **show ip ospf** command. In this example, the user had configured LSA throttling, and those lines of output are displayed in bold.

```

Device#show ip ospf 1
Routing Process "ospf 4" with ID 10.10.24.4
  Supports only single TOS(TOS0) routes
  Supports opaque LSA
  Supports Link-local Signaling (LLS)
  Initial SPF schedule delay 5000 msec
  Minimum hold time between two consecutive SPF's 10000 msec
  Maximum wait time between two consecutive SPF's 10000 msec
  Incremental-SPF disabled
  Initial LSA throttle delay 100 msec
  Minimum hold time for LSA throttle 10000 msec
  Maximum wait time for LSA throttle 45000 msec
  Minimum LSA arrival 1000 msec
  LSA group pacing timer 240 secs
  Interface flood pacing timer 33 msec
  Retransmission pacing timer 66 msec
  Number of external LSA 0. Checksum Sum 0x0
  Number of opaque AS LSA 0. Checksum Sum 0x0
  Number of DCbitless external and opaque AS LSA 0
  Number of DoNotAge external and opaque AS LSA 0

```

```
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
External flood list length 0
  Area 24
    Number of interfaces in this area is 2
    Area has no authentication
    SPF algorithm last executed 04:28:18.396 ago
    SPF algorithm executed 8 times
    Area ranges are
    Number of LSA 4. Checksum Sum 0x23EB9
    Number of opaque link LSA 0. Checksum Sum 0x0
    Number of DCbitless LSA 0
    Number of indication LSA 0
    Number of DoNotAge LSA 0
    Flood list length 0
```

## show ip ospf border-routers

To display the internal Open Shortest Path First (OSPF) routing table entries to an Area Border Router (ABR) and Autonomous System Boundary Router (ASBR), use the **show ip ospf border-routers** command in privileged EXEC mode.

### show ip ospf border-routers

#### Syntax Description

This command has no arguments or keywords.

#### Command Modes

Privileged EXEC

#### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

#### Examples

The following is sample output from the **show ip ospf border-routers** command:

```
Device#show ip ospf border-routers
OSPF Process 109 internal Routing Table
Codes: i - Intra-area route, I - Inter-area route
i 192.168.97.53 [10] via 172.16.1.53, Serial0, ABR, Area 0.0.0.3, SPF 3
i 192.168.103.51 [10] via 192.168.96.51, Serial0, ABR, Area 0.0.0.3, SPF 3
I 192.168.103.52 [22] via 192.168.96.51, Serial0, ASBR, Area 0.0.0.3, SPF 3
I 192.168.103.52 [22] via 172.16.1.53, Serial0, ASBR, Area 0.0.0.3, SPF 3
```

The table below describes the significant fields shown in the display.

**Table 149: show ip ospf border-routers Field Descriptions**

Field	Description
192.168.97.53	Router ID of the destination.
[10]	Cost of using this route.
via 172.16.1.53	Next hop toward the destination.
Serial0	Interface type for the outgoing interface.
ABR	The router type of the destination; it is either an ABR or ASBR or both.
Area	The area ID of the area from which this route is learned.
SPF 3	The internal number of the shortest path first (SPF) calculation that installs this route.

## show ip ospf database

To display lists of information related to the Open Shortest Path First (OSPF) database for a specific router, use the **show ip ospf database** command in EXEC mode.

```

show ip ospf [process-id area-id] database
show ip ospf [process-id area-id] database [adv-router [ip-address]]
show ip ospf [process-id area-id] database [asbr-summary] [link-state-id]
show ip ospf [process-id area-id] database [asbr-summary] [link-state-id] [adv-router [ip-address]]
show ip ospf [process-id area-id] database [asbr-summary] [link-state-id] [self-originate]
[link-state-id]
show ip ospf [process-id area-id] database [database-summary]
show ip ospf [process-id] database [external] [link-state-id]
show ip ospf [process-id] database [external] [link-state-id] [adv-router [ip-address]]
show ip ospf [process-id area-id] database [external] [link-state-id] [self-originate] [link-state-id]
show ip ospf [process-id area-id] database [network] [link-state-id]
show ip ospf [process-id area-id] database [network] [link-state-id] [adv-router [ip-address]]
show ip ospf [process-id area-id] database [network] [link-state-id] [self-originate] [link-state-id]
show ip ospf [process-id area-id] database [nssa-external] [link-state-id]
show ip ospf [process-id area-id] database [nssa-external] [link-state-id] [adv-router [ip-address]]
show ip ospf [process-id area-id] database [nssa-external] [link-state-id] [self-originate] [link-state-id]
show ip ospf [process-id area-id] database [router] [link-state-id]
show ip ospf [process-id area-id] database [router] [adv-router [ip-address]]
show ip ospf [process-id area-id] database [router] [self-originate] [link-state-id]
show ip ospf [process-id area-id] database [self-originate] [link-state-id]
show ip ospf [process-id area-id] database [summary] [link-state-id]
show ip ospf [process-id area-id] database [summary] [link-state-id] [adv-router [ip-address]]
show ip ospf [process-id area-id] database [summary] [link-state-id] [self-originate] [link-state-id]

```

### Syntax Description

<i>process-id</i>	(Optional) Internal identification. It is locally assigned and can be any positive integer. The number used here is the number assigned administratively when enabling the OSPF routing process.
<i>area-id</i>	(Optional) Area number associated with the OSPF address range defined in the <b>network</b> router configuration command used to define the particular area.
<b>adv-router</b> [ip-address]	(Optional) Displays all the LSAs of the specified router. If no IP address is included, the information is about the local router itself (in this case, the same as <b>self-originate</b> ).

<i>link-state-id</i>	<p>(Optional) Portion of the Internet environment that is being described by the advertisement. The value entered depends on the advertisement's LS type. It must be entered in the form of an IP address.</p> <p>When the link state advertisement is describing a network, the <i>link-state-id</i> can take one of two forms:</p> <p>The network's IP address (as in type 3 summary link advertisements and in autonomous system external link advertisements).</p> <p>A derived address obtained from the link state ID. (Note that masking a network links advertisement's link state ID with the network's subnet mask yields the network's IP address.)</p> <p>When the link state advertisement is describing a router, the link state ID is always the described router's OSPF router ID.</p> <p>When an autonomous system external advertisement (LS Type = 5) is describing a default route, its link state ID is set to Default Destination (0.0.0.0).</p>
<b>asbr-summary</b>	(Optional) Displays information only about the autonomous system boundary router summary LSAs.
<b>database-summary</b>	(Optional) Displays how many of each type of LSA for each area there are in the database, and the total.
<b>external</b>	(Optional) Displays information only about the external LSAs.
<b>network</b>	(Optional) Displays information only about the network LSAs.
<b>nssa-external</b>	(Optional) Displays information only about the NSSA external LSAs.
<b>router</b>	(Optional) Displays information only about the router LSAs.
<b>self-originate</b>	(Optional) Displays only self-originated LSAs (from the local router).
<b>summary</b>	(Optional) Displays information only about the summary LSAs.

**Command Modes** EXEC

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

The various forms of this command deliver information about different OSPF link state advertisements.

**Examples**

The following is sample output from the **show ip ospf database** command when no arguments or keywords are used:

```
Device#show ip ospf database
OSPF Router with id(192.168.239.66) (Process ID 300)
      Displaying Router Link States(Area 0.0.0.0)
  Link ID      ADV Router   Age         Seq#         Checksum    Link count
172.16.21.6   172.16.21.6   1731       0x80002CFB   0x69BC      8
```



```

172.16.21.5 172.16.21.5 1112 0x800009D2 0xA2B8 5
172.16.1.2 172.16.1.2 1662 0x80000A98 0x4CB6 9
172.16.1.1 172.16.1.1 1115 0x800009B6 0x5F2C 1
172.16.1.5 172.16.1.5 1691 0x80002BC 0x2A1A 5
172.16.65.6 172.16.65.6 1395 0x80001947 0xEEE1 4
172.16.241.5 172.16.241.5 1161 0x8000007C 0x7C70 1
172.16.27.6 172.16.27.6 1723 0x80000548 0x8641 4
172.16.70.6 172.16.70.6 1485 0x80000B97 0xEB84 6
    Displaying Net Link States(Area 0.0.0.0)
    Link ID      ADV Router      Age      Seq#      Checksum
172.16.1.3 192.168.239.66 1245    0x800000EC 0x82E
    Displaying Summary Net Link States(Area 0.0.0.0)
    Link ID      ADV Router      Age      Seq#      Checksum
172.16.240.0 172.16.241.5 1152    0x80000077 0x7A05
172.16.241.0 172.16.241.5 1152    0x80000070 0xAEB7
172.16.244.0 172.16.241.5 1152    0x80000071 0x95CB
    
```

The table below describes the significant fields shown in the display.

**Table 150: show ip ospf Database Field Descriptions**

Field	Description
Link ID	Router ID number.
ADV Router	Advertising router's ID.
Age	Link state age.
Seq#	Link state sequence number (detects old or duplicate link state advertisements).
Checksum	Fletcher checksum of the complete contents of the link state advertisement.
Link count	Number of interfaces detected for router.

The following is sample output from the **show ip ospf database** command with the **asbr-summary** keyword:

```

Device#show ip ospf database asbr-summary
OSPF Router with id(192.168.239.66) (Process ID 300)
    Displaying Summary ASB Link States(Area 0.0.0.0)
    LS age: 1463
    Options: (No TOS-capability)
    LS Type: Summary Links(AS Boundary Router)
    Link State ID: 172.16.245.1 (AS Boundary Router address)
    Advertising Router: 172.16.241.5
    LS Seq Number: 80000072
    Checksum: 0x3548
    Length: 28
    Network Mask: 0.0.0.0 TOS: 0 Metric: 1
    
```

The table below describes the significant fields shown in the display.

**Table 151: show ip ospf database asbr-summary Field Descriptions**

Field	Description
OSPF Router with id	Router ID number.
Process ID	OSPF process ID.

Field	Description
LS age	Link state age.
Options	Type of service options (Type 0 only).
LS Type	Link state type.
Link State ID	Link state ID (autonomous system boundary router).
Advertising Router	Advertising router's ID.
LS Seq Number	Link state sequence (detects old or duplicate link state advertisements).
Checksum	LS checksum (Fletcher checksum of the complete contents of the link state advertisement).
Length	Length in bytes of the link state advertisement.
Network Mask	Network mask implemented.
TOS	Type of service.
Metric	Link state metric.

The following is sample output from the **show ip ospf database external** command with the **external** keyword:

```
Device#show ip ospf database external
OSPF Router with id(192.168.239.66) (Autonomous system 300)
      Displaying AS External Link States
LS age: 280
Options: (No TOS-capability)
LS Type: AS External Link
Link State ID: 10.105.0.0 (External Network Number)
Advertising Router: 172.16.70.6
LS Seq Number: 80000AFD
Checksum: 0xC3A
Length: 36
Network Mask: 255.255.0.0
      Metric Type: 2 (Larger than any link state path)
      TOS: 0
      Metric: 1
      Forward Address: 0.0.0.0
      External Route Tag: 0
```

The table below describes the significant fields shown in the display.

**Table 152: show ip ospf database external Field Descriptions**

Field	Description
OSPF Router with id	Router ID number.
Autonomous system	OSPF autonomous system number (OSPF process ID).
LS age	Link state age.
Options	Type of service options (Type 0 only).

Field	Description
LS Type	Link state type.
Link State ID	Link state ID (external network number).
Advertising Router	Advertising router's ID.
LS Seq Number	Link state sequence number (detects old or duplicate link state advertisements).
Checksum	LS checksum (Fletcher checksum of the complete contents of the LSA).
Length	Length in bytes of the link state advertisement.
Network Mask	Network mask implemented.
Metric Type	External Type.
TOS	Type of service.
Metric	Link state metric.
Forward Address	Forwarding address. Data traffic for the advertised destination will be forwarded to this address. If the forwarding address is set to 0.0.0.0, data traffic will be forwarded instead to the advertisement's originator.
External Route Tag	External route tag, a 32-bit field attached to each external route. This is not used by the OSPF protocol itself.

The following is sample output from the **show ip ospf database** command with the **network** keyword:

```
Device#show ip ospf database network
  OSPF Router with id(192.168.239.66) (Process ID 300)
    Displaying Net Link States(Area 0.0.0.0)

LS age: 1367
Options: (No TOS-capability)
LS Type: Network Links
Link State ID: 172.16.1.3 (address of Designated Router)
Advertising Router: 192.168.239.66
LS Seq Number: 800000E7
Checksum: 0x1229
Length: 52
Network Mask: 255.255.255.0
  Attached Router: 192.168.239.66
  Attached Router: 172.16.241.5
  Attached Router: 172.16.1.1
  Attached Router: 172.16.54.5
  Attached Router: 172.16.1.5
```

The table below describes the significant fields shown in the display.

**Table 153: show ip ospf database network Field Descriptions**

Field	Description
OSPF Router with id	Router ID number.
Process ID 300	OSPF process ID.

Field	Description
LS age	Link state age.
Options	Type of service options (Type 0 only).
LS Type:	Link state type.
Link State ID	Link state ID of designated router.
Advertising Router	Advertising router's ID.
LS Seq Number	Link state sequence (detects old or duplicate link state advertisements).
Checksum	LS checksum (Fletcher checksum of the complete contents of the link state advertisement).
Length	Length in bytes of the link state advertisement.
Network Mask	Network mask implemented.
AS Boundary Router	Definition of router type.
Attached Router	List of routers attached to the network, by IP address.

The following is sample output from the **show ip ospf database** command with the **router** keyword:

```
Device#show ip ospf database router
OSPF Router with id(192.168.239.66) (Process ID 300)
Displaying Router Link States(Area 0.0.0.0)
LS age: 1176
Options: (No TOS-capability)
LS Type: Router Links
Link State ID: 172.16.21.6
Advertising Router: 172.16.21.6
LS Seq Number: 80002CF6
Checksum: 0x73B7
Length: 120
AS Boundary Router
155   Number of Links: 8
Link connected to: another Router (point-to-point)
(link ID) Neighboring Router ID: 172.16.21.5
(Link Data) Router Interface address: 172.16.21.6
Number of TOS metrics: 0
TOS 0 Metrics: 2
```

The table below describes the significant fields shown in the display.

**Table 154: show ip ospf database router Field Descriptions**

Field	Description
OSPF Router with id	Router ID number.
Process ID	OSPF process ID.
LS age	Link state age.

Field	Description
Options	Type of service options (Type 0 only).
LS Type	Link state type.
Link State ID	Link state ID.
Advertising Router	Advertising router's ID.
LS Seq Number	Link state sequence (detects old or duplicate link state advertisements).
Checksum	LS checksum (Fletcher checksum of the complete contents of the link state advertisement).
Length	Length in bytes of the link state advertisement.
AS Boundary Router	Definition of router type.
Number of Links	Number of active links.
link ID	Link type.
Link Data	Router interface address.
TOS	Type of service metric (Type 0 only).

The following is sample output from **show ip ospf database** command with the **summary** keyword:

```
Device#show ip ospf database summary
      OSPF Router with id(192.168.239.66) (Process ID 300)
      Displaying Summary Net Link States(Area 0.0.0.0)
LS age: 1401
Options: (No TOS-capability)
LS Type: Summary Links(Network)
Link State ID: 172.16.240.0 (summary Network Number)
Advertising Router: 172.16.241.5
LS Seq Number: 80000072
Checksum: 0x84FF
Length: 28
Network Mask: 255.255.255.0  TOS: 0  Metric: 1
```

The table below describes the significant fields shown in the display.

**Table 155: show ip ospf database summary Field Descriptions**

Field	Description
OSPF Router with id	Router ID number.
Process ID	OSPF process ID.
LS age	Link state age.
Options	Type of service options (Type 0 only).
LS Type	Link state type.

Field	Description
Link State ID	Link state ID (summary network number).
Advertising Router	Advertising router's ID.
LS Seq Number	Link state sequence (detects old or duplicate link state advertisements).
Checksum	LS checksum (Fletcher checksum of the complete contents of the link state advertisement).
Length	Length in bytes of the link state advertisement.
Network Mask	Network mask implemented.
TOS	Type of service.
Metric	Link state metric.

The following is sample output from **show ip ospf database database-summary** command with the **database-summary** keyword:

```

Device#show ip ospf database database-summary
OSPF Router with ID (10.0.0.1) (Process ID 1)
Area 0 database summary
  LSA Type      Count  Delete  Maxage
  Router        3      0       0
  Network       0      0       0
  Summary Net   0      0       0
  Summary ASBR  0      0       0
  Type-7 Ext    0      0       0
  Self-originated Type-7  0
Opaque Link    0      0       0
Opaque Area    0      0       0
Subtotal      3      0       0
Process 1 database summary
  LSA Type      Count  Delete  Maxage
  Router        3      0       0
  Network       0      0       0
  Summary Net   0      0       0
  Summary ASBR  0      0       0
  Type-7 Ext    0      0       0
  Opaque Link   0      0       0
  Opaque Area   0      0       0
  Type-5 Ext    0      0       0
  Self-originated Type-5  200
Opaque AS      0      0       0
Total         203    0       0

```

The table below describes the significant fields shown in the display.

**Table 156: show ip ospf database database-summary Field Descriptions**

Field	Description
Area 0 database summary	Area number.
Count	Count of LSAs of the type identified in the first column.

Field	Description
Router	Number of router link state advertisements in that area.
Network	Number of network link state advertisements in that area.
Summary Net	Number of summary link state advertisements in that area.
Summary ASBR	Number of summary autonomous system boundary router (ASBR) link state advertisements in that area.
Type-7 Ext	Type-7 LSA count.
Self-originated Type-7	Self-originated Type-7 LSA.
Opaque Link	Type-9 LSA count.
Opaque Area	Type-10 LSA count
Subtotal	Sum of LSAs for that area.
Delete	Number of link state advertisements that are marked "Deleted" in that area.
Maxage	Number of link state advertisements that are marked "Maxaged" in that area.
Process 1 database summary	Database summary for the process.
Count	Count of LSAs of the type identified in the first column.
Router	Number of router link state advertisements in that process.
Network	Number of network link state advertisements in that process.
Summary Net	Number of summary link state advertisements in that process.
Summary ASBR	Number of summary autonomous system boundary router (ASBR) link state advertisements in that process.
Type-7 Ext	Type-7 LSA count.
Opaque Link	Type-9 LSA count.
Opaque Area	Type-10 LSA count.
Type-5 Ext	Type-5 LSA count.
Self-Originated Type-5	Self-originated Type-5 LSA count.
Opaque AS	Type-11 LSA count.
Total	Sum of LSAs for that process.
Delete	Number of link state advertisements that are marked "Deleted" in that process.
Maxage	Number of link state advertisements that are marked "Maxaged" in that process.

# show ip ospf interface

To display interface information related to Open Shortest Path First (OSPF), use the **show ip ospf interface** command in user EXEC or privileged EXEC mode.

**show ip [ospf] [process-id] interface [type number] [brief] [multicast] [topology topology-name | base]**

## Syntax Description

<i>process-id</i>	(Optional) Process ID number. If this argument is included, only information for the specified routing process is included. The range is 1 to 65535.
<i>type</i>	(Optional) Interface type. If the <i>type</i> argument is included, only information for the specified interface type is included.
<i>number</i>	(Optional) Interface number. If the <i>number</i> argument is included, only information for the specified interface number is included.
<b>brief</b>	(Optional) Displays brief overview information for OSPF interfaces, states, addresses and masks, and areas on the device.
<b>multicast</b>	(Optional) Displays multicast information.
<b>topology topology-name</b>	(Optional) Displays OSPF-related information about the named topology instance.
<b>topology base</b>	(Optional) Displays OSPF-related information about the base topology.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following is sample output from the **show ip ospf interface** command when Ethernet interface 0/0 is specified:

```
Device#show ip ospf interface ethernet 0/0

Ethernet0/0 is up, line protocol is up
 Internet Address 192.168.254.202/24, Area 0
 Process ID 1, Router ID 192.168.99.1, Network Type BROADCAST, Cost: 10
 Topology-MTID Cost Disabled Shutdown Topology Name
 0 10 no no Base
 Transmit Delay is 1 sec, State DR, Priority 1
 Designated Router (ID) 192.168.99.1, Interface address 192.168.254.202
 Backup Designated router (ID) 192.168.254.10, Interface address 192.168.254.10
 Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
 oob-resync timeout 40
 Hello due in 00:00:05
 Supports Link-local Signaling (LLS)
 Cisco NSF helper support enabled
```



```

IETF NSF helper support enabled
Index 1/1, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 192.168.254.10 (Backup Designated Router)
Suppress hello for 0 neighbor(s)

```

In Cisco IOS Release 12.2(33)SRB, the following sample output from the **show ip ospf interface brief topology VOICE** command shows a summary of information, including a confirmation that the Multitopology Routing (MTR) VOICE topology is configured in the interface configuration:

```

Device#show ip ospf interface brief topology VOICE

VOICE Topology (MTID 10)
Interface  PID  Area  IP Address/Mask  Cost  State Nbrs F/C
Lo0        1   0     10.0.0.2/32      1     LOOP  0/0
Se2/0      1   0     10.1.0.2/30     10    P2P   1/1

```

The following sample output from the **show ip ospf interface brief topology VOICE** command displays details of the MTR VOICE topology for the interface. When the command is entered without the **brief** keyword, more information is displayed.

```

Device#show ip ospf interface topology VOICE

                               VOICE Topology (MTID 10)
Loopback0 is up, line protocol is up
  Internet Address 10.0.0.2/32, Area 0
  Process ID 1, Router ID 10.0.0.2, Network Type LOOPBACK
  Topology-MTID   Cost   Disabled   Shutdown   Topology Name
  10              1     no        no        VOICE
Loopback interface is treated as a stub Host Serial2/0 is up, line protocol is up
  Internet Address 10.1.0.2/30, Area 0
  Process ID 1, Router ID 10.0.0.2, Network Type POINT_TO_POINT
  Topology-MTID   Cost   Disabled   Shutdown   Topology Name
  10              10    no        no        VOICE
Transmit Delay is 1 sec, State POINT_TO_POINT
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
  oob-resync timeout 40
  Hello due in 00:00:03
Supports Link-local Signaling (LLS)
Cisco NSF helper support enabled
IETF NSF helper support enabled
Index 1/1, flood queue length 0
Next 0x0(0)/0x0(0)
Last flood scan length is 1, maximum is 1
Last flood scan time is 0 msec, maximum is 0 msec
Neighbor Count is 1, Adjacent neighbor count is 1
  Adjacent with neighbor 10.0.0.1
Suppress hello for 0 neighbor(s)

```

In Cisco IOS Release 12.2(33)SRC, the following sample output from the **show ip ospf interface** command displays details about the configured Time-to-Live (TTL) limits:

```

Device#show ip ospf interface ethernet 0
.
.
.
Strict TTL checking enabled
! or a message similar to the following is displayed
Strict TTL checking enabled, up to 4 hops allowed

```

·  
·  
·

The table below describes the significant fields shown in the displays.

**Table 157: show ip ospf interface Field Descriptions**

Field	Description
Ethernet	Status of the physical link and operational status of the protocol.
Process ID	OSPF process ID.
Area	OSPF area.
Cost	Administrative cost assigned to the interface.
State	Operational state of the interface.
Nbrs F/C	OSPF neighbor count.
Internet Address	Interface IP address, subnet mask, and area address.
Topology-MTID	MTR topology Multitopology Identifier (MTID). A number assigned so that the protocol can identify the topology associated with information that it sends to its peers.
Transmit Delay	Transmit delay in seconds, interface state, and device priority.
Designated Router	Designated router ID and respective interface IP address.
Backup Designated router	Backup designated router ID and respective interface IP address.
Timer intervals configured	Configuration of timer intervals.
Hello	Number of seconds until the next hello packet is sent out this interface.
Strict TTL checking enabled	Only one hop is allowed.
Strict TTL checking enabled, up to 4 hops allowed	A set number of hops has been explicitly configured.
Neighbor Count	Count of network neighbors and list of adjacent neighbors.

# show ip ospf neighbor

To display Open Shortest Path First (OSPF) neighbor information on a per-interface basis, use the **show ip ospf neighbor** command in privileged EXEC mode.

**show ip ospf neighbor** [*interface-type interface-number*] [*neighbor-id*] [**detail**] [**summary**] [**per-instance**]

Syntax Description	
<i>interface-type interface-number</i>	(Optional) Type and number associated with a specific OSPF interface.
<i>neighbor-id</i>	(Optional) Neighbor hostname or IP address in A.B.C.D format.
<b>detail</b>	(Optional) Displays all neighbors given in detail (lists all neighbors).
<b>summary</b>	(Optional) Displays total number summary of all neighbors.
<b>per-instance</b>	(Optional) Displays total number of neighbors in each neighbor state. The output is printed for each configured OSPF instance separately.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following sample output from the **show ip ospf neighbor** command shows a single line of summary information for each neighbor:

```
Device#show ip ospf neighbor

Neighbor ID    Pri   State           Dead Time   Address           Interface
10.199.199.137 1     FULL/DR         0:00:31    192.168.80.37    Ethernet0
172.16.48.1    1     FULL/DROTHER    0:00:33    172.16.48.1      Fddi0
172.16.48.200 1     FULL/DROTHER    0:00:33    172.16.48.200    Fddi0
10.199.199.137 5     FULL/DR         0:00:33    172.16.48.189    Fddi0
```

The following is sample output showing summary information about the neighbor that matches the neighbor ID:

```
Device#show ip ospf neighbor 10.199.199.137

Neighbor 10.199.199.137, interface address 192.168.80.37
  In the area 0.0.0.0 via interface Ethernet0
  Neighbor priority is 1, State is FULL
  Options 2
  Dead timer due in 0:00:32
  Link State retransmission due in 0:00:04
Neighbor 10.199.199.137, interface address 172.16.48.189
  In the area 0.0.0.0 via interface Fddi0
  Neighbor priority is 5, State is FULL
  Options 2
  Dead timer due in 0:00:32
```

```
Link State retransmission due in 0:00:03
```

If you specify the interface along with the neighbor ID, the system displays the neighbors that match the neighbor ID on the interface, as in the following sample display:

```
Device#show ip ospf neighbor ethernet 0 10.199.199.137

Neighbor 10.199.199.137, interface address 192.168.80.37
  In the area 0.0.0.0 via interface Ethernet0
  Neighbor priority is 1, State is FULL
  Options 2
  Dead timer due in 0:00:37
  Link State retransmission due in 0:00:04
```

You can also specify the interface without the neighbor ID to show all neighbors on the specified interface, as in the following sample display:

```
Device#show ip ospf neighbor fddi 0

      ID          Pri   State           Dead Time      Address          Interface
172.16.48.1      1   FULL/DROTHER   0:00:33       172.16.48.1     Fddi0
172.16.48.200   1   FULL/DROTHER   0:00:32       172.16.48.200   Fddi0
10.199.199.137  5   FULL/DR        0:00:32       172.16.48.189   Fddi0
```

The following is sample output from the **show ip ospf neighbor detail** command:

```
Device#show ip ospf neighbor detail

Neighbor 192.168.5.2, interface address 10.225.200.28
  In the area 0 via interface GigabitEthernet1/0/0
  Neighbor priority is 1, State is FULL, 6 state changes
  DR is 10.225.200.28 BDR is 10.225.200.30
  Options is 0x42
  LLS Options is 0x1 (LR), last OOB-Resync 00:03:08 ago
  Dead timer due in 00:00:36
  Neighbor is up for 00:09:46
  Index 1/1, retransmission queue length 0, number of retransmission 1
  First 0x0(0)/0x0(0) Next 0x0(0)/0x0(0)
  Last retransmission scan length is 1, maximum is 1
  Last retransmission scan time is 0 msec, maximum is 0 msec
```

The table below describes the significant fields shown in the displays.

**Table 158: show ip ospf neighbor detail Field Descriptions**

Field	Description
Neighbor	Neighbor router ID.
interface address	IP address of the interface.
In the area	Area and interface through which the OSPF neighbor is known.
Neighbor priority	Router priority of the neighbor and neighbor state.
State	OSPF state. If one OSPF neighbor has enabled TTL security, the other side of the connection will show the neighbor in the INIT state.

Field	Description
state changes	Number of state changes since the neighbor was created. This value can be reset using the <b>clearipospfcountersneighbor</b> command.
DR is	Router ID of the designated router for the interface.
BDR is	Router ID of the backup designated router for the interface.
Options	Hello packet options field contents. (E-bit only. Possible values are 0 and 2; 2 indicates area is not a stub; 0 indicates area is a stub.)
LLS Options..., last OOB-Resync	Link-Local Signaling and out-of-band (OOB) link-state database resynchronization performed hours:minutes:seconds ago. This is nonstop forwarding (NSF) information. The field indicates the last successful out-of-band resynchronization with the NSF-capable router.
Dead timer due in	Expected time in hours:minutes:seconds before Cisco IOS software will declare the neighbor dead.
Neighbor is up for	Number of hours:minutes:seconds since the neighbor went into the two-way state.
Index	Neighbor location in the area-wide and autonomous system-wide retransmission queue.
retransmission queue length	Number of elements in the retransmission queue.
number of retransmission	Number of times update packets have been re-sent during flooding.
First	Memory location of the flooding details.
Next	Memory location of the flooding details.
Last retransmission scan length	Number of link state advertisements (LSAs) in the last retransmission packet.
maximum	Maximum number of LSAs sent in any retransmission packet.
Last retransmission scan time	Time taken to build the last retransmission packet.
maximum	Maximum time, in milliseconds, taken to build any retransmission packet.

The following is sample output from the **show ip ospf neighbor** command showing a single line of summary information for each neighbor. If one OSPF neighbor has enabled TTL security, the other side of the connection will show the neighbor in the INIT state.

```
Device#show ip ospf neighbor
```

```
Neighbor ID    Pri   State           Dead Time   Address           Interface
10.199.199.137 1     FULL/DR        0:00:31    192.168.80.37    Ethernet0
172.16.48.1    1     FULL/DROTHER   0:00:33    172.16.48.1      Fddi0
172.16.48.200 1     FULL/DROTHER   0:00:33    172.16.48.200    Fddi0
```

```

10.199.199.137 5 FULL/DR 0:00:33 172.16.48.189 Fddi0
172.16.1.201 1 INIT/DROTHER 00.00.35 10.1.1.201 Ethernet0/0

```

### Cisco IOS Release 15.1(3)S

The following sample output from the **show ip ospf neighbor** command shows the network from the neighbor's point of view:

```

Device#show ip ospf neighbor 192.0.2.1
      OSPF Router with ID (192.1.1.1) (Process ID 1)

          Area with ID (0)

Neighbor with Router ID 192.0.2.1:
  Reachable over:
    Ethernet0/0, IP address 192.0.2.1, cost 10

  SPF was executed 1 times, distance to computing router 10

  Router distance table:
    192.1.1.1 i [10]
    192.0.2.1 i [0]
    192.3.3.3 i [10]
    192.4.4.4 i [20]
    192.5.5.5 i [20]

  Network LSA distance table:
    192.2.12.2 i [10]
    192.2.13.3 i [20]
    192.2.14.4 i [20]
    192.2.15.5 i [20]

```

The following is sample output from the **show ip ospf neighbor summary** command:

```

Device#show ip ospf neighbor summary

  Neighbor summary for all OSPF processes

DOWN          0
ATTEMPT      0
INIT         0
2WAY         0
EXSTART      0
EXCHANGE     0
LOADING      0
FULL         1
Total count  1      (Undergoing NSF 0)

```

The following is sample output from the **show ip ospf neighbor summary per-instance** command:

```

Device#show ip ospf neighbor summary

      OSPF Router with ID (1.0.0.10) (Process ID 1)

DOWN          0
ATTEMPT      0
INIT         0
2WAY         0

```

```

EXSTART      0
EXCHANGE     0
LOADING      0
FULL         1
Total count  1      (Undergoing NSF 0)

```

Neighbor summary for all OSPF processes

```

DOWN         0
ATTEMPT      0
INIT         0
2WAY         0
EXSTART      0
EXCHANGE     0
LOADING      0
FULL         1
Total count  1      (Undergoing NSF 0)

```

**Table 159: show ip ospf neighbor summary and show ip ospf neighbor summary per-instance Field Descriptions**

Field	Description
DOWN	No information (hellos) has been received from this neighbor, but hello packets can still be sent to the neighbor in this state.
ATTEMPT	This state is only valid for manually configured neighbors in a Non-Broadcast Multi-Access (NBMA) environment. In Attempt state, the router sends unicast hello packets every poll interval to the neighbor, from which hellos have not been received within the dead interval.
INIT	This state specifies that the router has received a hello packet from its neighbor, but the receiving router's ID was not included in the hello packet. When a router receives a hello packet from a neighbor, it should list the sender's router ID in its hello packet as an acknowledgment that it received a valid hello packet.
2WAY	This state designates that bi-directional communication has been established between two routers.
EXSTART	This state is the first step in creating an adjacency between the two neighboring routers. The goal of this step is to decide which router is active, and to decide upon the initial DD sequence number. Neighbor conversations in this state or greater are called adjacencies.
EXCHANGE	In this state, OSPF routers exchange database descriptor (DBD) packets. Database descriptors contain link-state advertisement (LSA) headers only and describe the contents of the entire link-state database. Each DBD packet has a sequence number which can be incremented only by the active router which is explicitly acknowledged by the secondary router. Routers also send link-state request packets and link-state update packets (which contain the entire LSA) in this state. The contents of the DBD received are compared to the information contained in the routers link-state database to check if new or more current link-state information is available with the neighbor.

Field	Description
LOADING	<p>In this state, the actual exchange of link state information occurs. Based on the information provided by the DBDs, routers send link-state request packets. The neighbor then provides the requested link-state information in link-state update packets. During the adjacency, if a device receives an outdated or missing LSA, it requests that LSA by sending a link-state request packet. All link-state update packets are acknowledged.</p>
FULL	<p>In this state, devices are fully adjacent with each other. All the device and network LSAs are exchanged and the devices' databases are fully synchronized.</p> <p>Full is the normal state for an OSPF device. If a device is stuck in another state, it's an indication that there are problems in forming adjacencies. The only exception to this is the 2-way state, which is normal in a broadcast network. Devices achieve the full state with their DR and BDR only. Neighbors always see each other as 2-way.</p>



# show ip ospf virtual-links

To display parameters and the current state of Open Shortest Path First (OSPF) virtual links, use the **show ip ospf virtual-links** command in EXEC mode.

**show ip ospf virtual-links**

## Syntax Description

This command has no arguments or keywords.

## Command Modes

EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The information displayed by the **show ip ospf virtual-links** command is useful in debugging OSPF routing operations.

## Examples

The following is sample output from the **show ip ospf virtual-links** command:

```
Device#show ip ospf virtual-links
Virtual Link to router 192.168.101.2 is up
Transit area 0.0.0.1, via interface Ethernet0, Cost of using 10
Transmit Delay is 1 sec, State POINT_TO_POINT
Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
Hello due in 0:00:08
Adjacency State FULL
```

The table below describes the significant fields shown in the display.

**Table 160: show ip ospf virtual-links Field Descriptions**

Field	Description
Virtual Link to router 192.168.101.2 is up	Specifies the OSPF neighbor, and if the link to that neighbor is up or down.
Transit area 0.0.0.1	The transit area through which the virtual link is formed.
via interface Ethernet0	The interface through which the virtual link is formed.
Cost of using 10	The cost of reaching the OSPF neighbor through the virtual link.
Transmit Delay is 1 sec	The transmit delay (in seconds) on the virtual link.
State POINT_TO_POINT	The state of the OSPF neighbor.
Timer intervals...	The various timer intervals configured for the link.
Hello due in 0:00:08	When the next hello is expected from the neighbor.
Adjacency State FULL	The adjacency state between the neighbors.

## summary-address (OSPF)

To create aggregate addresses for Open Shortest Path First (OSPF), use the **summary-address** command in router configuration mode. To restore the default, use the no form of this command.

**summary-address** **command**  
**summary-address** *ip-address mask | prefix mask* [**not-advertise**] [**tag tag**] [**nssa-only**]  
**no summary-address** *ip-address mask | prefix mask* [**not-advertise**] [**tag tag**] [**nssa-only**]

### Syntax Description

<i>ip-address</i>	Summary address designated for a range of addresses.
<i>mask</i>	IP subnet mask used for the summary route.
<i>prefix</i>	IP route prefix for the destination.
<b>not-advertise</b>	(Optional) Suppresses routes that match the specified prefix/mask pair. This keyword applies to OSPF only.
<b>tag tag</b>	(Optional) Specifies the tag value that can be used as a “match” value for controlling redistribution via route maps. This keyword applies to OSPF only.
<b>nssa-only</b>	(Optional) Sets the nssa-only attribute for the summary route (if any) generated for the specified prefix, which limits the summary to not-so-stubby-area (NSSA) areas.

### Command Default

This command behavior is disabled by default.

### Command Modes

Router configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

R routes learned from other routing protocols can be summarized. The metric used to advertise the summary is the lowest metric of all the more specific routes. This command helps reduce the size of the routing table.

Using this command for OSPF causes an OSPF Autonomous System Boundary Router (ASBR) to advertise one external route as an aggregate for all redistributed routes that are covered by the address. For OSPF, this command summarizes only routes from other routing protocols that are being redistributed into OSPF. Use the **area range** command for route summarization between OSPF areas.

OSPF does not support the **summary-address 0.0.0.0 0.0.0.0** command.

### Examples

In the following example, the summary address 10.1.0.0 includes address 10.1.1.0, 10.1.2.0, 10.1.3.0, and so on. Only the address 10.1.0.0 is advertised in an external link-state advertisement.

```
Device(config)#summary-address 10.1.0.0 255.255.0.0
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>area range</b>	Consolidates and summarizes routes at an area boundary.
<b>ip ospf authentication-key</b>	Assigns a password to be used by neighboring routers that are using the simple password authentication of OSPF.
<b>ip ospf message-digest-key</b>	Enables OSPF MD5 authentication.

## timers throttle spf

To turn on Open Shortest Path First (OSPF) shortest path first (SPF) throttling, use the **timers throttle spf** command in the appropriate configuration mode. To turn off OSPF SPF throttling, use the **no** form of this command.

**timers throttle spf** *spf-start spf-hold spf-max-wait*

**no timers throttle spf** *spf-start spf-hold spf-max-wait*

### Syntax Description

<i>spf-start</i>	Initial delay to schedule an SPF calculation after a change, in milliseconds. Range is from 1 to 600000. In OSPF for IPv6, the default value is 5000.
<i>spf-hold</i>	Minimum hold time between two consecutive SPF calculations, in milliseconds. Range is from 1 to 600000. In OSPF for IPv6, the default value is 10,000.
<i>spf-max-wait</i>	Maximum wait time between two consecutive SPF calculations, in milliseconds. Range is from 1 to 600000. In OSPF for IPv6, the default value is 10,000.

### Command Default

SPF throttling is not set.

### Command Modes

Address family configuration (config-router-af) Router address family topology configuration (config-router-af-topology) Router configuration (config-router) OSPF for IPv6 router configuration (config-rtr)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The first wait interval between SPF calculations is the amount of time in milliseconds specified by the *spf-start* argument. Each consecutive wait interval is two times the current hold level in milliseconds until the wait time reaches the maximum time in milliseconds as specified by the *spf-max-wait* argument. Subsequent wait times remain at the maximum until the values are reset or a link-state advertisement (LSA) is received between SPF calculations.

#### Release 12.2(33)SRB

If you plan to configure the Multi-Topology Routing (MTR) feature, you need to enter the **timers throttle spf** command in router address family topology configuration mode in order to make this OSPF router configuration command become topology-aware.

#### Release 15.2(1)T

When you configure the **ospfv3 network manet** command on any interface attached to the OSPFv3 process, the default values for the *spf-start*, *spf-hold*, and the *spf-max-wait* arguments are reduced to 1000 milliseconds, 1000 milliseconds, and 2000 milliseconds respectively.

### Examples

The following example shows how to configure a router with the delay, hold, and maximum interval values for the **timers throttle spf** command set at 5, 1000, and 90,000 milliseconds, respectively.

```
router ospf 1
router-id 10.10.10.2
```

```
log-adjacency-changes
timers throttle spf 5 1000 90000
redistribute static subnets
network 10.21.21.0 0.0.0.255 area 0
network 10.22.22.0 0.0.0.255 area 00
```

The following example shows how to configure a router using IPv6 with the delay, hold, and maximum interval values for the **timers throttle spf** command set at 500, 1000, and 10,000 milliseconds, respectively.

```
ipv6 router ospf 1
event-log size 10000 one-shot
log-adjacency-changes
timers throttle spf 500 1000 10000
```

**Related Commands**

Command	Description
<b>ospfv3 network manet</b>	Sets the network type to Mobile Ad Hoc Network (MANET).





## PART **XI**

# Security

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## Security

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## aaa accounting

To enable authentication, authorization, and accounting (AAA) accounting of requested services for billing or security purposes when you use RADIUS or TACACS+, use the **aaa accounting** command in global configuration mode. To disable AAA accounting, use the **no** form of this command.

```
aaa accounting {auth-proxy | system | network | exec | connections | commands level}
{default | list-name} {start-stop | stop-only | none} [broadcast] group group-name
no aaa accounting {auth-proxy | system | network | exec | connections | commands level}
{default | list-name} {start-stop | stop-only | none} [broadcast] group group-name
```

### Syntax Description

<b>auth-proxy</b>	Provides information about all authenticated-proxy user events.
<b>system</b>	Performs accounting for all system-level events not associated with users, such as reloads.
<b>network</b>	Runs accounting for all network-related service requests.
<b>exec</b>	Runs accounting for EXEC shell session. This keyword might return user profile information such as what is generated by the <b>autocommand</b> command.
<b>connection</b>	Provides information about all outbound connections made from the network access server.
<b>commands level</b>	Runs accounting for all commands at the specified privilege level. Valid privilege level entries are integers from 0 through 15.
<b>default</b>	Uses the listed accounting methods that follow this argument as the default list of methods for accounting services.
<i>list-name</i>	Character string used to name the list of at least one of the accounting methods described in
<b>start-stop</b>	Sends a "start" accounting notice at the beginning of a process and a "stop" accounting notice at the end of a process. The "start" accounting record is sent in the background. The requested user process begins regardless of whether the "start" accounting notice was received by the accounting server.
<b>stop-only</b>	Sends a "stop" accounting notice at the end of the requested user process.
<b>none</b>	Disables accounting services on this line or interface.
<b>broadcast</b>	(Optional) Enables sending accounting records to multiple AAA servers. Simultaneously sends accounting records to the first server in each group. If the first server is unavailable, fail over occurs using the backup servers defined within that group.
<i>group</i> <i>groupname</i>	At least one of the keywords described in <a href="#">Table 161: AAA accounting Methods, on page 1101</a>

### Command Default

AAA accounting is disabled.

### Command Modes

Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **aaa accounting** command to enable accounting and to create named method lists defining specific accounting methods on a per-line or per-interface basis.

**Table 161: AAA accounting Methods**

Keyword	Description
<b>group radius</b>	Uses the list of all RADIUS servers for authentication as defined by the <b>aaa group server radius</b> command.
<b>group tacacs+</b>	Uses the list of all TACACS+ servers for authentication as defined by the <b>aaa group server tacacs+</b> command.
<b>group</b> <i>group-name</i>	Uses a subset of RADIUS or TACACS+ servers for accounting as defined by the server group <i>group-name</i> .

In [Table 161: AAA accounting Methods, on page 1101](#), the **group radius** and **group tacacs+** methods refer to a set of previously defined RADIUS or TACACS+ servers. Use the **radius server** and **tacacs server** commands to configure the host servers. Use the **aaa group server radius** and **aaa group server tacacs+** commands to create a named group of servers.

Cisco IOS software supports the following two methods of accounting:

- **RADIUS**—The network access server reports user activity to the RADIUS security server in the form of accounting records. Each accounting record contains accounting attribute-value (AV) pairs and is stored on the security server.
- **TACACS+**—The network access server reports user activity to the TACACS+ security server in the form of accounting records. Each accounting record contains accounting attribute-value (AV) pairs and is stored on the security server.

Method lists for accounting define the way accounting will be performed. Named accounting method lists enable you to designate a particular security protocol to be used on specific lines or interfaces for particular types of accounting services. Create a list by entering the *list-name* and the *method*, where *list-name* is any character string used to name this list (excluding the names of methods, such as radius or tacacs+) and *method* identifies the methods to be tried in sequence as given.

If the **aaa accounting** command for a particular accounting type is issued without a named method list specified, the default method list is automatically applied to all interfaces or lines (where this accounting type applies) except those that have a named method list explicitly defined. (A defined method list overrides the default method list.) If no default method list is defined, then no accounting takes place.



**Note** System accounting does not use named accounting lists; you can only define the default list for system accounting.

For minimal accounting, include the **stop-only** keyword to send a stop record accounting notice at the end of the requested user process. For more accounting, you can include the **start-stop** keyword, so that RADIUS

or TACACS+ sends a start accounting notice at the beginning of the requested process and a stop accounting notice at the end of the process. Accounting is stored only on the RADIUS or TACACS+ server. The none keyword disables accounting services for the specified line or interface.

When AAA accounting is activated, the network access server monitors either RADIUS accounting attributes or TACACS+ AV pairs pertinent to the connection, depending on the security method you have implemented. The network access server reports these attributes as accounting records, which are then stored in an accounting log on the security server. For a list of supported RADIUS accounting attributes, refer to the appendix RADIUS Attributes in the *Cisco IOS Security Configuration Guide*. For a list of supported TACACS+ accounting AV pairs, refer to the appendix TACACS+ Attribute-Value Pairs in the *Cisco IOS Security Configuration Guide*.



---

**Note** This command cannot be used with TACACS or extended TACACS.

---

This example defines a default commands accounting method list, where accounting services are provided by a TACACS+ security server, set for privilege level 15 commands with a stop-only restriction:

```
Device(config)# aaa accounting commands 15 default stop-only group TACACS+
```

This example defines a default auth-proxy accounting method list, where accounting services are provided by a TACACS+ security server with a stop-only restriction. The aaa accounting commands activates authentication proxy accounting.

```
Device(config)# aaa new model
Device(config)# aaa authentication login default group TACACS+
Device(config)# aaa authorization auth-proxy default group TACACS+
Device(config)# aaa accounting auth-proxy default start-stop group TACACS+
```

## aaa accounting dot1x

To enable authentication, authorization, and accounting (AAA) accounting and to create method lists defining specific accounting methods on a per-line or per-interface basis for IEEE 802.1x sessions, use the **aaa accounting dot1x** command in global configuration mode. To disable IEEE 802.1x accounting, use the **no** form of this command.

```
aaa accounting dot1x {name | default} start-stop {broadcast group {name | radius | tacacs+}
[group {name | radius | tacacs+} ... ] | group {name | radius | tacacs+} [group
{name | radius | tacacs+} ... ]}
no aaa accounting dot1x {name | default}
```

### Syntax Description

<b>name</b>	Name of a server group. This is optional when you enter it after the <b>broadcast group</b> and <b>group</b> keywords.
<b>default</b>	Specifies the accounting methods that follow as the default list for accounting services.
<b>start-stop</b>	Sends a start accounting notice at the beginning of a process and a stop accounting notice at the end of a process. The start accounting record is sent in the background. The requested user process begins regardless of whether or not the start accounting notice was received by the accounting server.
<b>broadcast</b>	Enables accounting records to be sent to multiple AAA servers and sends accounting records to the first server in each group. If the first server is unavailable, the switch uses the list of backup servers to identify the first server.
<b>group</b>	Specifies the server group to be used for accounting services. These are valid server group names: <ul style="list-style-type: none"> <li>• <b>name</b> — Name of a server group.</li> <li>• <b>radius</b> — Lists of all RADIUS hosts.</li> <li>• <b>tacacs+</b> — Lists of all TACACS+ hosts.</li> </ul> <p>The <b>group</b> keyword is optional when you enter it after the <b>broadcast group</b> and <b>group</b> keywords. You can enter more than optional <b>group</b> keyword.</p>
<b>radius</b>	(Optional) Enables RADIUS accounting.
<b>tacacs+</b>	(Optional) Enables TACACS+ accounting.

### Command Default

AAA accounting is disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

**Usage Guidelines**

This command requires access to a RADIUS server.

We recommend that you enter the **dot1x reauthentication** interface configuration command before configuring IEEE 802.1x RADIUS accounting on an interface.

This example shows how to configure IEEE 802.1x accounting:

```
Device(config)# aaa new-model  
Device(config)# aaa accounting dot1x default start-stop group radius
```



## aaa accounting identity

To enable authentication, authorization, and accounting (AAA) for IEEE 802.1x, MAC authentication bypass (MAB), and web authentication sessions, use the **aaa accounting identity** command in global configuration mode. To disable IEEE 802.1x accounting, use the **no** form of this command.

```
aaa accounting identity {name | default} start-stop {broadcast group {name | radius | tacacs+}
[group {name | radius | tacacs+} ... ] | group {name | radius | tacacs+} [group
{name | radius | tacacs+} ... ]}
no aaa accounting identity {name | default}
```

### Syntax Description

<b>name</b>	Name of a server group. This is optional when you enter it after the <b>broadcast group</b> and <b>group</b> keywords.
<b>default</b>	Uses the accounting methods that follow as the default list for accounting services.
<b>start-stop</b>	Sends a start accounting notice at the beginning of a process and a stop accounting notice at the end of a process. The start accounting record is sent in the background. The requested-user process begins regardless of whether or not the start accounting notice was received by the accounting server.
<b>broadcast</b>	Enables accounting records to be sent to multiple AAA servers and send accounting records to the first server in each group. If the first server is unavailable, the switch uses the list of backup servers to identify the first server.
<b>group</b>	Specifies the server group to be used for accounting services. These are valid server group names: <ul style="list-style-type: none"> <li>• <b>name</b> — Name of a server group.</li> <li>• <b>radius</b> — Lists of all RADIUS hosts.</li> <li>• <b>tacacs+</b> — Lists of all TACACS+ hosts.</li> </ul> <p>The <b>group</b> keyword is optional when you enter it after the <b>broadcast group</b> and <b>group</b> keywords. You can enter more than optional <b>group</b> keyword.</p>
<b>radius</b>	(Optional) Enables RADIUS authorization.
<b>tacacs+</b>	(Optional) Enables TACACS+ accounting.

### Command Default

AAA accounting is disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

To enable AAA accounting identity, you need to enable policy mode. To enable policy mode, enter the **authentication display new-style** command in privileged EXEC mode.

This example shows how to configure IEEE 802.1x accounting identity:

```
Device# authentication display new-style
```

Please note that while you can revert to legacy style configuration at any time unless you have explicitly entered new-style configuration, the following caveats should be carefully read and understood.

- (1) If you save the config in this mode, it will be written to NVRAM in NEW-style config, and if you subsequently reload the router without reverting to legacy config and saving that, you will no longer be able to revert.
- (2) In this and legacy mode, Webauth is not IPv6-capable. It will only become IPv6-capable once you have entered new-style config manually, or have reloaded with config saved in 'authentication display new' mode.

```
Device# configure terminal
```

```
Device(config)# aaa accounting identity default start-stop group radius
```

## aaa authentication dot1x

To specify the authentication, authorization, and accounting (AAA) method to use on ports complying with the IEEE 802.1x authentication, use the **aaa authentication dot1x** command in global configuration mode on a standalone switch. To disable authentication, use the **no** form of this command.

```
aaa authentication dot1x {default} method1
no aaa authentication dot1x {default} method1
```

<b>Syntax Description</b>	<b>default</b>	The default method when a user logs in. Use the listed authentication method that follows this argument.
	<i>method1</i>	Specifies the server authentication. Enter the <b>group radius</b> keywords to use the list of all RADIUS servers for authentication.
	<b>Note</b>	Though other keywords are visible in the command-line help strings, only the <b>default</b> and <b>group radius</b> keywords are supported.
<b>Command Default</b>	No authentication is performed.	
<b>Command Modes</b>	Global configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

The **method** argument identifies the method that the authentication algorithm tries in the specified sequence to validate the password provided by the client. The only method that is IEEE 802.1x-compliant is the **group radius** method, in which the client data is validated against a RADIUS authentication server.

If you specify **group radius**, you must configure the RADIUS server by entering the **radius-server host** global configuration command.

Use the **show running-config** privileged EXEC command to display the configured lists of authentication methods.

This example shows how to enable AAA and how to create an IEEE 802.1x-compliant authentication list. This authentication first tries to contact a RADIUS server. If this action returns an error, the user is not allowed access to the network.

```
Device(config)# aaa new-model
Device(config)# aaa authentication dot1x default group radius
```

## aaa authorization

To set the parameters that restrict user access to a network, use the **aaa authorization** command in global configuration mode. To remove the parameters, use the **no** form of this command.

```
aaa authorization { auth-proxy | cache | commands level | config-commands | configuration
| console | credential-download | exec | multicast | network | onep | policy-if | prepaid
| radius-proxy | reverse-access | subscriber-service | template } { default | list_name }
[method1 [ method2 . . . ]]
```

```
aaa authorization { auth-proxy | cache | commands level | config-commands | configuration
| console | credential-download | exec | multicast | network | reverse-access | template }
{ default | list_name } [method1 [ method2 . . . ]]
```

```
no aaa authorization { auth-proxy | cache | commands level | config-commands | configuration
| console | credential-download | exec | multicast | network | reverse-access | template }
{ default | list_name } [method1 [ method2 . . . ]]
```

### Syntax Description

<b>auth-proxy</b>	Runs authorization for authentication proxy services.
<b>cache</b>	Configures the authentication, authorization, and accounting (AAA) server.
<b>commands</b>	Runs authorization for all commands at the specified privilege level.
<i>level</i>	Specific command level that should be authorized. Valid entries are 0 through 15.
<b>config-commands</b>	Runs authorization to determine whether commands entered in configuration mode are authorized.
<b>configuration</b>	Downloads the configuration from the AAA server.
<b>console</b>	Enables the console authorization for the AAA server.
<b>credential-download</b>	Downloads EAP credential from Local/RADIUS/LDAP.
<b>exec</b>	Enables the console authorization for the AAA server.
<b>multicast</b>	Downloads the multicast configuration from the AAA server.
<b>network</b>	Runs authorization for all network-related service requests, including Serial Line Internet Protocol (SLIP), PPP, PPP Network Control Programs (NCPs), and AppleTalk Remote Access (ARA).
<b>onep</b>	Runs authorization for the ONEP service.
<b>reverse-access</b>	Runs authorization for reverse access connections, such as reverse Telnet.
<b>template</b>	Enables template authorization for the AAA server.
<b>default</b>	Uses the listed authorization methods that follow this keyword as the default list of methods for authorization.
<i>list_name</i>	Character string used to name the list of authorization methods.

---

*method1* [*method2...*] (Optional) An authorization method or multiple authorization methods to be used for authorization. A method may be any one of the keywords listed in the table below.

---

**Command Default** Authorization is disabled for all actions (equivalent to the method keyword **none**).

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **aaa authorization** command to enable authorization and to create named methods lists, which define authorization methods that can be used when a user accesses the specified function. Method lists for authorization define the ways in which authorization will be performed and the sequence in which these methods will be performed. A method list is a named list that describes the authorization methods (such as RADIUS or TACACS+) that must be used in sequence. Method lists enable you to designate one or more security protocols to be used for authorization, which ensures a backup system in case the initial method fails. Cisco IOS software uses the first method listed to authorize users for specific network services; if that method fails to respond, the Cisco IOS software selects the next method listed in the method list. This process continues until there is successful communication with a listed authorization method, or until all the defined methods are exhausted.



**Note** The Cisco IOS software attempts authorization with the next listed method only when there is no response from the previous method. If authorization fails at any point in this cycle--meaning that the security server or the local username database responds by denying the user services--the authorization process stops and no other authorization methods are attempted.

If the **aaa authorization** command for a particular authorization type is issued without a specified named method list, the default method list is automatically applied to all interfaces or lines (where this authorization type applies) except those that have a named method list explicitly defined. (A defined method list overrides the default method list.) If no default method list is defined, then no authorization takes place. The default authorization method list must be used to perform outbound authorization, such as authorizing the download of IP pools from the RADIUS server.

Use the **aaa authorization** command to create a list by entering the values for the *list-name* and the *method* arguments, where *list-name* is any character string used to name this list (excluding all method names) and *method* identifies the list of authorization methods tried in the given sequence.



**Note** In the table that follows, the **group***group-name*, **group ldap**, **group radius**, and **group tacacs+** methods refer to a set of previously defined RADIUS or TACACS+ servers. Use the **radius server** and **tacacs server** commands to configure the host servers. Use the **aaa group server radius**, **aaa group server ldap**, and **aaa group server tacacs+** commands to create a named group of servers.

This table describes the method keywords.

**Table 162: aaa authorization Methods**

Keyword	Description
<b>cache</b> <i>group-name</i>	Uses a cache server group for authorization.
<b>group</b> <i>group-name</i>	Uses a subset of RADIUS or TACACS+ servers for accounting as defined by the <b>server group</b> <i>group-name</i> command.
<b>group ldap</b>	Uses the list of all Lightweight Directory Access Protocol (LDAP) servers for authentication.
<b>group radius</b>	Uses the list of all RADIUS servers for authentication as defined by the <b>aaa group server radius</b> command.
<b>grouptacacs+</b>	Uses the list of all TACACS+ servers for authentication as defined by the <b>aaa group server tacacs+</b> command.
<b>if-authenticated</b>	Allows the user to access the requested function if the user is authenticated.  <b>Note</b> The <b>if-authenticated</b> method is a terminating method. Therefore, if it is listed as a method, any methods listed after it will never be evaluated.
<b>local</b>	Uses the local database for authorization.
<b>none</b>	Indicates that no authorization is performed.

Cisco IOS software supports the following methods for authorization:

- Cache Server Groups—The router consults its cache server groups to authorize specific rights for users.
- If-Authenticated—The user is allowed to access the requested function provided the user has been authenticated successfully.
- Local—The router or access server consults its local database, as defined by the **username** command, to authorize specific rights for users. Only a limited set of functions can be controlled through the local database.
- None—The network access server does not request authorization information; authorization is not performed over this line or interface.
- RADIUS—The network access server requests authorization information from the RADIUS security server group. RADIUS authorization defines specific rights for users by associating attributes, which are stored in a database on the RADIUS server, with the appropriate user.
- TACACS+—The network access server exchanges authorization information with the TACACS+ security daemon. TACACS+ authorization defines specific rights for users by associating attribute-value (AV) pairs, which are stored in a database on the TACACS+ security server, with the appropriate user.

Method lists are specific to the type of authorization being requested. AAA supports five different types of authorization:

- **Commands**—Applies to the EXEC mode commands a user issues. Command authorization attempts authorization for all EXEC mode commands, including global configuration commands, associated with a specific privilege level.
- **EXEC**—Applies to the attributes associated with a user EXEC terminal session.
- **Network**—Applies to network connections. The network connections can include a PPP, SLIP, or ARA connection.



---

**Note** You must configure the **aaa authorization config-commands** command to authorize global configuration commands, including EXEC commands prepended by the **do** command.

---

- **Reverse Access**—Applies to reverse Telnet sessions.
- **Configuration**—Applies to the configuration downloaded from the AAA server.

When you create a named method list, you are defining a particular list of authorization methods for the indicated authorization type.

Once defined, the method lists must be applied to specific lines or interfaces before any of the defined methods are performed.

The authorization command causes a request packet containing a series of AV pairs to be sent to the RADIUS or TACACS daemon as part of the authorization process. The daemon can do one of the following:

- Accept the request as is.
- Make changes to the request.
- Refuse the request and authorization.

For a list of supported RADIUS attributes, see the module RADIUS Attributes. For a list of supported TACACS+ AV pairs, see the module TACACS+ Attribute-Value Pairs.



---

**Note** Five commands are associated with privilege level 0: **disable**, **enable**, **exit**, **help**, and **logout**. If you configure AAA authorization for a privilege level greater than 0, these five commands will not be included in the privilege level command set.

---

The following example shows how to define the network authorization method list named `mygroup`, which specifies that RADIUS authorization will be used on serial lines using PPP. If the RADIUS server fails to respond, local network authorization will be performed.

```
Device(config)# aaa authorization network mygroup group radius local
```

# aaa new-model

To enable the authentication, authorization, and accounting (AAA) access control model, issue the **aaa new-model** command in global configuration mode. To disable the AAA access control model, use the **no** form of this command.

**aaa new-model**  
**no aaa new-model**

**Syntax Description** This command has no arguments or keywords.

**Command Default** AAA is not enabled.

**Command Modes** Global configuration (config)

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command enables the AAA access control system.

If the **login local** command is configured for a virtual terminal line (VTY), and the **aaa new-model** command is removed, you must reload the switch to get the default configuration or the **login** command. If the switch is not reloaded, the switch defaults to the **login local** command under the VTY.



**Note** We do not recommend removing the **aaa new-model** command.

The following example shows this restriction:

```
Device(config)# aaa new-model
Device(config)# line vty 0 15
Device(config-line)# login local
Device(config-line)# exit
Device(config)# no aaa new-model
Device(config)# exit
Device# show running-config | b line vty

line vty 0 4
  login local !<=== Login local instead of "login"
line vty 5 15
  login local
!
```

## Examples

The following example initializes AAA:

```
Device(config)# aaa new-model
Device(config)#
```



Related Commands	Command	Description
	<b>aaa accounting</b>	Enables AAA accounting of requested services for billing or security purposes.
	<b>aaa authentication arap</b>	Enables an AAA authentication method for ARAP using TACACS+.
	<b>aaa authentication enable default</b>	Enables AAA authentication to determine if a user can access the privileged command level.
	<b>aaa authentication login</b>	Sets AAA authentication at login.
	<b>aaa authentication ppp</b>	Specifies one or more AAA authentication method for use on serial interfaces running PPP.
	<b>aaa authorization</b>	Sets parameters that restrict user access to a network.

## access-session mac-move deny

To disable MAC move on a , use the **access-session mac-move deny** global configuration command. To return to the default setting, use the **no** form of this command.

**access-session mac-move deny**  
**no access-session mac-move deny**

**Syntax Description** This command has no arguments or keywords.

**Command Default** MAC move is enabled.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **no** form of this command enables authenticated hosts to move between any authentication-enabled ports (MAC authentication bypass [MAB], 802.1x, or Web-auth) on a . For example, if there is a device between an authenticated host and port, and that host moves to another port, the authentication session is deleted from the first port, and the host is reauthenticated on the new port.

If MAC move is disabled, and an authenticated host moves to another port, it is not reauthenticated, and a violation error occurs.

This example shows how to enable MAC move on a :

```
Device(config)# no access-session mac-move deny
```

### Related Commands

Command	Description
<b>authentication event</b>	Sets the action for specific authentication events.
<b>authentication fallback</b>	Configures a port to use web authentication as a fallback method for clients that do not support IEEE 802.1x authentication.
<b>authentication host-mode</b>	Sets the authorization manager mode on a port.
<b>authentication open</b>	Enables or disables open access on a port.
<b>authentication order</b>	Sets the order of authentication methods used on a port.
<b>authentication periodic</b>	Enables or disables reauthentication on a port.
<b>authentication port-control</b>	Enables manual control of the port authorization state.

<b>Command</b>	<b>Description</b>
<b>authentication priority</b>	Adds an authentication method to the port-priority list.
<b>authentication timer</b>	Configures the timeout and reauthentication parameters for an 802.1x-enabled port.
<b>authentication violation</b>	Configures the violation modes that occur when a new device connects to a port or when a new device connects to a port with the maximum number of devices already connected to that port.
<b>show authentication</b>	Displays information about authentication manager events on the switch.

# access-session template monitor

To set the access session template to monitor ports, use the **access-session template monitor** command in global configuration mode. To return to the default setting, use the **no** form of this command.

**access-session template monitor**

**no access-session template monitor**

**Syntax Description** This command has no arguments or keywords.

**Command Default** This command is not configured.

**Command Modes** Global configuration (config)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **access-session template monitor** command enables session monitoring to create sessions on all ports where authentication configurations are not present, and MAC addresses are known. These sessions have open access ports for traffic, multi-auth host mode to control the number of hosts on a port, and port-control set to auto for sessions to undergo authentication and authorization. The **access-session template monitor** command is enabled by default if the **device classifier** or **autoconf** command is enabled. Session monitoring can be disabled on a per port basis.

This command is available on devices that has Identity-Based Networking Services (IBNS). The equivalent command for **access-session template monitor** command in IBNS **new-style** mode is **access-session monitor**. To switch from IBNS legacy mode to new style mode, use the **authentication convert-to new-style** command.

## Examples

The following example shows how to set the access session template to monitor ports:

```
Device(config)# access-session template monitor
```

## Related Commands

Command	Description
<b>device classifier</b>	Creates a monitor session for all the MAC addresses learned in the system.
<b>authentication convert-to new-style</b>	Converts all the relevant authentication commands to their CPL control policy-equivalents.

# action

To set the action for the VLAN access map entry, use the **action** command in access-map configuration mode. To return to the default setting, use the **no** form of this command.

**action**drop | forward  
**no action**

<b>Syntax Description</b>	<b>drop</b>	Drops the packet when the specified conditions are matched.
	<b>forward</b>	Forwards the packet when the specified conditions are matched.
<b>Command Default</b>	The default action is to forward packets.	
<b>Command Modes</b>	Access-map configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

You enter access-map configuration mode by using the **vlan access-map** global configuration command.

If the action is **drop**, you should define the access map, including configuring any access control list (ACL) names in match clauses, before applying the map to a VLAN, or all packets could be dropped.

In access-map configuration mode, use the **match access-map** configuration command to define the match conditions for a VLAN map. Use the **action** command to set the action that occurs when a packet matches the conditions.

The drop and forward parameters are not used in the **no** form of the command.

You can verify your settings by entering the **show vlan access-map** privileged EXEC command.

This example shows how to identify and apply a VLAN access map (vmap4) to VLANs 5 and 6 that causes the VLAN to forward an IP packet if the packet matches the conditions defined in access list a12:

```
Device(config)# vlan access-map vmap4
Device(config-access-map)# match ip address a12
Device(config-access-map)# action forward
Device(config-access-map)# exit
Device(config)# vlan filter vmap4 vlan-list 5-6
```

# authentication host-mode

To set the authorization manager mode on a port, use the **authentication host-mode** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

**authentication host-mode** { **multi-auth** | **multi-domain** | **multi-host** | **single-host** }  
**no authentication host-mode**

Syntax Description		
<b>multi-auth</b>	Enables multiple-authorization mode (multi-auth mode) on the port.	
<b>multi-domain</b>	Enables multiple-domain mode on the port.	
<b>multi-host</b>	Enables multiple-host mode on the port.	
<b>single-host</b>	Enables single-host mode on the port.	

**Command Default** Single host mode is enabled.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Single-host mode should be configured if only one data host is connected. Do not connect a voice device to authenticate on a single-host port. Voice device authorization fails if no voice VLAN is configured on the port.

Multi-domain mode should be configured if data host is connected through an IP phone to the port. Multi-domain mode should be configured if the voice device needs to be authenticated.

Multi-auth mode should be configured to allow devices behind a hub to obtain secured port access through individual authentication. Only one voice device can be authenticated in this mode if a voice VLAN is configured.

Multi-host mode also offers port access for multiple hosts behind a hub, but multi-host mode gives unrestricted port access to the devices after the first user gets authenticated.

This example shows how to enable multi-auth mode on a port:

```
Device(config-if)# authentication host-mode multi-auth
```

This example shows how to enable multi-domain mode on a port:

```
Device(config-if)# authentication host-mode multi-domain
```

This example shows how to enable multi-host mode on a port:

```
Device(config-if) # authentication host-mode multi-host
```

This example shows how to enable single-host mode on a port:

```
Device(config-if) # authentication host-mode single-host
```

You can verify your settings by entering the **show authentication sessions interface** *interface* **details** privileged EXEC command.

# authentication mac-move permit

To enable MAC move on a , use the **authentication mac-move permit** command in global configuration mode. To disable MAC move, use the **no** form of this command.

**authentication mac-move permit**  
**no authentication mac-move permit**

**Syntax Description** This command has no arguments or keywords.

**Command Default** MAC move is disabled.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This is a legacy command. The new command is **access-session mac-move deny**.

The command enables authenticated hosts to move between any authentication-enabled ports (MAC authentication bypass [MAB], 802.1x, or Web-auth) on a . For example, if there is a device between an authenticated host and port, and that host moves to another port, the authentication session is deleted from the first port, and the host is reauthenticated on the new port.

If MAC move is disabled, and an authenticated host moves to another port, it is not reauthenticated, and a violation error occurs.

This example shows how to enable MAC move on a :

```
Device(config)# authentication mac-move permit
```

## Related Commands

Command	Description
<b>access-session mac-move deny</b>	Disables MAC move on a .
<b>authentication event</b>	Sets the action for specific authentication events.
<b>authentication fallback</b>	Configures a port to use web authentication as a fallback method for clients that do not support IEEE 802.1x authentication.
<b>authentication host-mode</b>	Sets the authorization manager mode on a port.
<b>authentication open</b>	Enables or disables open access on a port.
<b>authentication order</b>	Sets the order of authentication methods used on a port.
<b>authentication periodic</b>	Enable or disables reauthentication on a port.



<b>Command</b>	<b>Description</b>
<b>authentication port-control</b>	Enables manual control of the port authorization state.
<b>authentication priority</b>	Adds an authentication method to the port-priority list.
<b>authentication timer</b>	Configures the timeout and reauthentication parameters for an 802.1x-enabled port.
<b>authentication violation</b>	Configures the violation modes that occur when a new device connects to a port or when a new device connects to a port with the maximum number of devices already connected to that port.
<b>show authentication</b>	Displays information about authentication manager events on the switch.

# authentication priority

To add an authentication method to the port-priority list, use the **authentication priority** command in interface configuration mode. To return to the default, use the **no** form of this command.

```
authentication priority [dot1x | mab] {webauth}
no authentication priority [dot1x | mab] {webauth}
```

Syntax Description		
<b>dot1x</b>	(Optional) Adds 802.1x to the order of authentication methods.	
<b>mab</b>	(Optional) Adds MAC authentication bypass (MAB) to the order of authentication methods.	
<b>webauth</b>	Adds web authentication to the order of authentication methods.	

**Command Default** The default priority is 802.1x authentication, followed by MAC authentication bypass and web authentication.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Ordering sets the order of methods that the switch attempts when trying to authenticate a new device is connected to a port.

When configuring multiple fallback methods on a port, set web authentication (webauth) last.

Assigning priorities to different authentication methods allows a higher-priority method to interrupt an in-progress authentication method with a lower priority.



**Note** If a client is already authenticated, it might be reauthenticated if an interruption from a higher-priority method occurs.

The default priority of an authentication method is equivalent to its position in execution-list order: 802.1x authentication, MAC authentication bypass (MAB), and web authentication. Use the **dot1x**, **mab**, and **webauth** keywords to change this default order.

This example shows how to set 802.1x as the first authentication method and web authentication as the second authentication method:

```
Device(config-if)# authentication priority dotx webauth
```

This example shows how to set MAB as the first authentication method and web authentication as the second authentication method:

```
Device(config-if) # authentication priority mab webauth
```

Related Commands	Command	Description
	<b>authentication control-direction</b>	Configures the port mode as unidirectional or bidirectional.
	<b>authentication event fail</b>	Specifies how the Auth Manager handles authentication failures as a result of unrecognized user credentials.
	<b>authentication event no-response action</b>	Specifies how the Auth Manager handles authentication failures as a result of a nonresponsive host.
	<b>authentication event server alive action reinitialize</b>	Reinitializes an authorized Auth Manager session when a previously unreachable authentication, authorization, and accounting server becomes available.
	<b>authentication event server dead action authorize</b>	Authorizes Auth Manager sessions when the authentication, authorization, and accounting server becomes unreachable.
	<b>authentication fallback</b>	Enables a web authentication fallback method.
	<b>authentication host-mode</b>	Allows hosts to gain access to a controlled port.
	<b>authentication open</b>	Enables open access on a port.
	<b>authentication order</b>	Specifies the order in which the Auth Manager attempts to authenticate a client on a port.
	<b>authentication periodic</b>	Enables automatic reauthentication on a port.
	<b>authentication port-control</b>	Configures the authorization state of a controlled port.
	<b>authentication timer inactivity</b>	Configures the time after which an inactive Auth Manager session is terminated.
	<b>authentication timer reauthenticate</b>	Specifies the period of time between which the Auth Manager attempts to reauthenticate authorized ports.
	<b>authentication timer restart</b>	Specifies the period of time after which the Auth Manager attempts to authenticate an unauthorized port.
	<b>authentication violation</b>	Specifies the action to be taken when a security violation occurs on a port.
	<b>mab</b>	Enables MAC authentication bypass on a port.

<b>Command</b>	<b>Description</b>
<b>show authentication registrations</b>	Displays information about the authentication methods that are registered with the Auth Manager.
<b>show authentication sessions</b>	Displays information about current Auth Manager sessions.
<b>show authentication sessions interface</b>	Displays information about the Auth Manager for a given interface.

# authentication violation

To configure the violation modes that occur when a new device connects to a port or when a new device connects to a port after the maximum number of devices are connected to that port, use the **authentication violation** command in interface configuration mode.

```
authentication violation { protect | replace | restrict | shutdown }
no authentication violation { protect | replace | restrict | shutdown }
```

Syntax Description	Mode	Description
	<b>protect</b>	Drops unexpected incoming MAC addresses. No syslog errors are generated.
	<b>replace</b>	Removes the current session and initiates authentication with the new host.
	<b>restrict</b>	Generates a syslog error when a violation error occurs.
	<b>shutdown</b>	Error-disables the port or the virtual port on which an unexpected MAC address occurs.

**Command Default** Authentication violation shutdown mode is enabled.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **authentication violation** command to specify the action to be taken when a security violation occurs on a port.

This example shows how to configure an IEEE 802.1x-enabled port as error-disabled and to shut down when a new device connects it:

```
Device(config-if) # authentication violation shutdown
```

This example shows how to configure an 802.1x-enabled port to generate a system error message and to change the port to restricted mode when a new device connects to it:

```
Device(config-if) # authentication violation restrict
```

This example shows how to configure an 802.1x-enabled port to ignore a new device when it connects to the port:

```
Device(config-if) # authentication violation protect
```

This example shows how to configure an 802.1x-enabled port to remove the current session and initiate authentication with a new device when it connects to the port:

```
Device(config-if)# authentication violation replace
```

You can verify your settings by entering the **show authentication** privileged EXEC command.

# cisp enable

To enable Client Information Signaling Protocol (CISP) on a switch so that it acts as an authenticator to a supplicant switch and a supplicant to an authenticator switch, use the **cisp enable** global configuration command.

**cisp enable**  
**no cisp enable**

**Syntax Description** This command has no arguments or keywords.

**Command Default** No default behavior or values.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
		This command was reintroduced. This command was not supported in and

**Usage Guidelines** The link between the authenticator and supplicant switch is a trunk. When you enable VTP on both switches, the VTP domain name must be the same, and the VTP mode must be server.

To avoid the MD5 checksum mismatch error when you configure VTP mode, verify that:

- VLANs are not configured on two different switches, which can be caused by two VTP servers in the same domain.
- Both switches have different configuration revision numbers.

This example shows how to enable CISP:

```
Device(config)# cisp enable
```

Related Commands	Command	Description
	<b>dot1x credentials</b> <i>profile</i>	Configures a profile on a supplicant switch.
	<b>dot1x supplicant force-multicast</b>	Forces 802.1X supplicant to send multicast packets.
	<b>dot1x supplicant controlled transient</b>	Configures controlled access by 802.1X supplicant.
	<b>show cisp</b>	Displays CISP information for a specified interface.

## clear errdisable interface vlan

To reenable a VLAN that was error-disabled, use the **clear errdisable interface** command in privileged EXEC mode.

**clear errdisable interface** *interface-id* **vlan** [*vlan-list*]

<b>Syntax Description</b>	<i>interface-id</i>	Specifies an interface.
	<i>vlan list</i>	(Optional) Specifies a list of VLANs to be reenabled. If a VLAN list is not specified, then all VLANs are reenabled.
<b>Command Default</b>	No default behavior or values.	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You can reenable a port by using the **shutdown** and **no shutdown** interface configuration commands, or you can clear error-disable for VLANs by using the **clear errdisable** interface command.

This example shows how to reenable all VLANs that were error-disabled on Gigabit Ethernet port 4/0/2:

```
Device# clear errdisable interface gigabitethernet4/0/2 vlan
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>errdisable detect cause</b>	Enables error-disabled detection for a specific cause or all causes.
	<b>errdisable recovery</b>	Configures the recovery mechanism variables.
	<b>show errdisable detect</b>	Displays error-disabled detection status.
	<b>show errdisable recovery</b>	Displays error-disabled recovery timer information.
	<b>show interfaces status err-disabled</b>	Displays interface status of a list of interfaces in error-disabled state.



## clear mac address-table

To delete from the MAC address table a specific dynamic address, all dynamic addresses on a particular interface, all dynamic addresses on stack members, or all dynamic addresses on a particular VLAN, use the **clear mac address-table** command in privileged EXEC mode. This command also clears the MAC address notification global counters.

```
clear mac address-table {dynamic [address mac-addr | interface interface-id | vlan vlan-id] | move update | notification}
```

Syntax Description		
<b>dynamic</b>		Deletes all dynamic MAC addresses.
<b>address</b> <i>mac-addr</i>		(Optional) Deletes the specified dynamic MAC address.
<b>interface</b> <i>interface-id</i>		(Optional) Deletes all dynamic MAC addresses on the specified physical port or port channel.
<b>vlan</b> <i>vlan-id</i>		(Optional) Deletes all dynamic MAC addresses for the specified VLAN. The range is 1 to 4094.
<b>move update</b>		Clears the MAC address table move-update counters.
<b>notification</b>		Clears the notifications in the history table and reset the counters.

**Command Default** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You can verify that the information was deleted by entering the **show mac address-table** privileged EXEC command.

This example shows how to remove a specific MAC address from the dynamic address table:

```
Device# clear mac address-table dynamic address 0008.0070.0007
```

Related Commands	Command	Description
	<b>mac address-table notification</b>	Enables the MAC address notification feature.
	<b>mac address-table move update</b> { <b>receive</b>   <b>transmit</b> }	Configures MAC address-table move update on the switch.

Command	Description
<b>show mac address-table</b>	Displays the MAC address table static and dynamic entries.
<b>show mac address-table move update</b>	Displays the MAC address-table move update information on the switch.
<b>show mac address-table notification</b>	Displays the MAC address notification settings for all interfaces or on the specified interface when the <b>interface</b> keyword is appended.
<b>snmp trap mac-notification change</b>	Enables the SNMP MAC address notification trap on a specific interface.

## confidentiality-offset

To enable MACsec Key Agreement protocol (MKA) to set the confidentiality offset for MACsec operations, use the **confidentiality-offset** command in MKA-policy configuration mode. To disable confidentiality offset, use the **no** form of this command.

**confidentiality-offset**  
**no confidentiality-offset**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Confidentiality offset is disabled.

**Command Modes** MKA-policy configuration (config-mka-policy)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Examples

The following example shows how to enable the confidentiality offset:

```
Device> enable
Device# configure terminal
Device(config)# mka policy 2
Device(config-mka-policy)# confidentiality-offset
```

### Related Commands

Command	Description
<b>mka policy</b>	Configures an MKA policy.
<b>delay-protection</b>	Configures MKA to use delay protection in sending MKPDU.
<b>include-icv-indicator</b>	Includes ICV indicator in MKPDU.
<b>key-server</b>	Configures MKA key-server options.
<b>macsec-cipher-suite</b>	Configures cipher suite for deriving SAK.
<b>sak-rekey</b>	Configures the SAK rekey interval.
<b>send-secure-announcements</b>	Configures MKA to send secure announcements in sending MKPDUs.
<b>ssci-based-on-sci</b>	Computes SSCI based on the SCI.
<b>use-updated-eth-header</b>	Uses the updated Ethernet header for ICV calculation.

# cts manual

To manually enable an interface for Cisco TrustSec Security, use the **cts manual** command in interface configuration mode.

## cts manual

**Syntax Description** This command has no arguments or keywords.

**Command Default** Disabled

**Command Modes** Interface configuration (config-if)

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.1	This command was modified with additional options.
	Cisco IOS XE 3.7E	This command was introduced.

**Usage Guidelines** Use the **cts manual** command to enter the TrustSec manual interface configuration in which policies and the Security Association Protocol (SAP) are configured on the link.

When **cts manual** command is configured, 802.1X authentication is not performed on the link. Use the **policy** subcommand to define and apply policies on the link. By default no policy is applied. To configure MACsec link-to-link encryption, the SAP negotiation parameters must be defined. By default SAP is not enabled. The same SAP PMK should be configured on both sides of the link (that is, a shared secret)

## Examples

The following example shows how to enter the Cisco TrustSec manual mode:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet 0
Switch(config-if)# cts manual
Switch(config-if-cts-manual)#
```

The following example shows how to remove the Cisco TrustSec manual configuration from an interface:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet 0
Switch(config-if)# no cts manual
```

## Related Commands

Command	Description
<b>propagate sgt (cts manual)</b>	Enables SGT propagation at Layer 2 on Cisco TrustSec Security interfaces.
<b>sap mode-list (cts manual)</b>	Manually specifies the PMK and the SAP authentication and encryption modes to negotiate MACsec link encryption between two interfaces.
<b>show cts interface</b>	Displays Cisco TrustSec interface configuration statistics.

## cts role-based enforcement

To enable Cisco TrustSec role-based (security group) access control enforcement, use the **cts role-based enforcement** command in global configuration mode. To disable the configuration, use the **no** form of this command.

```
cts role-based enforcement [logging-interval interval | vlan-list all | vlan-ID [,] [-]]
no cts role-based enforcement [logging-interval interval | vlan-list all | vlan-ID [,] [-]]
```

Syntax Description	
<b>logging-interval</b> <i>interval</i>	(Optional) Configures a logging interval for a security group access control list (SGACL). Valid values for the <i>interval</i> argument are from 5 to 86400 seconds. The default is 300 seconds
<b>vlan-list</b>	(Optional) Configures VLANs on which role-based ACLs are enforced.
<b>all</b>	(Optional) Specifies all VLANs.
<i>vlan-ID</i>	(Optional) VLAN ID. Valid values are from 1 to 4094.
,	(Optional) Specifies another VLAN separated by a comma.
-	(Optional) Specifies a range of VLANs separated by a hyphen.

**Command Default** Role-based access control is not enforced.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.1	This command was introduced.

### Usage Guidelines



**Note** RBACL and SGACL are used interchangeably.

Use the **cts role-based enforcement** command to globally enable or disable SGACL enforcement for Cisco TrustSec-enabled interfaces in the system.

The default interval after which log for a given flow is printed is 300 seconds. Use the **logging-interval** keyword to change the default interval. Logging is only triggered when the Cisco ACE Application Control Engine has the **logging** keyword.

SGACL enforcement is not enabled by default on VLANs. Use the **cts role-based enforcement vlan-list** command to enable or disable SGACL enforcement for Layer 2 switched packets and for Layer 3 switched packets on an switched virtual interface (SVI).

The *vlan-ID* argument can be a single VLAN ID, a list of VLAN IDs, or VLAN ID ranges.

When a VLAN in which a SGACL is enforced has an active SVI, the SGACL is enforced for both Layer 2 and Layer 3 switched packets within that VLAN. Without an SVI, the SGACL is enforced only for Layer 2 switched packets, because no Layer 3 switching is possible within a VLAN without an SVI.

The following example shows configure an SGACL logging interval:

```
Switch(config)# cts role-based enforcement logging-interval 90
Switch(config)# logging rate-limit

May 27 10:19:21.509: %RBM-6-SGACLHIT:
ingress_interface='GigabitEthernet1/0/2' sgacl_name='sgacl2' action='Deny'
protocol='icmp' src-ip='16.16.1.3' src-port='8' dest-ip='17.17.1.2' dest-port='0'
sgt='101' dgt='202' logging_interval_hits='5'
```

#### Related Commands

Command	Description
<b>logging rate-limit</b>	Limits the rate of messages logged per second.
<b>show cts role-based permissions</b>	Displays the SGACL permission list.

## cts role-based l2-vrf

To select a virtual routing and forwarding (VRF) instance for Layer 2 VLANs, use the **cts role-based l2-vrf** command in global configuration mode. To remove the configuration, use the **no** form of this command.

```
cts role-based l2-vrf vrf-name vlan-list all vlan-ID [,] [-]
no cts role-based l2-vrf vrf-name vlan-list all vlan-ID [,] [-]
```

### Syntax Description

<i>vrf-name</i>	Name of the VRF instance.
<b>vlan-list</b>	Specifies the list of VLANs to be assigned to a VRF instance.
<b>all</b>	Specifies all VLANs.
<i>vlan-ID</i>	VLAN ID. Valid values are from 1 to 4094.
,	(Optional) Specifies another VLAN separated by a comma.
-	(Optional) Specifies a range of VLANs separated by a hyphen.

### Command Default

VRF instances are not selected.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

### Usage Guidelines

The *vlan-list* argument can be a single VLAN ID, a list of comma-separated VLAN IDs, or hyphen-separated VLAN ID ranges.

The **all** keyword is equivalent to the full range of VLANs supported by the network device. The **all** keyword is not preserved in the nonvolatile generation (NVGEN) process.

If the **cts role-based l2-vrf** command is issued more than once for the same VRF, each successive command entered adds the VLAN IDs to the specified VRF.

The VRF assignments configured by the **cts role-based l2-vrf** command are active as long as a VLAN remains a Layer 2 VLAN. The IP-SGT bindings learned while a VRF assignment is active are also added to the Forwarding Information Base (FIB) table associated with the VRF and the IP protocol version. If an Switched Virtual Interface (SVI) becomes active for a VLAN, the VRF-to-VLAN assignment becomes inactive and all bindings learned on the VLAN are moved to the FIB table associated with the VRF of the SVI.

Use the **interface vlan** command to configure an SVI interface, and the **vrf forwarding** command to associate a VRF instance to the interface.

The VRF-to-VLAN assignment is retained even when the assignment becomes inactive. It is reactivated when the SVI is removed or when the SVI IP address is changed. When reactivated, the IP-SGT bindings are moved back from the FIB table associated with the VRF of the SVI to the FIB table associated with the VRF assigned by the **cts role-based l2-vrf** command.

The following example shows how to select a list of VLANs to be assigned to a VRF instance:

```
Switch(config)# cts role-based l2-vrf vrf1 vlan-list 20
```

The following example shows how to configure an SVI interface and associate a VRF instance:

```
Switch(config)# interface vlan 101  
Switch(config-if)# vrf forwarding vrf1
```

**Related Commands**

Command	Description
<b>interface vlan</b>	Configures a VLAN interface.
<b>vrf forwarding</b>	Associates a VRF instance or a virtual network with an interface or subinterface.
<b>show cts role-based permissions</b>	Displays the SGACL permission list.



## cts role-based monitor

To enable role-based (security-group) access list monitoring, use the **cts role-based monitor** command in global configuration mode. To remove role-based access list monitoring, use the **no** form of this command.

```
cts role-based monitor all | permissions | default | from sgt | unknown to sgt | unknown [ipv4]
no cts role-based monitor all | permissions | default | from sgt | unknown to sgt | unknown [ipv4]
```

### Syntax Description

<b>all</b>	Monitors permissions for all source tags to all destination tags.
<b>permissions</b>	Monitors permissions from a source tags to a destination tags.
<b>default</b>	Monitors the default permission list.
<b>from</b>	Specifies the source group tag for filtered traffic.
<i>sgt</i>	Security Group Tag (SGT). Valid values are from 2 to 65519.
<b>unknown</b>	Specifies an unknown source or destination group tag (DST).
<b>ipv4</b>	(Optional) Specifies the IPv4 protocol.

### Command Default

Role-based access control monitoring is not enabled.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

### Usage Guidelines

Use the **cts role-based monitor all** command to enable the global monitor mode. If the **cts role-based monitor all** command is configured, the output of the **show cts role-based permissions** command displays monitor mode for all configured policies as true.

The following examples shows how to configure SGACL monitor from a source tag to a destination tag:

```
Switch(config)# cts role-based monitor permissions from 10 to 11
```

### Related Commands

Command	Description
<b>show cts role-based permissions</b>	Displays the SGACL permission list.

## cts role-based permissions

To enable permissions from a source group to a destination group, use the **cts role-based permissions** command in global configuration mode. To remove the permissions, use the **no** form of this command.

```
cts role-based permissions default ipv4 | from sgt | unknown to sgt | unknown ipv4 rbacl-name
[rbacl-name...]
no cts role-based permissions default [ipv4] | from sgt | unknown to sgt | unknown
[ipv4]
```

### Syntax Description

<b>default</b>	Specifies the default permissions list. Every cell (an SGT pair) for which, security group access control list (SGACL) permission is not configured statically or dynamically falls under the default category.
<b>ipv4</b>	Specifies the IPv4 protocol.
<b>from</b>	Specifies the source group tag of the filtered traffic.
<i>sgt</i>	Security Group Tag (SGT). Valid values are from 2 to 65519.
<b>unknown</b>	Specifies an unknown source or destination group tag.
<i>rbacl-name</i>	Role-based access control list (RBACL) or SGACL name. Up to 16 SGACLs can be specified in the configuration.

### Command Default

Permissions from a source group to a destination group is not enabled.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

### Usage Guidelines

Use the **cts role-based permissions** command to define, replace, or delete the list of SGACLs for a given source group tag (SGT), destination group tag (DGT) pair. This policy is in effect as long as there is no dynamic policy for the same DGT or SGT.

The **cts role-based permissions default** command defines, replaces, or deletes the list of SGACLs of the default policy as long as there is no dynamic policy for the same DGT.

The following example shows how to enable permissions for a destination group:

```
Switch(config)# cts role-based permissions from 6 to 6 mon_2
```

### Related Commands

Command	Description
<b>show cts role-based permissions</b>	Displays the SGACL permission list.

# delay-protection

To configure MKA to use delay protection in sending MACsec Key Agreement Protocol Data Units (MKPDUs), use the **delay-protection** command in MKA-policy configuration mode. To disable delay protection, use the **no** form of this command.

**delay-protection**  
**no delay-protection**

## Syntax Description

This command has no arguments or keywords.

## Command Default

Delay protection for sending MKPDUs is disabled.

## Command Modes

MKA-policy configuration (config-mka-policy)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following example shows how to configure MKA to use delay protection in sending MKPDUs:

```
Device> enable
Device# configure terminal
Device(config)# mka policy 2
Device(config-mka-policy)# delay-protection
```

## Related Commands

Command	Description
<b>mka policy</b>	Configures an MKA policy.
<b>confidentiality-offset</b>	Sets the confidentiality offset for MACsec operations.
<b>include-icv-indicator</b>	Includes ICV indicator in MKPDU.
<b>key-server</b>	Configures MKA key-server options.
<b>macsec-cipher-suite</b>	Configures cipher suite for deriving SAK.
<b>sak-rekey</b>	Configures the SAK rekey interval.
<b>send-secure-announcements</b>	Configures MKA to send secure announcements in sending MKPDUs.
<b>ssci-based-on-sci</b>	Computes SSCI based on the SCI.
<b>use-updated-eth-header</b>	Uses the updated Ethernet header for ICV calculation.

## deny (MAC access-list configuration)

To prevent non-IP traffic from being forwarded if the conditions are matched, use the **deny** MAC access-list configuration command on the switch stack or on a standalone switch. To remove a deny condition from the named MAC access list, use the **no** form of this command.

```
deny {any | host src-MAC-addr | src-MAC-addr mask} {any | host dst-MAC-addr |
dst-MAC-addr mask} [type mask | aarp | amber | appletalk | dec-spanning | decnet-iv |
diagnostic | dsm | etype-6000 | etype-8042 | lat | larc-sca | lsap lsap mask | mop-console
| mop-dump | msdos | mumps | netbios | vines-echo | vines-ip | xns-idp] [cos cos]
no deny {any | host src-MAC-addr | src-MAC-addr mask} {any | host dst-MAC-addr |
dst-MAC-addr mask} [type mask | aarp | amber | appletalk | dec-spanning | decnet-iv |
diagnostic | dsm | etype-6000 | etype-8042 | lat | larc-sca | lsap lsap mask | mop-console
| mop-dump | msdos | mumps | netbios | vines-echo | vines-ip | xns-idp] [cos cos]
```

### Syntax Description

<b>any</b>	Denies any source or destination MAC address.
<b>host</b> <i>src-MAC-addr</i>   <i>src-MAC-addr mask</i>	Defines a host MAC address and optional subnet mask. If the source address for a packet matches the defined address, non-IP traffic from that address is denied.
<b>host</b> <i>dst-MAC-addr</i>   <i>dst-MAC-addr mask</i>	Defines a destination MAC address and optional subnet mask. If the destination address for a packet matches the defined address, non-IP traffic to that address is denied.
<i>type mask</i>	(Optional) Specifies the EtherType number of a packet with Ethernet II or SNAP encapsulation to identify the protocol of the packet.  The type is 0 to 65535, specified in hexadecimal.  The mask is a mask of don't care bits applied to the EtherType before testing for a match.
<b>aarp</b>	(Optional) Specifies EtherType AppleTalk Address Resolution Protocol that maps a data-link address to a network address.
<b>amber</b>	(Optional) Specifies EtherType DEC-Amber.
<b>appletalk</b>	(Optional) Specifies EtherType AppleTalk/EtherTalk.
<b>dec-spanning</b>	(Optional) Specifies EtherType Digital Equipment Corporation (DEC) spanning tree.
<b>decnet-iv</b>	(Optional) Specifies EtherType DECnet Phase IV protocol.
<b>diagnostic</b>	(Optional) Specifies EtherType DEC-Diagnostic.

<b>dsm</b>	(Optional) Specifies EtherType DEC-DSM.
<b>etype-6000</b>	(Optional) Specifies EtherType 0x6000.
<b>etype-8042</b>	(Optional) Specifies EtherType 0x8042.
<b>lat</b>	(Optional) Specifies EtherType DEC-LAT.
<b>lavc-sca</b>	(Optional) Specifies EtherType DEC-LAVC-SCA.
<b>lsap</b> <i>lsap-number mask</i>	(Optional) Specifies the LSAP number (0 to 65535) of a packet with 802.2 encapsulation to identify the protocol of the packet.  <i>mask</i> is a mask of don't care bits applied to the LSAP number before testing for a match.
<b>mop-console</b>	(Optional) Specifies EtherType DEC-MOP Remote Console.
<b>mop-dump</b>	(Optional) Specifies EtherType DEC-MOP Dump.
<b>msdos</b>	(Optional) Specifies EtherType DEC-MSDOS.
<b>mumps</b>	(Optional) Specifies EtherType DEC-MUMPS.
<b>netbios</b>	(Optional) Specifies EtherType DEC- Network Basic Input/Output System (NetBIOS).
<b>vines-echo</b>	(Optional) Specifies EtherType Virtual Integrated Network Service (VINES) Echo from Banyan Systems.
<b>vines-ip</b>	(Optional) Specifies EtherType VINES IP.
<b>xns-idp</b>	(Optional) Specifies EtherType Xerox Network Systems (XNS) protocol suite (0 to 65535), an arbitrary EtherType in decimal, hexadecimal, or octal.
<b>cos</b> <i>cos</i>	(Optional) Specifies a class of service (CoS) number from 0 to 7 to set priority. Filtering on CoS can be performed only in hardware. A warning message reminds the user if the <b>cos</b> option is configured.

**Command Default**

This command has no defaults. However, the default action for a MAC-named ACL is to deny.

**Command Modes**

Mac-access list configuration

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

You enter MAC-access list configuration mode by using the **mac access-list extended** global configuration command.

If you use the **host** keyword, you cannot enter an address mask; if you do not use the **host** keyword, you must enter an address mask.

When an access control entry (ACE) is added to an access control list, an implied **deny-any-any** condition exists at the end of the list. That is, if there are no matches, the packets are denied. However, before the first ACE is added, the list permits all packets.

To filter IPX traffic, you use the *type mask* or **lsap lsap mask** keywords, depending on the type of IPX encapsulation being used. Filter criteria for IPX encapsulation types as specified in Novell terminology and Cisco IOS terminology are listed in the table.

**Table 163: IPX Filtering Criteria**

IPX Encapsulation Type		Filter Criterion
Cisco IOS Name	Novel Name	
arpa	Ethernet II	EtherType 0x8137
snap	Ethernet-snap	EtherType 0x8137
sap	Ethernet 802.2	LSAP 0xE0E0
novell-ether	Ethernet 802.3	LSAP 0xFFFF

This example shows how to define the named MAC extended access list to deny NETBIOS traffic from any source to MAC address 00c0.00a0.03fa. Traffic matching this list is denied.

```
Device(config-ext-macl)# deny any host 00c0.00a0.03fa netbios.
```

This example shows how to remove the deny condition from the named MAC extended access list:

```
Device(config-ext-macl)# no deny any 00c0.00a0.03fa 0000.0000.0000 netbios.
```

This example denies all packets with EtherType 0x4321:

```
Device(config-ext-macl)# deny any any 0x4321 0
```

You can verify your settings by entering the **show access-lists** privileged EXEC command.

**Related Commands**

Command	Description
<b>mac access-list extended</b>	Creates an access list based on MAC addresses for non-IP traffic.
<b>permit</b>	Permits from the MAC access-list configuration. Permits non-IP traffic to be forwarded if conditions are matched.

Command	Description
show access-lists	Displays access control lists configured on a switch.

## device-role (IPv6 snooping)

To specify the role of the device attached to the port, use the **device-role** command in IPv6 snooping configuration mode.

**device-role** { **node** | **switch** }

<b>Syntax Description</b>	<b>node</b> Sets the role of the attached device to node.
	<b>switch</b> Sets the role of the attached device to switch.

**Command Default** The device role is node.

**Command Modes** IPv6 snooping configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **device-role** command specifies the role of the device attached to the port. By default, the device role is node.

The **switch** keyword indicates that the remote device is a switch and that the local switch is now operating in multiswitch mode; binding entries learned from the port will be marked with trunk\_port preference level. If the port is configured as a trust-port, binding entries will be marked with trunk\_trusted\_port preference level.

This example shows how to define an IPv6 snooping policy name as policy1, place the device in IPv6 snooping configuration mode, and configure the device as the node:

```
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# device-role node
```



## device-role (IPv6 nd inspection)

To specify the role of the device attached to the port, use the **device-role** command in neighbor discovery (ND) inspection policy configuration mode.

**device-role** { **host** | **switch** }

### Syntax Description

<b>host</b>	Sets the role of the attached device to host.
<b>switch</b>	Sets the role of the attached device to switch.

### Command Default

The device role is host.

### Command Modes

ND inspection policy configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **device-role** command specifies the role of the device attached to the port. By default, the device role is host, and therefore all the inbound router advertisement and redirect messages are blocked.

The **switch** keyword indicates that the remote device is a switch and that the local switch is now operating in multiswitch mode; binding entries learned from the port will be marked with trunk\_port preference level. If the port is configured as a trust-port, binding entries will be marked with trunk\_trusted\_port preference level.

The following example defines a Neighbor Discovery Protocol (NDP) policy name as policy1, places the device in ND inspection policy configuration mode, and configures the device as the host:

```
Device(config)# ipv6 nd inspection policy policy1
Device(config-nd-inspection)# device-role host
```

# device-tracking policy

To configure a Switch Integrated Security Features (SISF)-based IP device tracking policy, use the **device-tracking** command in global configuration mode. To delete a device tracking policy, use the **no** form of this command.

**device -tracking policy** *policy-name*  
**no device-tracking policy** *policy-name*

<b>Syntax Description</b>	<i>policy-name</i> User-defined name of the device tracking policy. The policy name can be a symbolic string (such as Engineering) or an integer (such as 0).				
<b>Command Default</b>	A device tracking policy is not configured.				
<b>Command Modes</b>	Global configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td></td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification		This command was introduced.
Release	Modification				
	This command was introduced.				

**Usage Guidelines** Use the SISF-based **device-tracking policy** command to create a device tracking policy. When the **device-tracking policy** command is enabled, the configuration mode changes to device-tracking configuration mode. In this mode, the administrator can configure the following first-hop security commands:

- (Optional) **device-role** {**node** | **switch**}—Specifies the role of the device attached to the port. Default is **node**.
- (Optional) **limit address-count** *value*—Limits the number of addresses allowed per target.
- (Optional) **no**—Negates a command or sets it to defaults.
- (Optional) **destination-glean** {**recovery** | **log-only**} [**dhcp**]}—Enables binding table recovery by data traffic source address gleaning.
- (Optional) **data-glean** {**recovery** | **log-only**} [**dhcp** | **ndp**]}—Enables binding table recovery using source or data address gleaning.
- (Optional) **security-level** {**glean** | **guard** | **inspect**}—Specifies the level of security enforced by the feature. Default is **guard**.
  - glean**—Gleans addresses from messages and populates the binding table without any verification.
  - guard**—Gleans addresses and inspects messages. In addition, it rejects RA and DHCP server messages. This is the default option.
  - inspect**—Gleans addresses, validates messages for consistency and conformance, and enforces address ownership.
- (Optional) **tracking** {**disable** | **enable**}—Specifies a tracking option.
- (Optional) **trusted-port**—Sets up a trusted port. It disables the guard on applicable targets. Bindings learned through a trusted port have preference over bindings learned through any other port. A trusted port is given preference in case of a collision while making an entry in the table.

This example shows how to configure an a device-tracking policy:

```
Device(config)# device-tracking policy policy1  
Device(config-device-tracking)# trusted-port
```

## dot1x critical (global configuration)

To configure the IEEE 802.1X critical authentication parameters, use the **dot1x critical** command in global configuration mode.

### dot1x critical eapol

<b>Syntax Description</b>	<b>eapol</b> Specifies that the switch send an EAPOL-Success message when the switch successfully authenticates the critical port.				
<b>Command Default</b>	<b>eapol</b> is disabled				
<b>Command Modes</b>	Global configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

This example shows how to specify that the switch sends an EAPOL-Success message when the switch successfully authenticates the critical port:

```
Device(config)# dot1x critical eapol
```

## dot1x max-start

To set the maximum number of Extensible Authentication Protocol over LAN (EAPOL) start frames that a supplicant sends (assuming that no response is received) to the client before concluding that the other end is 802.1X unaware, use the **dot1x max-start** command in interface configuration mode. To remove the maximum number-of-times setting, use the **no** form of this command.

**dot1x max-start** *number*  
**no dot1x max-start**

### Syntax Description

*number* Maximum number of times that the router sends an EAPOL start frame. The value is from 1 to 10. The default is 3.

### Command Default

The default maximum number setting is 3.

### Command Modes

Interface configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

You must enter the **switchport mode access** interface configuration command on a switch port before entering this command.

The following example shows that the maximum number of EAPOL Start requests has been set to 5:

```
Device(config)# interface g1/0/3
Device(config-if)# dot1x max-start 5
```

# dot1x pae

To set the Port Access Entity (PAE) type, use the **dot1x pae** command in interface configuration mode. To disable the PAE type that was set, use the **no** form of this command.

```
dot1x pae {supplicant | authenticator}
no dot1x pae {supplicant | authenticator}
```

## Syntax Description

<b>supplicant</b>	The interface acts only as a supplicant and will not respond to messages that are meant for an authenticator.
<b>authenticator</b>	The interface acts only as an authenticator and will not respond to any messages meant for a supplicant.

## Command Default

PAE type is not set.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.
	This command was reintroduced. This command was not supported in and

## Usage Guidelines

Use the **no dot1x pae** interface configuration command to disable IEEE 802.1x authentication on the port.

When you configure IEEE 802.1x authentication on a port, such as by entering the **dot1x port-control** interface configuration command, the switch automatically configures the port as an IEEE 802.1x authenticator. After the **no dot1x pae** interface configuration command is entered, the Authenticator PAE operation is disabled.

The following example shows that the interface has been set to act as a supplicant:

```
Device(config)# interface g1/0/3
Device(config-if)# dot1x pae supplicant
```

## dot1x supplicant controlled transient

To control access to an 802.1x supplicant port during authentication, use the **dot1x supplicant controlled transient** command in global configuration mode. To open the supplicant port during authentication, use the **no** form of this command

**dot1x supplicant controlled transient**  
**no dot1x supplicant controlled transient**

### Syntax Description

This command has no arguments or keywords.

### Command Default

Access is allowed to 802.1x supplicant ports during authentication.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.
	This command was reintroduced. This command was not supported in and

### Usage Guidelines

In the default state, when you connect a supplicant switch to an authenticator switch that has BPCU guard enabled, the authenticator port could be error-disabled if it receives a Spanning Tree Protocol (STP) bridge protocol data unit (BPDU) packets before the supplicant switch has authenticated. Beginning with Cisco IOS Release 15.0(1)SE, you can control traffic exiting the supplicant port during the authentication period. Entering the **dot1x supplicant controlled transient** global configuration command temporarily blocks the supplicant port during authentication to ensure that the authenticator port does not shut down before authentication completes. If authentication fails, the supplicant port opens. Entering the **no dot1x supplicant controlled transient** global configuration command opens the supplicant port during the authentication period. This is the default behavior.

We strongly recommend using the **dot1x supplicant controlled transient** command on a supplicant switch when BPDU guard is enabled on the authenticator switch port with the **spanning-tree bpduguard enable** interface configuration command.

This example shows how to control access to 802.1x supplicant ports on a switch during authentication:

```
Device(config)# dot1x supplicant controlled transient
```

## dot1x supplicant force-multicast

To force a supplicant switch to send only multicast Extensible Authentication Protocol over LAN (EAPOL) packets whenever it receives multicast or unicast EAPOL packets, use the **dot1x supplicant force-multicast** command in global configuration mode. To return to the default setting, use the **no** form of this command.

**dot1x supplicant force-multicast**  
**no dot1x supplicant force-multicast**

<b>Syntax Description</b>	This command has no arguments or keywords.	
<b>Command Default</b>	The supplicant switch sends unicast EAPOL packets when it receives unicast EAPOL packets. Similarly, it sends multicast EAPOL packets when it receives multicast EAPOL packets.	
<b>Command Modes</b>	Global configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
		This command was reintroduced. This command was not supported in and

**Usage Guidelines** Enable this command on the supplicant switch for Network Edge Access Topology (NEAT) to work in all host modes.

This example shows how force a supplicant switch to send multicast EAPOL packets to the authenticator switch:

```
Device(config)# dot1x supplicant force-multicast
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>cisp enable</b>	Enable Client Information Signalling Protocol (CISP) on a switch so that it acts as an authenticator to a supplicant switch.
	<b>dot1x credentials</b>	Configure the 802.1x supplicant credentials on the port.
	<b>dot1x pae supplicant</b>	Configure an interface to act only as a supplicant.



## dot1x test eapol-capable

To monitor IEEE 802.1x activity on all the switch ports and to display information about the devices that are connected to the ports that support IEEE 802.1x, use the **dot1x test eapol-capable** command in privileged EXEC mode on the switch stack or on a standalone switch.

```
dot1x test eapol-capable [interface interface-id]
```

<b>Syntax Description</b>	<b>interface interface-id</b> (Optional) Port to be queried.				
<b>Command Default</b>	There is no default setting.				
<b>Command Modes</b>	Privileged EXEC				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines** Use this command to test the IEEE 802.1x capability of the devices connected to all ports or to specific ports on a switch.

There is not a no form of this command.

This example shows how to enable the IEEE 802.1x readiness check on a switch to query a port. It also shows the response received from the queried port verifying that the device connected to it is IEEE 802.1x-capable:

```
Device# dot1x test eapol-capable interface gigabitethernet1/0/13
```

```
DOT1X_PORT_EAPOL_CAPABLE:DOT1X: MAC 00-01-02-4b-f1-a3 on gigabitethernet1/0/13 is EAPOL capable
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>dot1x test timeout timeout</b>	Configures the timeout used to wait for EAPOL response to an IEEE 802.1x readiness query.

# dot1x test timeout

To configure the timeout used to wait for EAPOL response from a port being queried for IEEE 802.1x readiness, use the **dot1x test timeout** command in global configuration mode on the switch stack or on a standalone switch.

**dot1x test timeout** *timeout*

<b>Syntax Description</b>	<i>timeout</i>	Time in seconds to wait for an EAPOL response. The range is from 1 to 65535 seconds.
---------------------------	----------------	--

**Command Default** The default setting is 10 seconds.

**Command Modes** Global configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use this command to configure the timeout used to wait for EAPOL response.

There is not a no form of this command.

This example shows how to configure the switch to wait 27 seconds for an EAPOL response:

```
Device# dot1x test timeout 27
```

You can verify the timeout configuration status by entering the **show run** privileged EXEC command.

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>dot1x test eapol-capable</b> [ <i>interface interface-id</i> ]	Checks for IEEE 802.1x readiness on devices connected to all or to specified IEEE 802.1x-capable ports.

## dot1x timeout

To configure the value for retry timeouts, use the **dot1x timeout** command in global configuration or interface configuration mode. To return to the default value for retry timeouts, use the **no** form of this command.

**dot1x timeout** { **auth-period** *seconds* | **held-period** *seconds* | **quiet-period** *seconds* | **ratelimit-period** *seconds* | **server-timeout** *seconds* | **start-period** *seconds* | **supp-timeout** *seconds* | **tx-period** *seconds* }

Syntax Description		
<b>auth-period</b> <i>seconds</i>	Configures the time, in seconds for which a supplicant will stay in the HELD state (that is, the length of time it will wait before trying to send the credentials again after a failed attempt).	The range is from 1 to 65535. The default is 30.
<b>held-period</b> <i>seconds</i>	Configures the time, in seconds for which a supplicant will stay in the HELD state (that is, the length of time it will wait before trying to send the credentials again after a failed attempt).	The range is from 1 to 65535. The default is 60.
<b>quiet-period</b> <i>seconds</i>	Configures the time, in seconds, that the authenticator (server) remains quiet (in the HELD state) following a failed authentication exchange before trying to reauthenticate the client.	The range is from 1 to 65535. The default is 60.
<b>ratelimit-period</b> <i>seconds</i>	Throttles the EAP-START packets that are sent from misbehaving client PCs (for example, PCs that send EAP-START packets that result in the wasting of switch processing power). <ul style="list-style-type: none"> <li>The authenticator ignores EAPOL-Start packets from clients that have successfully authenticated for the rate-limit period duration.</li> <li>The range is from 1 to 65535. By default, rate limiting is disabled.</li> </ul>	
<b>server-timeout</b> <i>seconds</i>	Configures the interval, in seconds, between two successive EAPOL-Start frames when they are being retransmitted. <ul style="list-style-type: none"> <li>The range is from 1 to 65535. The default is 30.</li> </ul> If the server does not send a response to an 802.1X packet within the specified period, the packet is sent again.	
<b>start-period</b> <i>seconds</i>	Configures the interval, in seconds, between two successive EAPOL-Start frames when they are being retransmitted. <p>The range is from 1 to 65535. The default is 30.</p> In Cisco IOS Release 15.2(5)E, this command is only available in the supplicant mode. If the command is applied in any other mode, the command misses from the configuration.	

---

**supp-timeout** *seconds* Sets the authenticator-to-supplicant retransmission time for all EAP messages other than EAP Request ID.  
The range is from 1 to 65535. The default is 30.

---

**tx-period** *seconds* Configures the number of seconds between retransmission of EAP request ID packets (assuming that no response is received) to the client.

- The range is from 1 to 65535. The default is 30.
- If an 802.1X packet is sent to the supplicant and the supplicant does not send a response after the retry period, the packet will be sent again.

---

**Command Default** Periodic reauthentication and periodic rate-limiting are done.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** You should change the default value of this command only to adjust for unusual circumstances such as unreliable links or specific behavioral problems with certain clients and authentication servers.

The **dot1x timeout reauth-period** interface configuration command affects the behavior of the switch only if you have enabled periodic re-authentication by using the **dot1x reauthentication** interface configuration command.

During the quiet period, the switch does not accept or initiate any authentication requests. If you want to provide a faster response time to the user, enter a number smaller than the default.

When the **ratelimit-period** is set to 0 (the default), the switch does not ignore EAPOL packets from clients that have been successfully authenticated and forwards them to the RADIUS server.

The following example shows that various 802.1X retransmission and timeout periods have been set:

```
Device(config)# configure terminal
Device(config)# interface g1/0/3
Device(config-if)# dot1x port-control auto
Device(config-if)# dot1x timeout auth-period 2000
Device(config-if)# dot1x timeout held-period 2400
Device(config-if)# dot1x timeout quiet-period 600
Device(config-if)# dot1x timeout start-period 90
Device(config-if)# dot1x timeout supp-timeout 300
Device(config-if)# dot1x timeout tx-period 60
Device(config-if)# dot1x timeout server-timeout 60
```

## epm access-control open

To configure an open directive for ports that do not have an access control list (ACL) configured, use the **epm access-control open** command in global configuration mode. To disable the open directive, use the **no** form of this command.

**epm access-control open**  
**no epm access-control open**

**Syntax Description** This command has no arguments or keywords.

**Command Default** The default directive applies.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use this command to configure an open directive that allows hosts without an authorization policy to access ports configured with a static ACL. If you do not configure this command, the port applies the policies of the configured ACL to the traffic. If no static ACL is configured on a port, both the default and open directives allow access to the port.

You can verify your settings by entering the **show running-config** privileged EXEC command.

This example shows how to configure an open directive.

```
Device(config)# epm access-control open
```

Related Commands	Command	Description
	<b>show running-config</b>	Displays the contents of the current running configuration file.

# include-icv-indicator

To include the integrity check value (ICV) indicator in MKPDU, use the **include-icv-indicator** command in MKA-policy configuration mode. To disable the ICV indicator, use the **no** form of this command.

**include-icv-indicator**  
**no include-icv-indicator**

**Syntax Description** This command has no arguments or keywords.

**Command Default** ICV indicator is included.

**Command Modes** MKA-policy configuration (config-mka-policy)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following example shows how to include the ICV indicator in MKPDU:

```
Device> enable
Device# configure terminal
Device(config)# mka policy 2
Device(config-mka-policy)# include-icv-indicator
```

## Related Commands

Command	Description
<b>mka policy</b>	Configures an MKA policy.
<b>confidentiality-offset</b>	Sets the confidentiality offset for MACsec operations.
<b>delay-protection</b>	Configures MKA to use delay protection in sending MKPDU.
<b>key-server</b>	Configures MKA key-server options.
<b>macsec-cipher-suite</b>	Configures cipher suite for deriving SAK.
<b>sak-rekey</b>	Configures the SAK rekey interval.
<b>send-secure-announcements</b>	Configures MKA to send secure announcements in sending MKPDUs.
<b>ssci-based-on-sci</b>	Computes SSCI based on the SCI.
<b>use-updated-eth-header</b>	Uses the updated Ethernet header for ICV calculation.

## ip access-list role-based

To create a role-based (security group) access control list (RBACL) and enter role-based ACL configuration mode, use the **ip access-list role-based** command in global configuration mode. To remove the configuration, use the **no** form of this command.

```
ip access-list role-based access-list-name
no ip access-list role-based access-list-name
```

<b>Syntax Description</b>	<i>access-list-name</i> Name of the security group access control list (SGACL).
---------------------------	---

<b>Command Default</b>	Role-based ACLs are not configured.
------------------------	-------------------------------------

<b>Command Modes</b>	Global configuration (config)
----------------------	-------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Denali 16.3.1	This command was introduced.

<b>Usage Guidelines</b>	For SGACL logging, you must configure the <b>permit ip log</b> command. Also, this command must be configured in Cisco Identity Services Engine (ISE) to enable logging for dynamic SGACLs.
-------------------------	---

The following example shows how to define an SGACL that can be applied to IPv4 traffic and enter role-based access list configuration mode:

```
Switch(config)# ip access-list role-based rbacl1
Switch(config-rb-acl)# permit ip log
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>permit ip log</b>	Permits logging that matches the configured entry.
	<b>show ip access-list</b>	Displays contents of all current IP access lists.

# ip admission

To enable web authentication, use the **ip admission** command in interface configuration mode. You can also use this command in fallback-profile configuration mode. To disable web authentication, use the **no** form of this command.

**ip admission** *rule*  
**no ip admission** *rule*

---

**Syntax Description**      *rule* IP admission rule name.

---



---

**Command Default**      Web authentication is disabled.

---



---

**Command Modes**      Interface configuration  
 Fallback-profile configuration

---



---

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---



---

**Usage Guidelines**      The **ip admission** command applies a web authentication rule to a switchport.

This example shows how to apply a web authentication rule to a switchport:

```
Device# configure terminal
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ip admission rule1
```

This example shows how to apply a web authentication rule to a fallback profile for use on an IEEE 802.1x enabled switch port.

```
Device# configure terminal
Device(config)# fallback profile profile1
Device(config-fallback-profile)# ip admission rule1
```



## ip admission name

To enable web authentication, use the **ip admission name** command in global configuration mode. To disable web authentication, use the **no** form of this command.

```
ip admission name name {consent | proxy http} [absolute timer minutes | inactivity-time
minutes | list {acl | acl-name} | service-policy type tag service-policy-name]
no ip admission name name {consent | proxy http} [absolute timer minutes | inactivity-time
minutes | list {acl | acl-name} | service-policy type tag service-policy-name]
```

### Syntax Description

<i>name</i>	Name of network admission control rule.
<b>consent</b>	Associates an authentication proxy consent web page with the IP admission rule specified using the <i>admission-name</i> argument.
<b>proxy http</b>	Configures web authentication custom page.
<b>absolute-timer</b> <i>minutes</i>	(Optional) Elapsed time, in minutes, before the external server times out.
<b>inactivity-time</b> <i>minutes</i>	(Optional) Elapsed time, in minutes, before the external file server is deemed unreachable.
<b>list</b>	(Optional) Associates the named rule with an access control list (ACL).
<i>acl</i>	Applies a standard, extended list to a named admission control rule. The value ranges from 1 through 199, or from 1300 through 2699 for expanded range.
<i>acl-name</i>	Applies a named access list to a named admission control rule.
<b>service-policy type tag</b>	(Optional) A control plane service policy is to be configured.
<i>service-policy-name</i>	Control plane tag service policy that is configured using the <b>policy-map type control tag</b> <i>policyname</i> command, keyword, and argument. This policy map is used to apply the actions on the host when a tag is received.

### Command Default

Web authentication is disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

The **ip admission name** command globally enables web authentication on a switch.

After you enable web authentication on a switch, use the **ip access-group in** and **ip admission web-rule** interface configuration commands to enable web authentication on a specific interface.

**Examples**

This example shows how to configure only web authentication on a switch port:

```
Device# configure terminal
Device(config) ip admission name http-rule proxy http
Device(config) # interface gigabitethernet1/0/1
Device(config-if) # ip access-group 101 in
Device(config-if) # ip admission rule
Device(config-if) # end
```

This example shows how to configure IEEE 802.1x authentication with web authentication as a fallback mechanism on a switch port:

```
Device# configure terminal
Device(config) # ip admission name rule2 proxy http
Device(config) # fallback profile profile1
Device(config) # ip access group 101 in
Device(config) # ip admission name rule2
Device(config) # interface gigabitethernet1/0/1
Device(config-if) # dot1x port-control auto
Device(config-if) # dot1x fallback profile1
Device(config-if) # end
```


**Related Commands**

Command	Description
<b>dot1x fallback</b>	Configures a port to use web authentication as a fallback method for clients that do not support IEEE 802.1x authentication.
<b>fallback profile</b>	Creates a web authentication fallback profile.
<b>ip admission</b>	Enables web authentication on a port.
<b>show authentication sessions interface <i>interface</i> detail</b>	Displays information about the web authentication session status.
<b>show ip admission</b>	Displays information about NAC cached entries or the NAC configuration.

## ip device tracking maximum

To configure IP device tracking parameters on a Layer 2 access port, use the **ip device tracking maximum** command in interface configuration mode. To remove the maximum value, use the **no** form of the command.

**ip device tracking maximum** *number*  
**no ip device tracking maximum**

<b>Syntax Description</b>	<i>number</i> Number of bindings created in the IP device tracking table for a port. The range is 0 (disabled) to 65535.	
<b>Command Default</b>	None	
<b>Command Modes</b>	Interface configuration mode	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	To remove the maximum value, use the <b>no ip device tracking maximum</b> command. To disable IP device tracking, use the <b>ip device tracking maximum 0</b> command.	
	<b>Note</b> This command enables IPDT wherever its configured	

### Examples

This example shows how to configure IP device tracking parameters on a Layer 2 access port:

```
Device# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Device(config)# ip device tracking
Device(config)# interface gigabitethernet1/0/3
Device(config-if)# switchport mode access
Device(config-if)# switchport access vlan 1
Device(config-if)# ip device tracking maximum 5
Device(config-if)# switchport port-security
Device(config-if)# switchport port-security maximum 5
Device(config-if)# end
```

# ip device tracking probe

To configure the IP device tracking table for Address Resolution Protocol (ARP) probes, use the **ip device tracking probe** command in global configuration mode. To disable ARP probes, use the **no** form of this command.

**ip device tracking probe count** *number* | **delay** *seconds* | **interval** *seconds* | **use-svi** *address*  
**no ip device tracking probe count** *number* | **delay** *seconds* | **interval** *seconds* | **use-svi** *address*

Syntax Description	
<b>count</b> <i>number</i>	Sets the number of times that the sends the ARP probe. The range is from 1 to 255.
<b>delay</b> <i>seconds</i>	Sets the number of seconds that the waits before sending the ARP probe. The range is from 1 to 120.
<b>interval</b> <i>seconds</i>	Sets the number of seconds that the waits for a response before resending the ARP probe. The range is from 30 to 1814400 seconds.
<b>use-svi</b>	Uses the switch virtual interface (SVI) IP address as source of ARP probes.

Command Default	
	The count number is 3.
	There is no delay.
	The interval is 30 seconds.
	The ARP probe default source IP address is the Layer 3 interface and 0.0.0.0 for switchports.

Command Modes	
	Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

Usage Guidelines	
	Use the <b>use-svi</b> keyword to configure the IP device tracking table to use the SVI IP address for ARP probes in cases when the default source IP address 0.0.0.0 for switch ports is used and the ARP probes drop.

Examples	
	This example shows how to set SVI as the source for ARP probes:

```
Device(config)# ip device tracking probe use-svi
```

## ip dhcp snooping database

To configure the Dynamic Host Configuration Protocol (DHCP)-snooping database, use the **ip dhcp snooping database** command in global configuration mode. To disable the DHCP-snooping database, use the **no** form of this command.

```
ip dhcp snooping database {crashinfo:url | flash:url | ftp:url | http:url | https:url | rcp:url
| scp:url | tftp:url | timeout seconds | usbflash0:url | write-delay seconds}
no ip dhcp snooping database [ timeout | write-delay ]
```

Syntax	Description
<b>crashinfo:url</b>	Specifies the database URL for storing entries using crashinfo.
<b>flash:url</b>	Specifies the database URL for storing entries using flash.
<b>ftp:url</b>	Specifies the database URL for storing entries using FTP.
<b>http:url</b>	Specifies the database URL for storing entries using HTTP.
<b>https:url</b>	Specifies the database URL for storing entries using secure HTTP (https).
<b>rcp:url</b>	Specifies the database URL for storing entries using remote copy (rcp).
<b>scp:url</b>	Specifies the database URL for storing entries using Secure Copy (SCP).
<b>tftp:url</b>	Specifies the database URL for storing entries using TFTP.
<b>timeout seconds</b>	Specifies the timeout interval; valid values are from 0 to 86400 seconds.
<b>usbflash0:url</b>	Specifies the database URL for storing entries using USB flash.
<b>write-delay seconds</b>	Specifies the amount of time before writing the DHCP-snooping entries to an external server after a change is seen in the local DHCP-snooping database; valid values are from 15 to 86400 seconds.

**Command Default** The DHCP-snooping database is not configured.

---

**Command Modes** Global configuration

---

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

**Usage Guidelines** You must enable DHCP snooping on the interface before entering this command. Use the **ip dhcp snooping** command to enable DHCP snooping.

This example shows how to specify the database URL using TFTP:

```
Device(config)# ip dhcp snooping database tftp://10.90.90.90/snooping-rp2
```

This example shows how to specify the amount of time before writing DHCP snooping entries to an external server:

```
Device(config)# ip dhcp snooping database write-delay 15
```

## ip dhcp snooping information option format remote-id

To configure the option-82 remote-ID suboption, use the **ip dhcp snooping information option format remote-id** command in global configuration mode on the switch to configure the option-82 remote-ID suboption. To configure the default remote-ID suboption, use the **no** form of this command.

```
ip dhcp snooping information option format remote-id {hostname | string string}
no ip dhcp snooping information option format remote-id {hostname | string string}
```

### Syntax Description

<b>hostname</b>	Specify the switch hostname as the remote ID.
<b>string string</b>	Specify a remote ID, using from 1 to 63 ASCII characters (no spaces).

### Command Default

The switch MAC address is the remote ID.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

You must globally enable DHCP snooping by using the **ip dhcp snooping** global configuration command for any DHCP snooping configuration to take effect.

When the option-82 feature is enabled, the default remote-ID suboption is the switch MAC address. This command allows you to configure either the switch hostname or a string of up to 63 ASCII characters (but no spaces) to be the remote ID.



**Note** If the hostname exceeds 63 characters, it will be truncated to 63 characters in the remote-ID configuration.

This example shows how to configure the option- 82 remote-ID suboption:

```
Device(config)# ip dhcp snooping information option format remote-id hostname
```

## ip dhcp snooping verify no-relay-agent-address

To disable the DHCP snooping feature from verifying that the relay agent address (giaddr) in a DHCP client message matches the client hardware address on an untrusted port, use the **ip dhcp snooping verify no-relay-agent-address** command in global configuration mode. To enable verification, use the **no** form of this command.

**ip dhcp snooping verify no-relay-agent-address**  
**no ip dhcp snooping verify no-relay-agent-address**

### Syntax Description

This command has no arguments or keywords.

### Command Default

The DHCP snooping feature verifies that the relay-agent IP address (giaddr) field in DHCP client message on an untrusted port is 0.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

By default, the DHCP snooping feature verifies that the relay-agent IP address (giaddr) field in DHCP client message on an untrusted port is 0; the message is dropped if the giaddr field is not 0. Use the **ip dhcp snooping verify no-relay-agent-address** command to disable the verification. Use the **no ip dhcp snooping verify no-relay-agent-address** to reenable verification.

This example shows how to enable verification of the giaddr in a DHCP client message:

```
Device(config)# no ip dhcp snooping verify no-relay-agent-address
```



## ip http access-class

To specify the access list that should be used to restrict access to the HTTP server, use the **ip http access-class** command in global configuration mode. To remove a previously configured access list association, use the **no** form of this command.



**Note** The existing **ip http access-class** *access-list-number* command is currently supported, but is going to be deprecated. Use the **ip http access-class ipv4** { *access-list-number* | *access-list-name* } and **ip http access-class ipv6** *access-list-name* instead.

```
ip http access-class { access-list-number | ipv4 { access-list-number | access-list-name } |
ipv6 access-list-name }
no ip http access-class { access-list-number | ipv4 { access-list-number | access-list-name }
| ipv6 access-list-name }
```

### Syntax Description

<b>ipv4</b>	Specifies the IPv4 access list to restrict access to the secure HTTP server.
<b>ipv6</b>	Specifies the IPv6 access list to restrict access to the secure HTTP server.
<i>access-list-number</i>	Standard IP access list number in the range 0 to 99, as configured by the <b>access-list</b> global configuration command.
<i>access-list-name</i>	Name of a standard IPv4 access list, as configured by the <b>ip access-list</b> command.

### Command Default

No access list is applied to the HTTP server.

### Command Modes

Global configuration (config)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was modified. The <b>ipv4</b> and <b>ipv6</b> keyword were added.
Cisco IOS XE Release 3.3SE	This command was introduced.

### Usage Guidelines

If this command is configured, the specified access list is assigned to the HTTP server. Before the HTTP server accepts a connection, it checks the access list. If the check fails, the HTTP server does not accept the request for a connection.

### Examples

The following example shows how to define an access list as 20 and assign it to the HTTP server:

```
Device(config)# ip access-list standard 20
Device(config-std-nacl)# permit 209.165.202.130 0.0.0.255
Device(config-std-nacl)# permit 209.165.201.1 0.0.255.255
```

```
Device(config-std-nacl)# permit 209.165.200.225 0.255.255.255
```

```
Device(config-std-nacl)# exit
```

```
Device(config)# ip http access-class 20
```

The following example shows how to define an IPv4 named access list as and assign it to the HTTP server.

```
Device(config)# ip access-list standard Internet_filter
```

```
Device(config-std-nacl)# permit 1.2.3.4
```

```
Device(config-std-nacl)# exit
```

```
Device(config)# ip http access-class ipv4 Internet_filter
```

#### Related Commands

Command	Description
<b>ip access-list</b>	Assigns an ID to an access list and enters access list configuration mode.
<b>ip http server</b>	Enables the HTTP 1.1 server, including the Cisco web browser user interface.

## ip radius source-interface

To force RADIUS to use the IP address of a specified interface for all outgoing RADIUS packets, use the **ip radius source-interface** command in global configuration mode. To prevent RADIUS from using the IP address of a specified interface for all outgoing RADIUS packets, use the no form of this command.

**ip radius source-interface** *interface-name* [**vrf** *vrf-name*]  
**no ip radius source-interface**

Syntax Description	
<i>interface-name</i>	Name of the interface that RADIUS uses for all of its outgoing packets.
<b>vrf</b> <i>vrf-name</i>	(Optional) Per virtual route forwarding (VRF) configuration.

**Command Default** No default behavior or values.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use this command to set the IP address of an interface to be used as the source address for all outgoing RADIUS packets. The IP address is used as long as the interface is in the *up* state. The RADIUS server can use one IP address entry for every network access client instead of maintaining a list of IP addresses. RADIUS uses the IP address of the interface that it is associated to, regardless of whether the interface is in the *up* or *down* state.

The **ip radius source-interface** command is especially useful in cases where the router has many interfaces and you want to ensure that all RADIUS packets from a particular router have the same IP address.

The specified interface should have a valid IP address and should be in the *up* state for a valid configuration. If the specified interface does not have a valid IP address or is in the *down* state, RADIUS selects a local IP that corresponds to the best possible route to the AAA server. To avoid this, add a valid IP address to the interface or bring the interface to the *up* state.

Use the **vrf** *vrf-name* keyword and argument to configure this command per VRF, which allows multiple disjointed routing or forwarding tables, where the routes of one user have no correlation with the routes of another user.

### Examples

The following example shows how to configure RADIUS to use the IP address of interface s2 for all outgoing RADIUS packets:

```
ip radius source-interface s2
```

The following example shows how to configure RADIUS to use the IP address of interface Ethernet0 for VRF definition:

```
ip radius source-interface Ethernet0 vrf vrfl
```

## ip source binding

To add a static IP source binding entry, use the **ip source binding** command. Use the **no** form of this command to delete a static IP source binding entry

```
ip source binding mac-address vlan vlan-id ip-address interface interface-id
no ip source binding mac-address vlan vlan-id ip-address interface interface-id
```

<b>Syntax Description</b>	<i>mac-address</i>	Binding MAC address.
	<b>vlan</b> <i>vlan-id</i>	Specifies the Layer 2 VLAN identification; valid values are from 1 to 4094.
	<i>ip-address</i>	Binding IP address.
	<b>interface</b> <i>interface-id</i>	ID of the physical interface.
<b>Command Default</b>	No IP source bindings are configured.	
<b>Command Modes</b>	Global configuration.	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

You can use this command to add a static IP source binding entry only.

The **no** format deletes the corresponding IP source binding entry. It requires the exact match of all required parameter in order for the deletion to be successful. Note that each static IP binding entry is keyed by a MAC address and a VLAN number. If the command contains the existing MAC address and VLAN number, the existing binding entry is updated with the new parameters instead of creating a separate binding entry.

This example shows how to add a static IP source binding entry:

```
Device# configure terminal
Deviceconfig) ip source binding 0100.0230.0002 vlan 11 10.0.0.4 interface gigabitethernet1/0/1
```

## ip verify source

To enable IP source guard on an interface, use the **ip verify source** command in interface configuration mode. To disable IP source guard, use the **no** form of this command.

**ip verify source** [**mac-check**] [**tracking**]  
**no ip verify source**

<b>mac-check</b>	(Optional) Enables IP source guard with MAC address verification.
<b>tracking</b>	(Optional) Enables IP port security to learn static IP address learning on a port.

**Command Default** IP source guard is disabled.

**Command Modes** Interface configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** To enable IP source guard with source IP address filtering, use the **ip verify source** interface configuration command.

To enable IP source guard with source IP address filtering and MAC address verification, use the **ip verify source mac-check** interface configuration command.

### Examples

This example shows how to enable IP source guard with source IP address filtering on an interface:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ip verify source
```

This example shows how to enable IP source guard with MAC address verification:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ip verify source mac-check
```

You can verify your settings by entering the **show ip verify source** privileged EXEC command.

## ipv6 access-list

To define an IPv6 access list and to place the device in IPv6 access list configuration mode, use the **ipv6 access-list** command in global configuration mode. To remove the access list, use the **no** form of this command.

**ipv6 access-list** *access-list-name* | **match-local-traffic** | **log-update threshold** *threshold-in-msgs* | **role-based** *list-name*  
**noipv6 access-list** *access-list-name* | **client** *permit-control-packets* | **log-update** *threshold* | **role-based** *list-name*

### Syntax Description

<b>ipv6</b> <i>access-list-name</i>	Creates a named IPv6 ACL (up to 64 characters in length) and enters IPv6 ACL configuration mode.  <i>access-list-name</i> - Name of the IPv6 access list. Names cannot contain a space or quotation mark, or begin with a numeric.
<b>match-local-traffic</b>	Enables matching for locally-generated traffic.
<b>log-update threshold</b> <i>threshold-in-msgs</i>	Determines how syslog messages are generated after the initial packet match.  <i>threshold-in-msgs</i> - Number of packets generated.
<b>role-based</b> <i>list-name</i>	Creates a role-based IPv6 ACL.

### Command Default

No IPv6 access list is defined.

### Command Modes

Global configuration

### Command History

Release	Modification
	This command was reintroduced. This command was not supported in and

### Usage Guidelines

IPv6 ACLs are defined by using the **ipv6 access-list** command in global configuration mode and their permit and deny conditions are set by using the **deny** and **permit** commands in IPv6 access list configuration mode. Configuring the **ipv6 access-list** command places the device in IPv6 access list configuration mode--the device prompt changes to Device(config-ipv6-acl)#. From IPv6 access list configuration mode, permit and deny conditions can be set for the defined IPv6 ACL.



### Note

IPv6 ACLs are defined by a unique name (IPv6 does not support numbered ACLs). An IPv4 ACL and an IPv6 ACL cannot share the same name.

IPv6 is automatically configured as the protocol type in **permit any any** and **deny any any** statements that are translated from global configuration mode to IPv6 access list configuration mode.

Every IPv6 ACL has implicit **permit icmp any any nd-na**, **permit icmp any any nd-ns**, and **deny ipv6 any any** statements as its last match conditions. (The former two match conditions allow for ICMPv6 neighbor

discovery.) An IPv6 ACL must contain at least one entry for the implicit **deny ipv6 any any** statement to take effect. The IPv6 neighbor discovery process makes use of the IPv6 network layer service; therefore, by default, IPv6 ACLs implicitly allow IPv6 neighbor discovery packets to be sent and received on an interface. In IPv4, the Address Resolution Protocol (ARP), which is equivalent to the IPv6 neighbor discovery process, makes use of a separate data link layer protocol; therefore, by default, IPv4 ACLs implicitly allow ARP packets to be sent and received on an interface.

Use the **ipv6 traffic-filter** interface configuration command with the *access-list-name* argument to apply an IPv6 ACL to an IPv6 interface. Use the **ipv6 access-class** line configuration command with the *access-list-name* argument to apply an IPv6 ACL to incoming and outgoing IPv6 virtual terminal connections to and from the device.

An IPv6 ACL applied to an interface with the **ipv6 traffic-filter** command filters traffic that is forwarded, not originated, by the device.

## Examples

The example configures the IPv6 ACL list named list1 and places the device in IPv6 access list configuration mode.

```
Device(config)# ipv6 access-list list1
Device(config-ipv6-acl)#
```

The following example configures the IPv6 ACL named list2 and applies the ACL to outbound traffic on Ethernet interface 0. Specifically, the first ACL entry keeps all packets from the network FEC0:0:0:2::/64 (packets that have the site-local prefix FEC0:0:0:2 as the first 64 bits of their source IPv6 address) from exiting out of Ethernet interface 0. The second entry in the ACL permits all other traffic to exit out of Ethernet interface 0. The second entry is necessary because an implicit deny all condition is at the end of each IPv6 ACL.

```
Device(config)# ipv6 access-list list2 deny FEC0:0:0:2::/64 any
Device(config)# ipv6 access-list list2 permit any any
Device(config)# interface ethernet 0
Device(config-if)# ipv6 traffic-filter list2 out
```



# ipv6 snooping policy



**Note** All existing IPv6 Snooping commands (prior to ) now have corresponding SISF-based device-tracking commands that allow you to apply your configuration to both IPv4 and IPv6 address families. For more information, see [device-tracking policy](#)

To configure an IPv6 snooping policy and enter IPv6 snooping configuration mode, use the **ipv6 snooping policy** command in global configuration mode. To delete an IPv6 snooping policy, use the **no** form of this command.

**ipv6 snooping policy** *snooping-policy*  
**no ipv6 snooping policy** *snooping-policy*

<b>Syntax Description</b>	<i>snooping-policy</i> User-defined name of the snooping policy. The policy name can be a symbolic string (such as Engineering) or an integer (such as 0).
---------------------------	--

<b>Command Default</b>	An IPv6 snooping policy is not configured.
------------------------	--

<b>Command Modes</b>	Global configuration
----------------------	----------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Use the **ipv6 snooping policy** command to create an IPv6 snooping policy. When the **ipv6 snooping policy** command is enabled, the configuration mode changes to IPv6 snooping configuration mode. In this mode, the administrator can configure the following IPv6 first-hop security commands:

- The **device-role** command specifies the role of the device attached to the port.
- The **limit address-count** *maximum* command limits the number of IPv6 addresses allowed to be used on the port.
- The **protocol** command specifies that addresses should be gleaned with Dynamic Host Configuration Protocol (DHCP) or Neighbor Discovery Protocol (NDP).
- The **security-level** command specifies the level of security enforced.
- The **tracking** command overrides the default tracking policy on a port.
- The **trusted-port** command configures a port to become a trusted port; that is, limited or no verification is performed when messages are received.

This example shows how to configure an IPv6 snooping policy:

```
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)#
```

# key chain macsec

To configure a MACsec key chain name on a device interface to fetch a Pre Shared Key (PSK), use the **key chain macsec** command in global configuration mode. To disable it, use the **no** form of this command.

**key chain** *name* **macsec** { **description** | **key** | **exit** }

Syntax Description	
<b>name</b>	Name of a key chain to be used to get keys.
<b>description</b>	Provides description of the MACsec key chain.
<b>key</b>	Configure a MACsec key.
<b>exit</b>	Exits from the MACsec key-chain configuration mode.
<b>no</b>	Negates the command or sets the default values.

**Command Default** key chain macsec is disabled.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Denali 16.3.1	This command was introduced.

This example shows how to configure MACsec key chain to fetch a 128-bit Pre Shared Key (PSK):

```
Switch#configure terminal
Switch(config)#key chain kc1 macsec
Switch(config-keychain-macsec)#key 1000
Switch(config-keychain-macsec)#cryptographic-algorithm aes-128-cmac
Switch(config-keychain-macsec-key)# key-string fb63e0269e2768c49bab8ee9a5c2258f
Switch(config-keychain-macsec-key)#end
Switch#
```

This example shows how to configure MACsec key chain to fetch a 256-bit Pre Shared Key (PSK):

```
Switch#configure terminal
Switch(config)#key chain kc1 macsec
Switch(config-keychain-macsec)#key 2000
Switch(config-keychain-macsec)#cryptographic-algorithm aes-256-cmac
Switch(config-keychain-macsec-key)# key-string
c865632acb269022447c417504a1bf5db1c296449b52627ba01f2ba2574c2878
Switch(config-keychain-macsec-key)#end
Switch#
```

# key-server

To configure MKA key-server options, use the **key-server** command in MKA-policy configuration mode. To disable MKA key-server options, use the **no** form of this command.

**key-server priority** *value*  
**no key-server priority**

<b>Syntax Description</b>	<b>priority</b> <i>value</i>	Specifies the priority value of the MKA key-server.
---------------------------	------------------------------	---

<b>Command Default</b>	MKA key-server is disabled.
------------------------	-----------------------------

<b>Command Modes</b>	MKA-policy configuration (config-mka-policy)
----------------------	--

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Examples

The following example shows how to configure the MKA key-server:

```
Device> enable
Device# configure terminal
Device(config)# mka policy 2
Device(config-mka-policy)# key-server priority 33
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>mka policy</b>	Configures an MKA policy.
	<b>confidentiality-offset</b>	Sets the confidentiality offset for MACsec operations.
	<b>delay-protection</b>	Configures MKA to use delay protection in sending MKPDU.
	<b>include-icv-indicator</b>	Includes ICV indicator in MKPDU.
	<b>macsec-cipher-suite</b>	Configures cipher suite for deriving SAK)
	<b>sak-rekey</b>	Configures the SAK rekey interval.
	<b>send-secure-announcements</b>	Configures MKA to send secure announcements in sending MKPDUs.
	<b>ssci-based-on-sci</b>	Computes SSCI based on the SCI.
<b>use-updated-eth-header</b>	Uses the updated Ethernet header for ICV calculation.	

# limit address-count

To limit the number of IPv6 addresses allowed to be used on the port, use the **limit address-count** command in Neighbor Discovery Protocol (NDP) inspection policy configuration mode or IPv6 snooping configuration mode. To return to the default, use the **no** form of this command.

**limit address-count** *maximum*  
**no limit address-count**

<b>Syntax Description</b>	<i>maximum</i> The number of addresses allowed on the port. The range is from 1 to 10000.
---------------------------	---

<b>Command Default</b>	The default is no limit.
------------------------	--------------------------

<b>Command Modes</b>	ND inspection policy configuration IPv6 snooping configuration
----------------------	---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	The <b>limit address-count</b> command limits the number of IPv6 addresses allowed to be used on the port on which the policy is applied. Limiting the number of IPv6 addresses on a port helps limit the binding table size. The range is from 1 to 10000.
-------------------------	---

This example shows how to define an NDP policy name as policy1, place the switch in NDP inspection policy configuration mode, and limit the number of IPv6 addresses allowed on the port to 25:

```
Device(config)# ipv6 nd inspection policy policy1
Device(config-nd-inspection)# limit address-count 25
```

This example shows how to define an IPv6 snooping policy name as policy1, place the switch in IPv6 snooping policy configuration mode, and limit the number of IPv6 addresses allowed on the port to 25:

```
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# limit address-count 25
```

## mab request format attribute 32

To enable VLAN ID-based MAC authentication on a switch, use the **mab request format attribute 32 vlan access-vlan** command in global configuration mode. To return to the default setting, use the **no** form of this command.

**mab request format attribute 32 vlan access-vlan**  
**no mab request format attribute 32 vlan access-vlan**

### Syntax Description

This command has no arguments or keywords.

### Command Default

VLAN-ID based MAC authentication is disabled.

### Command Modes

Global configuration

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use this command to allow a RADIUS server to authenticate a new user based on the host MAC address and VLAN.

Use this feature on networks with the Microsoft IAS RADIUS server. The Cisco ACS ignores this command.

This example shows how to enable VLAN-ID based MAC authentication on a switch:

```
Device(config)# mab request format attribute 32 vlan access-vlan
```

### Related Commands

Command	Description
<b>authentication event</b>	Sets the action for specific authentication events.
<b>authentication fallback</b>	Configures a port to use web authentication as a fallback method for clients that do not support IEEE 802.1x authentication.
<b>authentication host-mode</b>	Sets the authorization manager mode on a port.
<b>authentication open</b>	Enables or disables open access on a port.
<b>authentication order</b>	Sets the order of authentication methods used on a port.
<b>authentication periodic</b>	Enables or disables reauthentication on a port.
<b>authentication port-control</b>	Enables manual control of the port authorization state.
<b>authentication priority</b>	Adds an authentication method to the port-priority list.

<b>Command</b>	<b>Description</b>
<b>authentication timer</b>	Configures the timeout and reauthentication parameters for an 802.1x-enabled port.
<b>authentication violation</b>	Configures the violation modes that occur when a new device connects to a port or when a new device connects to a port with the maximum number of devices already connected to that port.
<b>mab</b>	Enables MAC-based authentication on a port.
<b>mab eap</b>	Configures a port to use the Extensible Authentication Protocol (EAP).
<b>show authentication</b>	Displays information about authentication manager events on the switch.

## macsec-cipher-suite

To configure cipher suite for deriving Security Association Key (SAK), use the **macsec-cipher-suite** command in MKA-policy configuration mode. To disable cipher suite for SAK, use the **no** form of this command.

**macsec-cipher-suite gcm-aes-128 | gcm-aes-256 | gcm-aes-xpn-128 | gcm-aes-xpn-256**  
**no macsec-cipher-suite gcm-aes-128 | gcm-aes-256 | gcm-aes-xpn-128 | gcm-aes-xpn-256**

### Syntax Description

<b>gcm-aes-128</b>	Configures cipher suite for deriving SAK with 128-bit encryption.
<b>gcm-aes-256</b>	Configures cipher suite for deriving SAK with 256-bit encryption.
<b>gcm-aes-xpn-128</b>	Configures cipher suite for deriving SAK with 128-bit encryption for Extended Packet Numbering (XPN).
<b>gcm-aes-xpn-256</b>	Configures cipher suite for deriving SAK with 256-bit encryption for XPN.

### Command Default

GCM-AES-128 encryption is enabled.

### Command Modes

MKA-policy configuration (config-mka-policy)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

If the device supports both GCM-AES-128 and GCM-AES-256 ciphers, it is highly recommended to define and use a user-defined MKA policy to include both or only 256 bits cipher, based on your requirements..

### Examples

The following example shows how to configure MACsec cipher suite for deriving SAK with 256-bit encryption:

```
Device> enable
Device# configure terminal
Device(config)# mka policy 2
Device(config-mka-policy)# macsec-cipher-suite gcm-aes-256
```

### Related Commands

Command	Description
<b>mka policy</b>	Configures an MKA policy.
<b>confidentiality-offset</b>	Sets the confidentiality offset for MACsec operations.
<b>delay-protection</b>	Configures MKA to use delay protection in sending MKPDU.
<b>include-icv-indicator</b>	Includes ICV indicator in MKPDU.
<b>key-server</b>	Configures MKA key-server options.
<b>sak-rekey</b>	Configures the SAK rekey interval.

<b>Command</b>	<b>Description</b>
<b>send-secure-announcements</b>	Configures MKA to send secure announcements in sending MKPDUs.
<b>ssci-based-on-sci</b>	Computes SSCI based on the SCI.
<b>use-updated-eth-header</b>	Uses the updated Ethernet header for ICV calculation.



# macsec network-link

To enable MKA MACsec configuration on the uplink interfaces, use the **macsec network-link** command on the interface. To disable it, use the **no** form of this command.

## macsec network-link

<b>Syntax Description</b>	<b>macsec network-link</b> Enables MKA MACsec configuration on device interfaces using EAP-TLS authentication protocol.				
<b>Command Default</b>	macsec network-link is disabled.				
<b>Command Modes</b>	Interface configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Denali 16.3.1</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Denali 16.3.1	This command was introduced.
Release	Modification				
Cisco IOS XE Denali 16.3.1	This command was introduced.				

This example shows how to configure MACsec MKA on an interface using the EAP-TLS authentication protocol:

```
Switch#configure terminal
Switch(config)# int G1/0/20
Switch(config-if)# macsec network-link
Switch(config-if)# end
Switch#
```

# match (access-map configuration)

To set the VLAN map to match packets against one or more access lists, use the **match** command in access-map configuration mode on the switch stack or on a standalone switch. To remove the match parameters, use the **no** form of this command.

```
match ip address namenumber [namenumber] [namenumber]. . . | ipv6 address namenumber
[namenumber] [namenumber]. . . | mac address name [name] [name]. . .
no match ip address namenumber [namenumber] [namenumber]. . . | ipv6 address namenumber
[namenumber] [namenumber]. . . | mac address name [name] [name]. . .
```

## Syntax Description

<b>ip address</b>	Sets the access map to match packets against an IP address access list.
<b>ipv6 address</b>	Sets the access map to match packets against an IPv6 address access list.
<b>mac address</b>	Sets the access map to match packets against a MAC address access list.
<i>name</i>	Name of the access list to match packets against.
<i>number</i>	Number of the access list to match packets against. This option is not valid for MAC access lists.

## Command Default

The default action is to have no match parameters applied to a VLAN map.

## Command Modes

Access-map configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

You enter access-map configuration mode by using the **vlan access-map** global configuration command.

You must enter one access list name or number; others are optional. You can match packets against one or more access lists. Matching any of the lists counts as a match of the entry.

In access-map configuration mode, use the **match** command to define the match conditions for a VLAN map applied to a VLAN. Use the **action** command to set the action that occurs when the packet matches the conditions.

Packets are matched only against access lists of the same protocol type; IP packets are matched against IP access lists, IPv6 packets are matched against IPv6 access lists, and all other packets are matched against MAC access lists.

IP, IPv6, and MAC addresses can be specified for the same map entry.

This example shows how to define and apply a VLAN access map vmap4 to VLANs 5 and 6 that will cause the interface to drop an IP packet if the packet matches the conditions defined in access list al2:

```
Device(config)# vlan access-map vmap4
Device(config-access-map)# match ip address al2
Device(config-access-map)# action drop
```

```
Device(config-access-map)# exit  
Device(config)# vlan filter vmap4 vlan-list 5-6
```

You can verify your settings by entering the **show vlan access-map** privileged EXEC command.

## mka pre-shared-key

To configure MKA MACsec on a device interface using a Pre Shared Key (PSK), use the **mka pre-shared-key key-chain** *key-chain name* command in global configuration mode. To disable it, use the **no** form of this command.

**mka pre-shared-key key-chain** *key-chain-name*

<b>Syntax Description</b>	<b>mka pre-shared-key key-chain</b> Enables MACsec MKA configuration on device interfaces using a PSK.	
<b>Command Default</b>	mka pre-shared-key is disabled.	
<b>Command Modes</b>	Interface configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Denali 16.3.1	This command was introduced.

This example shows how to configure MKA MACsec on an interface using a PSK:

```
Switch#
Switch(config)# int G1/0/20
Switch(config-if)# mka pre-shared-key key-chain kcl
Switch(config-if)# end
Switch#
```

# authentication logging verbose

To filter detailed information from authentication system messages, use the **authentication logging verbose** command in global configuration mode on the switch stack or on a standalone switch.

**authentication logging verbose**  
**no authentication logging verbose**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Detailed logging of system messages is not enabled.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command filters details, such as anticipated success, from authentication system messages. Failure messages are not filtered.

To filter verbose authentication system messages:

```
Device(config)# authentication logging verbose
```

You can verify your settings by entering the **show running-config** privileged EXEC command.

Related Commands	Command	Description
	<b>authentication logging verbose</b>	Filters details from authentication system messages.
	<b>dot1x logging verbose</b>	Filters details from 802.1x system messages.
	<b>mab logging verbose</b>	Filters details from MAC authentication bypass (MAB) system messages.

# dot1x logging verbose

To filter detailed information from 802.1x system messages, use the **dot1x logging verbose** command in global configuration mode on the switch stack or on a standalone switch.

**dot1x logging verbose**  
**no dot1x logging verbose**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Detailed logging of system messages is not enabled.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command filters details, such as anticipated success, from 802.1x system messages. Failure messages are not filtered.

To filter verbose 802.1x system messages:

```
Device(config)# dot1x logging verbose
```

You can verify your settings by entering the **show running-config** privileged EXEC command.

## Related Commands

Command	Description
<b>authentication logging verbose</b>	Filters details from authentication system messages.
<b>dot1x logging verbose</b>	Filters details from 802.1x system messages.
<b>mab logging verbose</b>	Filters details from MAC authentication bypass (MAB) system messages.

# mab logging verbose

To filter detailed information from MAC authentication bypass (MAB) system messages, use the **mab logging verbose** command in global configuration mode on the switch stack or on a standalone switch.

**mab logging verbose**  
**no mab logging verbose**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Detailed logging of system messages is not enabled.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This command filters details, such as anticipated success, from MAC authentication bypass (MAB) system messages. Failure messages are not filtered.

To filter verbose MAB system messages:

```
Device(config)# mab logging verbose
```

You can verify your settings by entering the **show running-config** privileged EXEC command.

Related Commands	Command	Description
	<b>authentication logging verbose</b>	Filters details from authentication system messages.
	<b>dot1x logging verbose</b>	Filters details from 802.1x system messages.
	<b>mab logging verbose</b>	Filters details from MAC authentication bypass (MAB) system messages.

## permit (MAC access-list configuration)

To allow non-IP traffic to be forwarded if the conditions are matched, use the **permit** MAC access-list configuration command on the switch stack or on a standalone switch. To remove a permit condition from the extended MAC access list, use the **no** form of this command.

```
{permit {any | hostsrc-MAC-addr | src-MAC-addr mask} {any | hostdst-MAC-addr |
dst-MAC-addr mask} [type mask | aarp | amber | appletalk | dec-spanning | decnet-iv |
diagnostic | dsm | etype-6000 | etype-8042 | lat | larc-sca | lsaplsap mask | mop-console
| mop-dump | msdos | mumps | netbios | vines-echo | vines-ip | xns-idp] [coscos]
nopermit {any | host src-MAC-addr | src-MAC-addr mask} {any | host dst-MAC-addr |
dst-MAC-addr mask} [type mask | aarp | amber | appletalk | dec-spanning | decnet-iv |
diagnostic | dsm | etype-6000 | etype-8042 | lat | larc-sca | lsap lsap mask | mop-console
| mop-dump | msdos | mumps | netbios | vines-echo | vines-ip | xns-idp] [coscos]
```

### Syntax Description

<b>any</b>	Denies any source or destination MAC address.
<b>host</b> <i>src-MAC-addr</i>   <i>src-MAC-addr mask</i>	Specifies a host MAC address and optional subnet mask. If the source address for a packet matches the defined address, non-IP traffic from that address is denied.
<b>host</b> <i>dst-MAC-addr</i>   <i>dst-MAC-addr mask</i>	Specifies a destination MAC address and optional subnet mask. If the destination address for a packet matches the defined address, non-IP traffic to that address is denied.
<i>type mask</i>	(Optional) Specifies the EtherType number of a packet with Ethernet II or SNAP encapsulation to identify the protocol of the packet. <ul style="list-style-type: none"> <li><i>type</i> is 0 to 65535, specified in hexadecimal.</li> <li><i>mask</i> is a mask of don't care bits applied to the EtherType before testing for a match.</li> </ul>
<b>aarp</b>	(Optional) Specifies EtherType AppleTalk Address Resolution Protocol that maps a data-link address to a network address.
<b>amber</b>	(Optional) Specifies EtherType DEC-Amber.
<b>appletalk</b>	(Optional) Specifies EtherType AppleTalk/EtherTalk.
<b>dec-spanning</b>	(Optional) Specifies EtherType Digital Equipment Corporation (DEC) spanning tree.
<b>decnet-iv</b>	(Optional) Specifies EtherType DECnet Phase IV protocol.
<b>diagnostic</b>	(Optional) Specifies EtherType DEC-Diagnostic.



<b>dsm</b>	(Optional) Specifies EtherType DEC-DSM.
<b>etype-6000</b>	(Optional) Specifies EtherType 0x6000.
<b>etype-8042</b>	(Optional) Specifies EtherType 0x8042.
<b>lat</b>	(Optional) Specifies EtherType DEC-LAT.
<b>lavc-sca</b>	(Optional) Specifies EtherType DEC-LAVC-SCA.
<b>lsap</b> <i>lsap-number mask</i>	(Optional) Specifies the LSAP number (0 to 65535) of a packet with 802.2 encapsulation to identify the protocol of the packet.  The <i>mask</i> is a mask of don't care bits applied to the LSAP number before testing for a match.
<b>mop-console</b>	(Optional) Specifies EtherType DEC-MOP Remote Console.
<b>mop-dump</b>	(Optional) Specifies EtherType DEC-MOP Dump.
<b>msdos</b>	(Optional) Specifies EtherType DEC-MSDOS.
<b>mumps</b>	(Optional) Specifies EtherType DEC-MUMPS.
<b>netbios</b>	(Optional) Specifies EtherType DEC- Network Basic Input/Output System (NetBIOS).
<b>vines-echo</b>	(Optional) Specifies EtherType Virtual Integrated Network Service (VINES) Echo from Banyan Systems.
<b>vines-ip</b>	(Optional) Specifies EtherType VINES IP.
<b>xns-idp</b>	(Optional) Specifies EtherType Xerox Network Systems (XNS) protocol suite.
<b>cos</b> <i>cos</i>	(Optional) Specifies an arbitrary class of service (CoS) number from 0 to 7 to set priority. Filtering on CoS can be performed only in hardware. A warning message appears if the <b>cos</b> option is configured.

**Command Default** This command has no defaults. However, the default action for a MAC-named ACL is to deny.

**Command Modes** Mac-access list configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Though visible in the command-line help strings, **appletalk** is not supported as a matching condition.

You enter MAC access-list configuration mode by using the **mac access-list extended** global configuration command.

If you use the **host** keyword, you cannot enter an address mask; if you do not use the **any** or **host** keywords, you must enter an address mask.

After an access control entry (ACE) is added to an access control list, an implied **deny-any-any** condition exists at the end of the list. That is, if there are no matches, the packets are denied. However, before the first ACE is added, the list permits all packets.

To filter IPX traffic, you use the *type mask* or **lsap lsap mask** keywords, depending on the type of IPX encapsulation being used. Filter criteria for IPX encapsulation types as specified in Novell terminology and Cisco IOS terminology are listed in the following table.

**Table 164: IPX Filtering Criteria**

IPX Encapsulation Type		Filter Criterion
Cisco IOS Name	Novell Name	
arpa	Ethernet II	EtherType 0x8137
snap	Ethernet-snap	EtherType 0x8137
sap	Ethernet 802.2	LSAP 0xE0E0
novell-ether	Ethernet 802.3	LSAP 0xFFFF

This example shows how to define the MAC-named extended access list to allow NetBIOS traffic from any source to MAC address 00c0.00a0.03fa. Traffic matching this list is allowed.

```
Device(config-ext-macl)# permit any host 00c0.00a0.03fa netbios
```

This example shows how to remove the permit condition from the MAC-named extended access list:

```
Device(config-ext-macl)# no permit any 00c0.00a0.03fa 0000.0000.0000 netbios
```

This example permits all packets with EtherType 0x4321:

```
Device(config-ext-macl)# permit any any 0x4321 0
```

You can verify your settings by entering the **show access-lists** privileged EXEC command.

#### Related Commands

Command	Description
<b>deny</b>	Denies from the MAC access-list configuration. Denies non-IP traffic to be forwarded if conditions are matched.
<b>mac access-list extended</b>	Creates an access list based on MAC addresses for non-IP traffic.

Command	Description
show access-lists	Displays access control lists configured on a switch.

# propagate sgt (cts manual)

To enable Security Group Tag (SGT) propagation at Layer 2 on Cisco TrustSec Security (CTS) interfaces, use the **propagate sgt** command in interface configuration mode. To disable SGT propagation, use the **no** form of this command.

## propagate sgt

<b>Syntax Description</b>	This command has no arguments or keywords.
<b>Command Default</b>	SGT processing propagation is enabled.
<b>Command Modes</b>	CTS manual interface configuration mode (config-if-cts-manual)

<b>Command History</b>	Release	Modification
	Cisco IOS XE Denali 16.3.1	This command was introduced.

**Usage Guidelines** SGT processing propagation allows a CTS-capable interface to accept and transmit a CTS Meta Data (CMD) based L2 SGT tag. The **no propagate sgt** command can be used to disable SGT propagation on an interface in situations where a peer device is not capable of receiving an SGT, and as a result, the SGT tag cannot be put in the L2 header.

## Examples

The following example shows how to disable SGT propagation on a manually-configured TrustSec-capable interface:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet 0
Switch(config-if)# cts manual
Switch(config-if-cts-manual)# no propagate sgt
```

The following example shows that SGT propagation is disabled on Gigabit Ethernet interface 0:

```
Switch#show cts interface brief
Global Dot1x feature is Disabled
Interface GigabitEthernet0:
  CTS is enabled, mode:      MANUAL
  IFC state:                 OPEN
  Authentication Status:    NOT APPLICABLE
  Peer identity:            "unknown"
  Peer's advertised capabilities: ""
  Authorization Status:     NOT APPLICABLE
  SAP Status:               NOT APPLICABLE
  Propagate SGT:            Disabled
  Cache Info:
    Cache applied to link : NONE
```

## Related Commands

Command	Description
<b>cts manual</b>	Enables an interface for CTS.

Command	Description
<b>show cts interface</b>	Displays Cisco TrustSec states and statistics per interface.

## protocol (IPv6 snooping)

To specify that addresses should be gleaned with Dynamic Host Configuration Protocol (DHCP) or Neighbor Discovery Protocol (NDP), or to associate the protocol with an IPv6 prefix list, use the **protocol** command. To disable address gleaning with DHCP or NDP, use the **no** form of the command.

```
protocol { dhcp | ndp }
no protocol { dhcp | ndp }
```

<b>Syntax Description</b>	<b>dhcp</b> Specifies that addresses should be gleaned in Dynamic Host Configuration Protocol (DHCP) packets.				
	<b>ndp</b> Specifies that addresses should be gleaned in Neighbor Discovery Protocol (NDP) packets.				
<b>Command Default</b>	Snooping and recovery are attempted using both DHCP and NDP.				
<b>Command Modes</b>	IPv6 snooping configuration mode				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	<p>If an address does not match the prefix list associated with DHCP or NDP, then control packets will be dropped and recovery of the binding table entry will not be attempted with that protocol.</p> <ul style="list-style-type: none"> <li>• Using the <b>no protocol</b> { <b>dhcp</b>   <b>ndp</b> } command indicates that a protocol will not be used for snooping or gleaning.</li> <li>• If the <b>no protocol dhcp</b> command is used, DHCP can still be used for binding table recovery.</li> <li>• Data glean can recover with DHCP and NDP, though destination guard will only recovery through DHCP.</li> </ul> <p>This example shows how to define an IPv6 snooping policy name as policy1, place the switch in IPv6 snooping policy configuration mode, and configure the port to use DHCP to glean addresses:</p> <pre>Device(config)# <b>ipv6 snooping policy policy1</b> Device(config-ipv6-snooping)# <b>protocol dhcp</b></pre>				

# radius server



**Note** Starting from Cisco IOS 15.2(5)E release, the **radius server** command replaces the **radius-server host** command, being used in releases prior to Cisco IOS Release 15.2(5)E. The old command has been deprecated.

Use the **radius server** configuration sub-mode command on the switch stack or on a standalone switch to configure the RADIUS server parameters, including the RADIUS accounting and authentication. Use the **no** form of this command to return to the default settings.

```
radius server name
address {ipv4 | ipv6} ip{address / hostname} auth-port udp-port acct-port udp-port
key string
automate tester name | retransmit value | timeout seconds
no radius server name
```

## Syntax Description

<b>address {ipv4   ipv6}</b> <i>ip{address / hostname}</i>	Specify the IP address of the RADIUS server.
<b>auth-port</b> <i>udp-port</i>	(Optional) Specify the UDP port for the RADIUS authentication server. The range is from 0 to 65536.
<b>acct-port</b> <i>udp-port</i>	(Optional) Specify the UDP port for the RADIUS accounting server. The range is from 0 to 65536.
<b>key</b> <i>string</i>	(Optional) Specify the authentication and encryption key for all RADIUS communication between the switch and the RADIUS daemon.  <b>Note</b> The key is a text string that must match the encryption key used on the RADIUS server. Always configure the key as the last item in this command. Leading spaces are ignored, but spaces within and at the end of the key are used. If there are spaces in your key, do not enclose the key in quotation marks unless the quotation marks are part of the key.
<b>automate tester</b> <i>name</i>	(Optional) Enable automatic server testing of the RADIUS server status, and specify the username to be used.
<b>retransmit</b> <i>value</i>	(Optional) Specifies the number of times a RADIUS request is resent when the server is not responding or responding slowly. The range is 1 to 100. This setting overrides the radius-server retransmit global configuration command setting.
<b>timeout</b> <i>seconds</i>	(Optional) Specifies the time interval that the Switch waits for the RADIUS server to reply before sending a request again. The range is 1 to 1000. This setting overrides the radius-server timeout global configuration command setting.
<b>no radius server</b> <i>name</i>	Returns to the default settings

**Command Default**

- The UDP port for the RADIUS accounting server is 1646.
- The UDP port for the RADIUS authentication server is 1645.
- Automatic server testing is disabled.
- The timeout is 60 minutes (1 hour).
- When the automatic testing is enabled, testing occurs on the accounting and authentication UDP ports.
- The authentication and encryption key ( string) is not configured.

**Command Modes**

Radius server sub-mode configuration

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced to replace the <b>radius-server host</b> command.

**Usage Guidelines**

- We recommend that you configure the UDP port for the RADIUS accounting server and the UDP port for the RADIUS authentication server to non-default values.
- You can configure the authentication and encryption key by using the **key string** sub-mode configuration command. Always configure the key as the last item in this command.
- Use the **automate-tester name** keywords to enable automatic server testing of the RADIUS server status and to specify the username to be used.

This example shows how to configure 1645 as the UDP port for the authentication server and 1646 as the UDP port for the accounting server, and configure a key string:

```
Device(config)# radius server ISE
Device(config-radius-server)# address ipv4 10.1.1.1 auth-port 1645 acct-port 1646
Device(config-radius-server)# key cisco123
```



# sak-rekey

To configure the Security Association Key (SAK) rekey time interval for a defined MKA policy, use the **sak-rekey** command in MKA-policy configuration mode. To stop the SAK rekey timer, use the **no** form of this command.

**sak-rekey interval** *time-interval* | **on-live-peer-loss**  
**no sak-rekey interval** | **on-live-peer-loss**

## Syntax Description

<b>interval</b>	SAK rekey interval in seconds.
<i>time-interval</i>	The range is from 30 to 65535, and the default is 0.
<b>on-live-peer-loss</b>	Peer loss from the live membership.

## Command Default

The SAK rekey timer is disabled. The default is 0.

## Command Modes

MKA-policy configuration (config-mka-policy)

## Command History

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

## Examples

The following example shows how to configure the SAK rekey interval:

```
Device> enable
Device# configure terminal
Device(config)# mka policy 2
Device(config-mka-policy)# sak-rekey interval 300
```

## Related Commands

Command	Description
<b>mka policy</b>	Configures an MKA policy.
<b>confidentiality-offset</b>	Sets the confidentiality offset for MACsec operations.
<b>delay-protection</b>	Configures MKA to use delay protection in sending MKPDU.
<b>include-icv-indicator</b>	Includes ICV indicator in MKPDU.
<b>key-server</b>	Configures MKA key-server options.
<b>macsec-cipher-suite</b>	Configures cipher suite for deriving SAK.
<b>send-secure-announcements</b>	Configures MKA to send secure announcements in sending MKPDUs.
<b>ssci-based-on-sci</b>	Computes SSCI based on the SCI.
<b>use-updated-eth-header</b>	Uses the updated Ethernet header for ICV calculation.

## sap mode-list (cts manual)

To select the Security Association Protocol (SAP) authentication and encryption modes (prioritized from highest to lowest) used to negotiate link encryption between two interfaces, use the **sap mode-list** command in Cisco TrustSec dot1x interface configuration mode. To remove a mode-list and revert to the default, use the **no** form of this command.

Use the **sap mode-list** command to manually specify the PMK and the Security Association Protocol (SAP) authentication and encryption modes to negotiate MACsec link encryption between two interfaces. Use the **no** form of the command to disable the configuration.

**sap pmk mode-list gcm-encrypt | gmac | no-encap | null [gcm-encrypt | gmac | no-encap | null]**  
**no sap pmk mode-list gcm-encrypt | gmac | no-encap | null [gcm-encrypt | gmac | no-encap | null]**

### Syntax Description

<b>pmk</b> <i>hex_value</i>	Specifies the Hex-data PMK (without leading 0x; enter even number of hex characters, or else the last character is prefixed with 0.).
<b>mode-list</b>	Specifies the list of advertised modes (prioritized from highest to lowest).
<b>gcm-encrypt</b>	Specifies GMAC authentication, GCM encryption.
<b>gmac</b>	Specifies GMAC authentication only, no encryption.
<b>no-encap</b>	Specifies no encapsulation.
<b>null</b>	Specifies encapsulation present, no authentication, no encryption.

### Command Default

The default encryption is **sap pmk mode-list gcm-encrypt null**. When the peer interface does not support 802.1AE MACsec or 802.REV layer-2 link encryption, the default encryption is **null**.

### Command Modes

CTS manual interface configuration (config-if-cts-manual)

### Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

### Usage Guidelines

Use the **sap pmk mode-list** command to specify the authentication and encryption method.

The Security Association Protocol (SAP) is an encryption key derivation and exchange protocol based on a draft version of the 802.11i IEEE protocol. SAP is used to establish and maintain the 802.1AE link-to-link encryption (MACsec) between interfaces that support MACsec.

SAP and PMK can be manually configured between two interfaces with the **sap pmk mode-list** command. When using 802.1X authentication, both sides (supplicant and authenticator) receive the PMK and the MAC address of the peer's port from the Cisco Secure Access Control Server.

If a device is running Cisco TrustSec-aware software but the hardware is not Cisco TrustSec-capable, disallow encapsulation with the **sap mode-list no-encap** command.

## Examples

The following example shows how to configure SAP on a Gigabit Ethernet interface:

```
Switch# configure terminal
Switch(config)# interface gigabitethernet 2/1
Switch(config-if)# cts manual
Switch(config-if-cts-manual)# sap pmk FFEED mode-list gcm-encrypt
```

## Related Commands

Command	Description
<b>cts manual</b>	Enables an interface for Cisco TrustSec.
<b>propagate sgt (cts manual)</b>	Enables SGT propagation at Layer 2 on Cisco TrustSec Security interfaces.
<b>show cts interface</b>	Displays Cisco TrustSec interface configuration statistics.

## security level (IPv6 snooping)

To specify the level of security enforced, use the **security-level** command in IPv6 snooping policy configuration mode.

**security level** { **glean** | **guard** | **inspect** }

Syntax Description	<b>glean</b>	Extracts addresses from the messages and installs them into the binding table without performing any verification.
	<b>guard</b>	Performs both glean and inspect. Additionally, RA and DHCP server messages are rejected unless they are received on a trusted port or another policy authorizes them.
	<b>inspect</b>	Validates messages for consistency and conformance; in particular, address ownership is enforced. Invalid messages are dropped.
Command Default	The default security level is guard.	
Command Modes	IPv6 snooping configuration	
Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This example shows how to define an IPv6 snooping policy name as policy1, place the device in IPv6 snooping configuration mode, and configure the security level as inspect:

```
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# security-level inspect
```

# security passthru

To modify the IPsec pass-through, use the **security passthru** command. To disable, use the no form of the command.

```
security passthru ip-address
no security passthru
```

<b>Syntax Description</b>	<i>ip-address</i> IP address of the IPsec gateway (router) that is terminating the VPN tunnel.				
<b>Command Default</b>	None.				
<b>Command Modes</b>	wlan				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	None.				

This example shows how to modify IPsec pass-through.

```
Device#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Device(config)#security passthrough 10.1.1.1
```

## server-private (RADIUS)

To configure the IP address of the private RADIUS server for the group server, use the **server-private** command in RADIUS server-group configuration mode. To remove the associated private server from the authentication, authorization, and accounting (AAA) group server, use the **no** form of this command.

**server-private** *ip-address* [**auth-port** *port-number* | **acct-port** *port-number*] [**non-standard**] [**timeout** *seconds*] [**retransmit** *retries*] [**key** *string*]

**no server-private** *ip-address* [**auth-port** *port-number* | **acct-port** *port-number*] [**non-standard**] [**timeout** *seconds*] [**retransmit** *retries*] [**key** *string*]

### Syntax Description

<i>ip-address</i>	IP address of the private RADIUS server host.
<b>auth-port</b> <i>port-number</i>	(Optional) User Datagram Protocol (UDP) destination port for authentication requests. The default value is 1645.
<b>acct-port</b> <i>port-number</i>	(Optional) UDP destination port for accounting requests. The default value is 1646.
<b>non-standard</b>	(Optional) RADIUS server is using vendor-proprietary RADIUS attributes.
<b>timeout</b> <i>seconds</i>	(Optional) Time interval (in seconds) that the device waits for the RADIUS server to reply before retransmitting. This setting overrides the global value of the <b>radius-server timeout</b> command. If no timeout value is specified, the global value is used.
<b>retransmit</b> <i>retries</i>	(Optional) Number of times a RADIUS request is resent to a server, if that server is not responding or responding slowly. This setting overrides the global setting of the <b>radius-server retransmit</b> command.
<b>key</b> <i>string</i>	(Optional) Authentication and encryption key used between the device and the RADIUS daemon running on the RADIUS server. This key overrides the global setting of the <b>radius-server key</b> command. If no key string is specified, the global value is used.  The <i>string</i> can be <b>0</b> (specifies that an unencrypted key follows), <b>6</b> (specifies that an advanced encryption scheme [AES] encrypted key follows), <b>7</b> (specifies that a hidden key follows), or a line specifying the unencrypted (clear-text) server key.

### Command Default

If server-private parameters are not specified, global configurations will be used; if global configurations are not specified, default values will be used.

### Command Modes

RADIUS server-group configuration (config-sg-radius)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **server-private** command to associate a particular private server with a defined server group. To prevent possible overlapping of private addresses between virtual route forwarding (VRF) instances, private

servers (servers with private addresses) can be defined within the server group and remain hidden from other groups, while the servers in the global pool (default "radius" server group) can still be referred to by IP addresses and port numbers. Thus, the list of servers in server groups includes references to the hosts in the global configuration and the definitions of private servers.

**Note**

- If the **radius-server directed-request** command is configured, then a private RADIUS server cannot be used as the group server by configuring the **server-private (RADIUS)** command.
- Creating or updating AAA server statistics record for private RADIUS servers are not supported. If private RADIUS servers are used, then error messages and tracebacks will be encountered, but these error messages or tracebacks do not have any impact on the AAA RADIUS functionality. To avoid these error messages and tracebacks, configure public RADIUS server instead of private RADIUS server.

Use the **password encryption aes** command to configure type 6 AES encrypted keys.

**Examples**

The following example shows how to define the sg\_water RADIUS group server and associate private servers with it:

```
Device> enable
Device# configure terminal
Device(config)# aaa new-model
Device(config)# aaa group server radius sg_water
Device(config-sg-radius)# server-private 10.1.1.1 timeout 5 retransmit 3 key xyz
Device(config-sg-radius)# server-private 10.2.2.2 timeout 5 retransmit 3 key xyz
Device(config-sg-radius)# end
```

**Related Commands**

Command	Description
<b>aaa group server</b>	Groups different server hosts into distinct lists and distinct methods.
<b>aaa new-model</b>	Enables the AAA access control model.
<b>password encryption aes</b>	Enables a type 6 encrypted preshared key.
<b>radius-server host</b>	Specifies a RADIUS server host.
<b>radius-server directed-request</b>	Allows users to log in to a Cisco NAS and select a RADIUS server for authentication.

## server-private (TACACS+)

To configure the IPv4 or IPv6 address of the private TACACS+ server for the group server, use the **server-private** command in server-group configuration mode. To remove the associated private server from the authentication, authorization, and accounting (AAA) group server, use the **no** form of this command.

```
server-private  ipv4-address | ipv6-address | fqdn [ nat ] [ single-connection ] [ port port-number ]
[ timeout seconds ] key [ 0 | 7 ] string
no server-private
```

### Syntax Description

<b>ipv4-address</b>	IPv4 address of the private TACACS+ server host.
<b>ipv6-address</b>	IPv6 address of the private TACACS+ server host.
<b>fqdn</b>	Fully qualified domain name (fqdn) of the private TACACS+ server host for address resolution from the Domain Name Server (DNS)
<b>nat</b>	(Optional) Specifies the port Network Address Translation (NAT) address of the remote device. This address is sent to the TACACS+ server.
<b>single-connection</b>	(Optional) Maintains a single TCP connection between the router and the TACACS+ server.
<b>timeout seconds</b>	(Optional) Specifies a timeout value for the server response. This value overrides the global timeout value set with the <b>tacacs-server timeout</b> command for this server only.
<b>port port-number</b>	(Optional) Specifies a server port number. This option overrides the default, which is port 49.
<b>key [ 0   7 ] string</b>	(Optional) Specifies an authentication and encryption key. This key must match the key used by the TACACS+ daemon. Specifying this key overrides the key set by the global <b>tacacs-server key</b> command for this server only.  If no number or 0 is entered, the <i>string</i> that is entered is considered to be plain text. If 7 is entered, the <i>string</i> that is entered is considered to be encrypted text.

### Command Default

If server-private parameters are not specified, global configurations will be used; if global configurations are not specified, default values will be used.

### Command Modes

TACACS+ server-group configuration (config-sg-tacacs+)

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **server-private** command to associate a particular private server with a defined server group. To prevent possible overlapping of private addresses between virtual route forwardings (VRFs), private servers (servers with private addresses) can be defined within the server group and remain hidden from other groups, while the servers in the global pool (default "TACACS+" server group) can still be referred to by IP addresses



and port numbers. Thus, the list of servers in server groups includes references to the hosts in the global configuration and the definitions of private servers.

The following example shows how to define the tacacs1 TACACS+ group server and associate private servers with it:

```
Device> enable
Device# configure terminal
Device(config)# aaa group server tacacs+ tacacs1
Device(config-sg-tacacs+)# server-private 10.1.1.1 port 19 key cisco
Device(config-sg-tacacs+)# exit
Device(config)#ip vrf cisco
Device(config-vrf)# rd 100:1
Device(config-vrf)# exit
Device(config)# interface Loopback0
Device(config-if)#ip address 10.0.0.2 255.0.0.0
Device(config-if)#ip vrf forwarding cisco
```

#### Related Commands

Command	Description
<b>aaa group server</b>	Groups different server hosts into distinct lists and distinct methods.
<b>aaa new-model</b>	Enables the AAA access control model.
<b>ip tacacs source-interface</b>	Uses the IP address of a specified interface for all outgoing TACACS+ packets.
<b>ip vrf forwarding (server-group)</b>	Configures the VRF reference of an AAA TACACS+ server group.

# show aaa clients

To show AAA client statistics, use the **show aaa clients** command.

**show aaa clients** [**detailed**]

---

## Syntax Description

**detailed** (Optional) Shows detailed AAA client statistics.

---



---

## Command Modes

User EXEC

---



---

## Command History

### Release

### Modification

Cisco IOS XE Everest 16.5.1a

This command was introduced.

---

This is an example of output from the **show aaa clients** command:

```
Device# show aaa clients
```

```
Dropped request packets: 0
```

# show aaa command handler

To show AAA command handler statistics, use the **show aaa command handler** command.

## show aaa command handler

<b>Syntax Description</b>	This command has no arguments or keywords.
---------------------------	--

<b>Command Modes</b>	User EXEC
----------------------	-----------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This is an example of output from the **show aaa command handler** command:

```
Device# show aaa command handler

AAA Command Handler Statistics:
  account-logon: 0, account-logoff: 0
  account-query: 0, pod: 0
  service-logon: 0, service-logoff: 0
  user-profile-push: 0, session-state-log: 0
  reauthenticate: 0, bounce-host-port: 0
  disable-host-port: 0, update-rbacl: 0
  update-sgt: 0, update-cts-policies: 0
  invalid commands: 0
  async message not sent: 0
```

# show aaa local

To show AAA local method options, use the **show aaa local** command.

**show aaa local** {**netuser** {*name* | **all**} | **statistics** | **user lockout**}

## Syntax Description

<b>netuser</b>	Specifies the AAA local network or guest user database.
<i>name</i>	Network user name.
<b>all</b>	Specifies the network and guest user information.
<b>statistics</b>	Displays statistics for local authentication.
<b>user lockout</b>	Specifies the AAA local locked-out user.

## Command Modes

User EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

This is an example of output from the **show aaa local statistics** command:

```
Device# show aaa local statistics

Local EAP statistics

EAP Method          Success      Fail
-----
Unknown              0            0
EAP-MD5              0            0
EAP-GTC              0            0
LEAP                 0            0
PEAP                 0            0
EAP-TLS              0            0
EAP-MSCHAPV2        0            0
EAP-FAST             0            0

Requests received from AAA:          0
Responses returned from EAP:        0
Requests dropped (no EAP AVP):      0
Requests dropped (other reasons):   0
Authentication timeouts from EAP:   0

Credential request statistics
Requests sent to backend:            0
Requests failed (unable to send):   0
Authorization results received

    Success:                          0
    Fail:                              0
```

# show aaa servers

To shows all AAA servers as seen by the AAA server MIB, use the **show aaa servers** command.

**show aaa servers** [ **private** | **public** | [**detailed**] ]

Syntax Description		
	<b>detailed</b>	(Optional) Displays private AAA servers as seen by the AAA Server MIB.
	<b>public</b>	(Optional) Displays public AAA servers as seen by the AAA Server MIB.
	<b>detailed</b>	(Optional) Displays detailed AAA server statistics.
Command Modes	User EXEC	
Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This is an example of output from the **show aaa servers** command:

```
Device# show aaa servers
RADIUS: id 1, priority 1, host 172.20.128.2, auth-port 1645, acct-port 1646
State: current UP, duration 9s, previous duration 0s
Dead: total time 0s, count 0
Quarantined: No
Authen: request 0, timeouts 0, failover 0, retransmission 0
Response: accept 0, reject 0, challenge 0
Response: unexpected 0, server error 0, incorrect 0, time 0ms
Transaction: success 0, failure 0
Throttled: transaction 0, timeout 0, failure 0
Author: request 0, timeouts 0, failover 0, retransmission 0
Response: accept 0, reject 0, challenge 0
Response: unexpected 0, server error 0, incorrect 0, time 0ms
Transaction: success 0, failure 0
Throttled: transaction 0, timeout 0, failure 0
Account: request 0, timeouts 0, failover 0, retransmission 0
Request: start 0, interim 0, stop 0
Response: start 0, interim 0, stop 0
Response: unexpected 0, server error 0, incorrect 0, time 0ms
Transaction: success 0, failure 0
Throttled: transaction 0, timeout 0, failure 0
Elapsed time since counters last cleared: 0m
Estimated Outstanding Access Transactions: 0
Estimated Outstanding Accounting Transactions: 0
Estimated Throttled Access Transactions: 0
Estimated Throttled Accounting Transactions: 0
Maximum Throttled Transactions: access 0, accounting 0
```

# show aaa sessions

To show AAA sessions as seen by the AAA Session MIB, use the **show aaa sessions** command.

## show aaa sessions

**Syntax Description** This command has no arguments or keywords.

**Command Modes** User EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This is an example of output from the **show aaa sessions** command:

```
Device# show aaa sessions
Total sessions since last reload: 7
Session Id: 4007
  Unique Id: 4025
  User Name: *not available*
  IP Address: 0.0.0.0
  Idle Time: 0
  CT Call Handle: 0
```

## show authentication brief

To display brief information about authentication sessions for a given interface, use the **show authentication brief** command in either user EXEC or privileged EXEC mode.

```
show authentication brief [switch {switch-number | active | standby} {R0}]
```

Syntax Description		
	<i>switch-number</i>	Valid values for the <i>switch-number</i> variable are from 1 to 9.
	<b>R0</b>	Displays information about the Route Processor (RP) slot 0.
	<b>active</b>	Specifies the active instance.
	<b>standby</b>	Specifies the standby instance.

Command Modes	
	Privileged EXEC (#)
	User EXEC (>)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

The following is a sample output from the **show authentication brief** command:

```
Device# show authentication brief
```

Interface	MAC Address	AuthC	AuthZ	Eg	Uptime
Gi2/0/14	0002.0002.0001	m:NA d:OK	AZ: SA-	X	281s
Gi2/0/14	0002.0002.0002	m:NA d:OK	AZ: SA-	X	280s
Gi2/0/14	0002.0002.0003	m:NA d:OK	AZ: SA-	X	279s
Gi2/0/14	0002.0002.0004	m:NA d:OK	AZ: SA-	X	278s
Gi2/0/14	0002.0002.0005	m:NA d:OK	AZ: SA-	X	278s
Gi2/0/14	0002.0002.0006	m:NA d:OK	AZ: SA-	X	277s
Gi2/0/14	0002.0002.0007	m:NA d:OK	AZ: SA-	X	276s
Gi2/0/14	0002.0002.0008	m:NA d:OK	AZ: SA-	X	276s
Gi2/0/14	0002.0002.0009	m:NA d:OK	AZ: SA-	X	275s
Gi2/0/14	0002.0002.000a	m:NA d:OK	AZ: SA-	X	275s
Gi2/0/14	0002.0002.000b	m:NA d:OK	AZ: SA-	X	274s
Gi2/0/14	0002.0002.000c	m:NA d:OK	AZ: SA-	X	274s
Gi2/0/14	0002.0002.000d	m:NA d:OK	AZ: SA-	X	273s
Gi2/0/14	0002.0002.000e	m:NA d:OK	AZ: SA-	X	273s
Gi2/0/14	0002.0002.000f	m:NA d:OK	AZ: SA-	X	272s
Gi2/0/14	0002.0002.0010	m:NA d:OK	AZ: SA-	X	272s
Gi2/0/14	0002.0002.0011	m:NA d:OK	AZ: SA-	X	271s
Gi2/0/14	0002.0002.0012	m:NA d:OK	AZ: SA-	X	271s
Gi2/0/14	0002.0002.0013	m:NA d:OK	AZ: SA-	X	270s
Gi2/0/14	0002.0002.0014	m:NA d:OK	AZ: SA-	X	270s
Gi2/0/14	0002.0002.0015	m:NA d:OK	AZ: SA-	X	269s

The following is a sample output from the **show authentication brief** command for active instances:

```
Device# show authentication brief switch active R0
```

Interface	MAC Address	AuthC	AuthZ	Fg	Uptime
Gi2/0/14	0002.0002.0001	m:NA d:OK	AZ: SA-	X	1s
Gi2/0/14	0002.0002.0002	m:NA d:OK	AZ: SA-	X	0s
Gi2/0/14	0002.0002.0003	m:NA d:OK	AZ: SA-	X	299s
Gi2/0/14	0002.0002.0004	m:NA d:OK	AZ: SA-	X	298s
Gi2/0/14	0002.0002.0005	m:NA d:OK	AZ: SA-	X	298s
Gi2/0/14	0002.0002.0006	m:NA d:OK	AZ: SA-	X	297s
Gi2/0/14	0002.0002.0007	m:NA d:OK	AZ: SA-	X	296s
Gi2/0/14	0002.0002.0008	m:NA d:OK	AZ: SA-	X	296s
Gi2/0/14	0002.0002.0009	m:NA d:OK	AZ: SA-	X	295s
Gi2/0/14	0002.0002.000a	m:NA d:OK	AZ: SA-	X	295s
Gi2/0/14	0002.0002.000b	m:NA d:OK	AZ: SA-	X	294s
Gi2/0/14	0002.0002.000c	m:NA d:OK	AZ: SA-	X	294s
Gi2/0/14	0002.0002.000d	m:NA d:OK	AZ: SA-	X	293s
Gi2/0/14	0002.0002.000e	m:NA d:OK	AZ: SA-	X	293s
Gi2/0/14	0002.0002.000f	m:NA d:OK	AZ: SA-	X	292s
Gi2/0/14	0002.0002.0010	m:NA d:OK	AZ: SA-	X	292s
Gi2/0/14	0002.0002.0011	m:NA d:OK	AZ: SA-	X	291s
Gi2/0/14	0002.0002.0012	m:NA d:OK	AZ: SA-	X	291s
Gi2/0/14	0002.0002.0013	m:NA d:OK	AZ: SA-	X	290s
Gi2/0/14	0002.0002.0014	m:NA d:OK	AZ: SA-	X	290s
Gi2/0/14	0002.0002.0015	m:NA d:OK	AZ: SA-	X	289s
Gi2/0/14	0002.0002.0016	m:NA d:OK	AZ: SA-	X	289s

The following is a sample output from the **show authentication brief** command for standby instances:

```
Device# show authentication brief switch standby R0
```

```
No sessions currently exist
```

The table below describes the significant fields shown in the displays.

**Table 165: show authentication brief Field Descriptions**

Field	Description
Interface	The type and number of the authentication interface.
MAC Address	The MAC address of the client.
AuthC	Indicates authentication status.
AuthZ	Indicates authorization status.



Field	Description
Fg	Flag indicates the current status. The valid values are: <ul style="list-style-type: none"><li>• A—Applying policy (multi-line status for details)</li><li>• D—Awaiting removal</li><li>• F—Final removal in progress</li><li>• I—Awaiting IIF ID allocation</li><li>• P—Pushed session</li><li>• R—Removing user profile (multi-line status for details)</li><li>• U—Applying user profile (multi-line status for details)</li><li>• X—Unknown blocker</li></ul>
Uptime	Indicates the duration since which the session came up

# show authentication history

To display the authenticated sessions alive on the device, use the **show authentication history** command.

**show authentication history** [**min-uptime** *seconds*]

## Syntax Description

**min-uptime** *seconds* (Optional) Displays sessions within the minimum uptime. The range is from 1 through 4294967295 seconds.

## Command Modes

User EXEC

## Command History

### Release

Cisco IOS XE Everest 16.5.1a

### Modification

This command was introduced.

## Usage Guidelines

Use the **show authentication history** command to display the authenticated sessions alive on the device.

This is an example of output from the **show authentication history** command:

```
Device# show authentication history
Interface  MAC Address      Method  Domain  Status  Uptime
Gi3/0/2    0021.d864.07c0  dot1x   DATA   Auth    38s

Session count = 1
```

## show authentication sessions

To display information about current Auth Manager sessions, use the **show authentication sessions** command.

```
show authentication sessions [database] [handle handle-id [details]] [interface type number
[details] [mac mac-address [interface type number] [method method-name [interface type number
[details] [session-id session-id [details]]]
```

### Syntax Description

<b>database</b>	(Optional) Shows only data stored in session database.
<b>handle</b> <i>handle-id</i>	(Optional) Specifies the particular handle for which Auth Manager information is to be displayed.
<b>details</b>	(Optional) Shows detailed information.
<b>interface</b> <i>type number</i>	(Optional) Specifies a particular interface type and number for which Auth Manager information is to be displayed.
<b>mac</b> <i>mac-address</i>	(Optional) Specifies the particular MAC address for which you want to display information.
<b>method</b> <i>method-name</i>	(Optional) Specifies the particular authentication method for which Auth Manager information is to be displayed. If you specify a method ( <b>dot1x</b> , <b>mab</b> , or <b>webauth</b> ), you may also specify an interface.
<b>session-id</b> <i>session-id</i>	(Optional) Specifies the particular session for which Auth Manager information is to be displayed.

### Command Modes

User EXEC

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

Use the **show authentication sessions** command to display information about all current Auth Manager sessions. To display information about specific Auth Manager sessions, use one or more of the keywords.

This table shows the possible operating states for the reported authentication sessions.

**Table 166: Authentication Method States**

State	Description
Not run	The method has not run for this session.
Running	The method is running for this session.
Failed over	The method has failed and the next method is expected to provide a result.

State	Description
Success	The method has provided a successful authentication result for the session.
Authc Failed	The method has provided a failed authentication result for the session.

This table shows the possible authentication methods.

**Table 167: Authentication Method States**

State	Description
dot1x	802.1X
mab	MAC authentication bypass
webauth	web authentication

The following example shows how to display all authentication sessions on the switch:

```
Device# show authentication sessions
Interface  MAC Address  Method  Domain  Status  Session ID
Gi1/0/48   0015.63b0.f676  dot1x   DATA   Authz Success  0A3462B1000000102983C05C
Gi1/0/5    000f.23c4.a401  mab     DATA   Authz Success  0A3462B10000000D24F80B58
Gi1/0/5    0014.bf5d.d26d  dot1x   DATA   Authz Success  0A3462B10000000E29811B94
```

The following example shows how to display all authentication sessions on an interface:

```
Device# show authentication sessions interface gigabitethernet2/0/47
      Interface: GigabitEthernet2/0/47
      MAC Address: Unknown
      IP Address: Unknown
      Status: Authz Success
      Domain: DATA
      Oper host mode: multi-host
      Oper control dir: both
      Authorized By: Guest Vlan
      Vlan Policy: 20
      Session timeout: N/A
      Idle timeout: N/A
      Common Session ID: 0A3462C80000000000002763C
      Acct Session ID: 0x00000002
      Handle: 0x25000000
Runnable methods list:
      Method  State
      mab     Failed over
      dot1x   Failed over
-----
      Interface: GigabitEthernet2/0/47
      MAC Address: 0005.5e7c.da05
      IP Address: Unknown
      User-Name: 00055e7cda05
      Status: Authz Success
      Domain: VOICE
      Oper host mode: multi-domain
```

```
Oper control dir: both
  Authorized By: Authentication Server
  Session timeout: N/A
  Idle timeout: N/A
Common Session ID: 0A3462C8000000010002A238
  Acct Session ID: 0x00000003
  Handle: 0x91000001
Runnable methods list:
  Method      State
  mab         Authc Success
  dot1x       Not run
```

# show cts interface

To display Cisco TrustSec (CTS) configuration statistics for an interface, use the **show cts interface** command in EXEC or privileged EXEC mode.

**show cts interface** [*type slot/port* | **brief** | **summary**]

Syntax Description	Parameter	Description
	<b>type</b> <i>slot/port</i>	(Optional) Specifies an interface type and slot or port number. A verbose output for this interface is returned.
	<b>brief</b>	(Optional) Displays abbreviated status for all CTS interfaces.
	<b>summary</b>	(Optional) Displays a tabular summary of all CTS interfaces with 4 or 5 key status fields for each interface.

**Command Default** None

## Command Modes

EXEC (>)  
Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was modified with additional options.
Cisco IOS XE Denali 16.2.1	This command was introduced.

## Usage Guidelines

Use the **show cts interface** command without keywords to display verbose status for all CTS interfaces.

## Examples

The following example displays output without using a keyword (verbose status for all CTS interfaces):

```
Switch# show cts interface

Global Dot1x feature is Disabled
Interface GigabitEthernet0/1/0:
  CTS is enabled, mode:    MANUAL
  IFC state:              OPEN
  Interface Active for 00:00:18.232
  Authentication Status:  NOT APPLICABLE
  Peer identity:          "unknown"
  Peer's advertised capabilities: ""
  Authorization Status:   NOT APPLICABLE
  SAP Status:             NOT APPLICABLE
  Configured pairwise ciphers:
    gcm-encrypt
    null

  Replay protection:      enabled
  Replay protection mode: STRICT

  Selected cipher:
```

```

Propagate SGT:          Enabled
Cache Info:
  Cache applied to link : NONE

Statistics:
  authc success:        0
  authc reject:         0
  authc failure:        0
  authc no response:    0
  authc logoff:         0
  sap success:          0
  sap fail:             0
  authz success:        0
  authz fail:           0
  port auth fail:      0
Ingress:
  control frame bypassed: 0
  sap frame bypassed:    0
  esp packets:           0
  unknown sa:           0
  invalid sa:           0
  inverse binding failed: 0
  auth failed:          0
  replay error:         0
Egress:
  control frame bypassed: 0
  esp packets:           0
  sgt filtered:          0
  sap frame bypassed:    0
  unknown sa dropped:    0
  unknown sa bypassed:   0

```

The following example displays output using the **brief** keyword:

```

Device# show cts interface brief

Global Dot1x feature is Disabled
Interface GigabitEthernet0/1/0:
  CTS is enabled, mode:    MANUAL
  IFC state:              OPEN
  Interface Active for 00:00:40.386
  Authentication Status:  NOT APPLICABLE
  Peer identity:          "unknown"
  Peer's advertised capabilities: ""
  Authorization Status:   NOT APPLICABLE
  SAP Status:             NOT APPLICABLE
  Propagate SGT:          Enabled
  Cache Info:
    Cache applied to link : NONE

```

Related Commands	Command	Description
	<b>cts manual</b>	Enables an interface for CTS.
	<b>propagate sgt (cts manual)</b>	Enables Security Group Tag (SGT) propagation at Layer 2 on Cisco TrustSec Security (CTS) interfaces.
	<b>sap mode-list (cts manual)</b>	Manually specifies the PMK and the SAP authentication and encryption modes to negotiate MACsec link encryption between two interfaces.

# show cts role-based permissions

To display the role-based (security group) access control permission list, use the **show cts role-based permissions** command in privileged EXEC mode.

```
show cts role-based permissions [default [details | ipv4 [details]] | from [sgt [ipv4 | to [sgt | unknown]
[details | ipv4 [details]]] | unknown] | ipv4 | to [sgt | unknown] [ipv4]]
```

## Syntax Description

<b>default</b>	(Optional) Displays information about the default permission list.
<b>details</b>	(Optional) Displays attached access control list (ACL) details.
<b>ipv4</b>	(Optional) Displays information about the IPv4 protocol.
<b>from</b>	(Optional) Displays information about the source group.
<i>sgt</i>	(Optional) Security Group Tag. Valid values are from 2 to 65519.
<b>to</b>	(Optional) Displays information about the destination group.
<b>unknown</b>	(Optional) Displays information about unknown source and destination groups.

## Command Modes

Privileged EXE (#)

## Command History

Release	Modification
Cisco IOS XE Denali 16.3.1	This command was introduced.

## Usage Guidelines

This command displays the content of the SGACL permission matrix. You can specify the source security group tag (SGT) by using the **from** keyword and the destination SGT by using the **to** keyword. When both these keywords are specified RBACLs of a single cell are displayed. An entire column is displayed when only the **to** keyword is used. An entire row is displayed when the **from** keyword is used. The entire permission matrix is displayed when both the **from** and **to** keywords are omitted.

The command output is sorted by destination SGT as a primary key and the source SGT as a secondary key. SGACLs for each cell is displayed in the same order they are defined in the configuration or acquired from Cisco Identity Services Engine (ISE).

The **details** keyword is provided when a single cell is selected by specifying both **from** and **to** keywords. When the **details** keyword is specified the access control entries of SGACLs of a single cell are displayed.

The following is sample output from the **show role-based permissions** command:

```
Switch# show cts role-based permissions

IPv4 Role-based permissions default (monitored):
default_sgacl-02
Permit IP-00
IPv4 Role-based permissions from group 305:sgt to group 306:dgt (monitored):
test_reg_tcp_permit-02
RBACL Monitor All for Dynamic Policies : TRUE
RBACL Monitor All for Configured Policies : FALSE
```



```
IPv4 Role-based permissions from group 6:SGT_6 to group 6:SGT_6 (configured):
  mon_1
IPv4 Role-based permissions from group 10 to group 11 (configured):
  mon_2
RBACL Monitor All for Dynamic Policies : FALSE
RBACL Monitor All for Configured Policies : FALSE
```

**Related Commands**

Command	Description
<b>cts role-based permissions</b>	Enables permissions from a source group to a destination group.
<b>cts role-based monitor</b>	Enables role-based access list monitoring.

# show cisp

To display CISP information for a specified interface, use the **show cisp** command in privileged EXEC mode.

**show cisp** {[**clients** | **interface** *interface-id*] | **registrations** | **summary**}

Syntax Description		
<b>clients</b>		(Optional) Display CISP client details.
<b>interface</b> <i>interface-id</i>		(Optional) Display CISP information about the specified interface. Valid interfaces include physical ports and port channels.
<b>registrations</b>		Displays CISP registrations.
<b>summary</b>		(Optional) Displays CISP summary.
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
		This command was reintroduced. This command was not supported in and

This example shows output from the **show cisp interface** command:

```
Device# show cisp interface fast 0
CISP not enabled on specified interface
```

This example shows output from the **show cisp registration** command:

```
Device# show cisp registrations
Interface(s) with CISP registered user(s):
-----
Fa1/0/13
Auth Mgr (Authenticator)
Gi2/0/1
Auth Mgr (Authenticator)
Gi2/0/2
Auth Mgr (Authenticator)
Gi2/0/3
Auth Mgr (Authenticator)
Gi2/0/5
Auth Mgr (Authenticator)
Gi2/0/9
Auth Mgr (Authenticator)
Gi2/0/11
Auth Mgr (Authenticator)
Gi2/0/13
```

```
Auth Mgr (Authenticator)
Gi3/0/3
Gi3/0/5
Gi3/0/23
```

**Related Commands**

Command	Description
<b>cisp enable</b>	Enable Client Information Signalling Protocol (CISP)
<b>dot1x credentials</b> <i>profile</i>	Configure a profile on a supplicant switch

# show dot1x

To display IEEE 802.1x statistics, administrative status, and operational status for the switch or for the specified port, use the **show dot1x** command in user EXEC mode.

**show dot1x** [**all** [**count** | **details** | **statistics** | **summary**]] [**interface type number** [**details** | **statistics**]] [**statistics**]

Syntax Description		
<b>all</b>	(Optional) Displays the IEEE 802.1x information for all interfaces.	
<b>count</b>	(Optional) Displays total number of authorized and unauthorized clients.	
<b>details</b>	(Optional) Displays the IEEE 802.1x interface details.	
<b>statistics</b>	(Optional) Displays the IEEE 802.1x statistics for all interfaces.	
<b>summary</b>	(Optional) Displays the IEEE 802.1x summary for all interfaces.	
<b>interface type number</b>	(Optional) Displays the IEEE 802.1x status for the specified port.	

**Command Modes** User EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This is an example of output from the **show dot1x all** command:

```
Device# show dot1x all
Sysauthcontrol           Enabled
Dot1x Protocol Version   3
```

This is an example of output from the **show dot1x all count** command:

```
Device# show dot1x all count
Number of Dot1x sessions
-----
Authorized Clients       = 0
UnAuthorized Clients     = 0
Total No of Client      = 0
```

This is an example of output from the **show dot1x all statistics** command:

```
Device# show dot1x statistics
Dot1x Global Statistics for
-----
RxStart = 0      RxLogoff = 0      RxResp = 0      RxRespID = 0
RxReq = 0        RxInvalid = 0    RxLenErr = 0
RxTotal = 0
```

```
TxStart = 0      TxLogoff = 0      TxResp = 0
TxReq = 0        ReTxReq = 0        ReTxReqFail = 0
TxReqID = 0      ReTxReqID = 0      ReTxReqIDFail = 0
TxTotal = 0
```

# show eap pac peer

To display stored Protected Access Credentials (PAC) for Extensible Authentication Protocol (EAP) Flexible Authentication via Secure Tunneling (FAST) peers, use the **show eap pac peer** command in privileged EXEC mode.

**show eap pac peer**

## Syntax Description

This command has no arguments or keywords.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

This is an example of output from the **show eap pac peers** privileged EXEC command:

```
Device> show eap pac peers
No PACs stored
```

## Related Commands

Command	Description
<b>clear eap sessions</b>	Clears EAP session information for the switch or for the specified port.

# show ip dhcp snooping statistics

To display DHCP snooping statistics in summary or detail form, use the **show ip dhcp snooping statistics** command in user EXEC mode.

**show ip dhcp snooping statistics** [**detail** ]

## Syntax Description

**detail** (Optional) Displays detailed statistics information.

## Command Modes

User EXEC

## Command History

### Release

Cisco IOS XE Everest 16.5.1a

### Modification

This command was introduced.

## Usage Guidelines

In a switch stack, all statistics are generated on the stack primary. If a new active switch is elected, the statistics counters reset.

This is an example of output from the **show ip dhcp snooping statistics** command:

```
Device> show ip dhcp snooping statistics

Packets Forwarded                = 0
Packets Dropped                  = 0
Packets Dropped From untrusted ports = 0
```

This is an example of output from the **show ip dhcp snooping statistics detail** command:

```
Device> show ip dhcp snooping statistics detail

Packets Processed by DHCP Snooping = 0
Packets Dropped Because
  IDB not known                    = 0
  Queue full                        = 0
  Interface is in errdisabled       = 0
  Rate limit exceeded               = 0
  Received on untrusted ports       = 0
  Nonzero giaddr                    = 0
  Source mac not equal to chaddr    = 0
  Binding mismatch                  = 0
  Insertion of opt82 fail           = 0
  Interface Down                    = 0
  Unknown output interface          = 0
  Reply output port equal to input port = 0
  Packet denied by platform         = 0
```

This table shows the DHCP snooping statistics and their descriptions:

**Table 168: DHCP Snooping Statistics**

DHCP Snooping Statistic	Description
Packets Processed by DHCP Snooping	Total number of packets handled by DHCP snooping, including forwarded and dropped packets.
Packets Dropped Because IDB not known	Number of errors when the input interface of the packet cannot be determined.
Queue full	Number of errors when an internal queue used to process the packets is full. This might happen if DHCP packets are received at an excessively high rate and rate limiting is not enabled on the ingress ports.
Interface is in errdisabled	Number of times a packet was received on a port that has been marked as error disabled. This might happen if packets are in the processing queue when a port is put into the error-disabled state and those packets are subsequently processed.
Rate limit exceeded	Number of times the rate limit configured on the port was exceeded and the interface was put into the error-disabled state.
Received on untrusted ports	Number of times a DHCP server packet (OFFER, ACK, NAK, or LEASEQUERY) was received on an untrusted port and was dropped.
Nonzero giaddr	Number of times the relay agent address field (giaddr) in the DHCP packet received on an untrusted port was not zero, or the <b>no ip dhcp snooping information option allow-untrusted</b> global configuration command is not configured and a packet received on an untrusted port contained option-82 data.
Source mac not equal to chaddr	Number of times the client MAC address field of the DHCP packet (chaddr) does not match the packet source MAC address and the <b>ip dhcp snooping verify mac-address</b> global configuration command is configured.
Binding mismatch	Number of times a RELEASE or DECLINE packet was received on a port that is different than the port in the binding for that MAC address-VLAN pair. This indicates someone might be trying to spoof the real client, or it could mean that the client has moved to another port on the switch and issued a RELEASE or DECLINE. The MAC address is taken from the chaddr field of the DHCP packet, not the source MAC address in the Ethernet header.
Insertion of opt82 fail	Number of times the option-82 insertion into a packet failed. The insertion might fail if the packet with the option-82 data exceeds the size of a single physical packet on the internet.



<b>DHCP Snooping Statistic</b>	<b>Description</b>
Interface Down	Number of times the packet is a reply to the DHCP relay agent, but the SVI interface for the relay agent is down. This is an unlikely error that occurs if the SVI goes down between sending the client request to the DHCP server and receiving the response.
Unknown output interface	Number of times the output interface for a DHCP reply packet cannot be determined by either option-82 data or a lookup in the MAC address table. The packet is dropped. This can happen if option 82 is not used and the client MAC address has aged out. If IPSG is enabled with the port-security option and option 82 is not enabled, the MAC address of the client is not learned, and the reply packets will be dropped.
Reply output port equal to input port	Number of times the output port for a DHCP reply packet is the same as the input port, causing a possible loop. Indicates a possible network misconfiguration or misuse of trust settings on ports.
Packet denied by platform	Number of times the packet has been denied by a platform-specific registry.

# show radius server-group

To display properties for the RADIUS server group, use the **show radius server-group** command.

**show radius server-group** { *name* | **all** }

<b>Syntax Description</b>	<i>name</i>	Name of the server group. The character string used to name the group of servers must be defined using the <b>aaa group server radius</b> command.
	<b>all</b>	Displays properties for all of the server groups.
<b>Command Modes</b>	User EXEC	
	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	Use the <b>show radius server-group</b> command to display the server groups that you defined by using the <b>aaa group server radius</b> command.	

This is an example of output from the **show radius server-group all** command:

```
Device# show radius server-group all
Server group radius
  Sharecount = 1  sg_unconfigured = FALSE
  Type = standard  Memlocks = 1
```

This table describes the significant fields shown in the display.

**Table 169: show radius server-group command Field Descriptions**

Field	Description
Server group	Name of the server group.
Sharecount	Number of method lists that are sharing this server group. For example, if one method list uses a particular server group, the sharecount would be 1. If two method lists use the same server group, the sharecount would be 2.
sg_unconfigured	Server group has been unconfigured.
Type	The type can be either standard or nonstandard. The type indicates whether the servers in the group accept nonstandard attributes. If all servers within the group are configured with the nonstandard option, the type will be shown as "nonstandard".

Field	Description
Memlocks	An internal reference count for the server-group structure that is in memory. The number represents how many internal data structure packets or transactions are holding references to this server group. Memlocks is used internally for memory management purposes.

# show storm-control

To display broadcast, multicast, or unicast storm control settings on the switch or on the specified interface or to display storm-control history, use the **show storm-control** command in user EXEC mode.

**show storm-control** [*interface-id*] [**broadcast** | **multicast** | **unicast**]

Syntax Description	
<i>interface-id</i>	(Optional) Interface ID for the physical port (including type, stack member for stacking-capable switches, module, and port number).
<b>broadcast</b>	(Optional) Displays broadcast storm threshold setting.
<b>multicast</b>	(Optional) Displays multicast storm threshold setting.
<b>unicast</b>	(Optional) Displays unicast storm threshold setting.

**Command Modes** User EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

When you enter an interface ID, the storm control thresholds appear for the specified interface.

If you do not enter an interface ID, settings appear for one traffic type for all ports on the switch.

If you do not enter a traffic type, settings appear for broadcast storm control.

This is an example of a partial output from the **show storm-control** command when no keywords are entered. Because no traffic-type keyword was entered, the broadcast storm control settings appear.

```
Device> show storm-control
Interface Filter State Upper Lower Current
-----
Gi1/0/1 Forwarding 20 pps 10 pps 5 pps
Gi1/0/2 Forwarding 50.00% 40.00% 0.00%
<output truncated>
```

This is an example of output from the **show storm-control** command for a specified interface. Because no traffic-type keyword was entered, the broadcast storm control settings appear.

```
Device> show storm-control gigabitethernet 1/0/1
Interface Filter State Upper Lower Current
-----
Gi1/0/1 Forwarding 20 pps 10 pps 5 pps
```

The following table describes the fields in the show storm-control display:

**Table 170: show storm-control Field Descriptions**

Field	Description
Interface	Displays the ID of the interface.

Field	Description
Filter State	Displays the status of the filter: <ul style="list-style-type: none"><li>• Blocking—Storm control is enabled, and a storm has occurred.</li><li>• Forwarding—Storm control is enabled, and no storms have occurred.</li><li>• Inactive—Storm control is disabled.</li></ul>
Upper	Displays the rising suppression level as a percentage of total available bandwidth in packets per second or in bits per second.
Lower	Displays the falling suppression level as a percentage of total available bandwidth in packets per second or in bits per second.
Current	Displays the bandwidth usage of broadcast traffic or the specified traffic type (broadcast, multicast, or unicast) as a percentage of total available bandwidth. This field is only valid when storm control is enabled.

# show vlan access-map

To display information about a particular VLAN access map or for all VLAN access maps, use the **show vlan access-map** command in privileged EXEC mode.

**show vlan access-map** [*map-name*]

<b>Syntax Description</b>	<i>map-name</i> (Optional) Name of a specific VLAN access map.	
<b>Command Default</b>	None	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This is an example of output from the **show vlan access-map** command:

```
Device# show vlan access-map
Vlan access-map "vmap4" 10
  Match clauses:
    ip address: a12
  Action:
    forward
Vlan access-map "vmap4" 20
  Match clauses:
    ip address: a12
  Action:
    forward
```

# show vlan filter

To display information about all VLAN filters or about a particular VLAN or VLAN access map, use the **show vlan filter** command in privileged EXEC mode.

```
show vlan filter access-map name | vlan vlan-id
```

<b>Syntax Description</b>	<b>access-map</b> <i>name</i> (Optional) Displays filtering information for the specified VLAN access map.	
	<b>vlan</b> <i>vlan-id</i> (Optional) Displays filtering information for the specified VLAN. The range is 1 to 4094.	
<b>Command Default</b>	None	
<b>Command Modes</b>	Privileged EXEC	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This is an example of output from the **show vlan filter** command:

```
Device# show vlan filter
VLAN Map map_1 is filtering VLANs:
 20-22
```

# show vlan group

To display the VLANs that are mapped to VLAN groups, use the **show vlan group** command in privileged EXEC mode.

```
show vlan group [group-name vlan-group-name [user_count]]
```

## Syntax Description

**group-name** *vlan-group-name* (Optional) Displays the VLANs mapped to the specified VLAN group.

**user\_count** (Optional) Displays the number of users in each VLAN mapped to a specified VLAN group.

## Command Default

None

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **show vlan group** command displays the existing VLAN groups and lists the VLANs and VLAN ranges that are members of each VLAN group. If you enter the **group-name** keyword, only the members of the specified VLAN group are displayed.

This example shows how to display the members of a specified VLAN group:



## snmp-server enable traps

To enable all Simple Network Management Protocol (SNMP) notification types that are available on your system, use the **snmp-server enable traps** command in global configuration mode. To disable all available SNMP notifications, use the **no** form of this command.

**snmp-server enable traps**  
**no snmp-server enable traps**

---

### Command Modes

Global configuration (config)

---

### Command History

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

---

### Usage Guidelines

SNMP notifications can be sent as traps or inform requests. This command enables both traps and inform requests for the specified notification types.

---

### Examples

The following example shows how to enable the device to send all traps to the host specified by the name myhost.cisco.com, using the community string defined as public:

```
Device(config)# snmp-server enable traps
```

```
Device(config)# snmp-server host myhost.cisco.com public
```

## snmp-server enable traps snmp

To enable the RFC 1157 Simple Network Management Protocol (SNMP) notifications, use the **snmp-server enable traps snmp** command in global configuration mode. To disable RFC 1157 SNMP notifications, use the **no** form of this command.

**snmp-server enable traps snmp** [authentication] [linkup] [linkdown] [coldstart] [warmstart]  
**no snmp-server enable traps snmp** [authentication] [linkup] [linkdown] [coldstart] [warmstart]

Syntax Description	
<b>authentication</b>	(Optional) Controls the sending of SNMP authentication failure notifications.
<b>linkup</b>	(Optional) Controls the sending of SNMP linkUp notifications.
<b>linkdown</b>	(Optional) Controls the sending of SNMP linkDown notifications.
<b>coldstart</b>	(Optional) Controls the sending of SNMP coldStart notifications.
<b>warmstart</b>	(Optional) Controls the sending of SNMP warmStart notifications.

**Command Default** SNMP notifications are disabled.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines** SNMP notifications can be sent as traps or inform requests. This command enables both traps and inform requests for the specified notification types.

If you do not enter an **snmp-server enable traps snmp** command, no notifications controlled by this command are sent. To configure the device to send these SNMP notifications, you must enter at least one **snmp-server enable traps snmp** command. When you enter the command with no keywords, all notification types are enabled. When you enter the command with a keyword, only the types of notifications related to that keyword are enabled.

When you use the optional **authentication** keyword, the authenticationFailure(4) trap signifies that the sending device is the addressee of a protocol message that is not properly authenticated. The authentication method depends on the version of SNMP being used. For SNMPv1 or SNMPv2c, authentication failure occurs for packets with an incorrect community string and the SNMP traps are generated. For SNMPv3, authentication failure occurs for packets with an incorrect SHA/MD5 authentication key or for a packet that is outside the authoritative SNMP engine's window (for example, packets that are configured outside access lists or time ranges) and a report PDU is generated, however authentication failure traps are not generated.

When you use the optional **linkup** keyword, the linkUp(3) trap signifies that the sending device recognizes one of the communication links represented in the agent's configuration coming up.

When you use the optional **linkdown** keyword, the linkDown(2) trap signifies that the sending device recognizes a failure in one of the communication links represented in the agent's configuration.

The **snmp-server enable traps snmp [linkup] [linkdown]** form of this command globally enables or disables SNMP linkUp and linkDown traps. After enabling either of these traps globally, you can disable them on specific interfaces using the **no snmp trap link-status** command in interface configuration mode. On the interface level, linkUp and linkDown traps are enabled by default, which means that these notifications do not have to be enabled on a per-interface basis. However, linkUp and linkDown notifications will not be sent unless you enable them globally using the **snmp-server enable traps snmp** command.

When you use the optional **coldstart** keyword, the coldStart(0) trap signifies that the sending device is reinitializing itself such that the agent's configuration or the protocol entity implementation may be altered.

When you use the optional **warmstart** keyword, the warmStart(1) trap signifies that the sending device is reinitializing itself such that neither the agent configuration nor the protocol entity implementation is altered.

The **snmp-server enable traps snmp** command is used in conjunction with the **snmp-server host** command. Use the **snmp-server host** command to specify which host or hosts receive SNMP notifications. In order to send notifications, you must configure at least one **snmp-server host** command.

For a host to receive a notification controlled by this command, you must enable both the **snmp-server enable traps** command and the **snmp-server host** command for that host. If the notification type is not controlled by this command, you must enable the appropriate **snmp-server host** command only.

## Examples

The following example shows how to enable the device to send all traps to the host myhost.cisco.com, using the community string public:

```
Device(config)# snmp-server enable traps snmp
Device(config)# snmp-server host myhost.cisco.com public snmp
```

The following example shows how to enable the device to send all inform notifications to the host myhost.cisco.com using the community string public:

```
Device(config)# snmp-server enable traps snmp
Device(config)# snmp-server host myhost.cisco.com informs version 2c public snmp
```

The following example shows how to enable all SNMP trap types, and then disable only the linkUp and linkDown traps:

```
Device> enable
Device# configure terminal
Device(config)# snmp-server enable traps snmp
Device(config)# end
Device# more system:running-config | include traps snmp
snmp-server enable traps snmp authentication linkup linkdown coldstart warmstart
Device# configure terminal
Device(config)# no snmp-server enable traps snmp linkup linkdown
Device(config)# end
Device# more system:running-config | include traps snmp
snmp-server enable traps snmp authentication coldstart warmstart
```

## Related Commands

Command	Description
<b>snmp-server enable traps</b>	Enables all available SNMP notifications on your system.
<b>snmp-server host</b>	Specifies the recipient of an SNMP notification operation.

Command	Description
<b>snmp-server informs</b>	Specifies inform request options.
<b>snmp-server trap authentication vrf</b>	Disables or reenables SNMP authentication notifications specific to VPN context mismatches.
<b>snmp-server trap-source</b>	Specifies the interface that an SNMP trap should originate from.

## snmp-server group

To configure a new Simple Network Management Protocol (SNMP) group, use the **snmp-server group** command in global configuration mode. To remove a specified SNMP group, use the **no** form of this command.

**snmp-server group** *group-name* **v1** | **v2c** | **v3** **auth** | **noauth** | **priv** [**context** *context-name*] [**match exact** | **prefix**] [**read** *read-view*] [**write** *write-view*] [**notify** *notify-view*] [**access** [**ipv6** *named-access-list*] [*acl-number* *acl-name*]]

**no snmp-server group** *group-name* **v1** | **v2c** | **v3** **auth** | **noauth** | **priv** [**context** *context-name*]

### Syntax Description

<i>group-name</i>	Name of the group.
<b>v1</b>	Specifies that the group is using the SNMPv1 security model. SNMPv1 is the least secure of the possible SNMP security models.
<b>v2c</b>	Specifies that the group is using the SNMPv2c security model. The SNMPv2c security model allows informs to be transmitted and supports 64-character strings.
<b>v3</b>	Specifies that the group is using the SNMPv3 security model. SNMPv3 is the most secure of the supported security models. It allows you to explicitly configure authentication characteristics.
<b>auth</b>	Specifies authentication of a packet without encrypting it.
<b>noauth</b>	Specifies no authentication of a packet.
<b>priv</b>	Specifies authentication of a packet with encryption.
<b>context</b>	(Optional) Specifies the SNMP context to associate with this SNMP group and its views.
<i>context-name</i>	(Optional) Context name.
<b>match</b>	(Optional) Specifies an exact context match or matches only the context prefix.
<i>exact</i>	(Optional) Matches the exact context.
<i>prefix</i>	(Optional) Matches only the context prefix.
<b>read</b>	(Optional) Specifies a read view for the SNMP group. This view enables you to view only the contents of the agent.
<i>read-view</i>	(Optional) String of a maximum of 64 characters that is the name of the view. The default is that the read-view is assumed to be every object belonging to the Internet object identifier (OID) space (1.3.6.1), unless the <b>read</b> option is used to override this state.
<b>write</b>	(Optional) Specifies a write view for the SNMP group. This view enables you to enter data and configure the contents of the agent.

<i>write-view</i>	(Optional) String of a maximum of 64 characters that is the name of the view. The default is that nothing is defined for the write view (that is, the null OID). You must configure write access.
<b>notify</b>	(Optional) Specifies a notify view for the SNMP group. This view enables you to specify a notify, inform, or trap.
<i>notify-view</i>	(Optional) String of a maximum of 64 characters that is the name of the view. By default, nothing is defined for the notify view (that is, the null OID) until the <b>snmp-server host</b> command is configured. If a view is specified in the <b>snmp-server group</b> command, any notifications in that view that are generated will be sent to all users associated with the group (provided a SNMP server host configuration exists for the user).  Cisco recommends that you let the software autogenerate the notify view. See the “Configuring Notify Views” section in this document.
<b>access</b>	(Optional) Specifies a standard access control list (ACL) to associate with the group.
<b>ipv6</b>	(Optional) Specifies an IPv6 named access list. If both IPv6 and IPv4 access lists are indicated, the IPv6 named access list must appear first in the list.
<i>named-access-list</i>	(Optional) Name of the IPv6 access list.
<i>acl-number</i>	(Optional) The <i>acl-number</i> argument is an integer from 1 to 99 that identifies a previously configured standard access list.
<i>acl-name</i>	(Optional) The <i>acl-name</i> argument is a string of a maximum of 64 characters that is the name of a previously configured standard access list.

**Command Default**

No SNMP server groups are configured.

**Command Modes**

Global configuration (config)

**Command History**

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines**

When a community string is configured internally, two groups with the name public are autogenerated, one for the v1 security model and the other for the v2c security model. Similarly, deleting a community string will delete a v1 group with the name public and a v2c group with the name public.

No default values exist for authentication or privacy algorithms when you configure the **snmp-server group** command. Also, no default passwords exist. For information about specifying a Message Digest 5 (MD5) password, see the documentation of the **snmp-server user** command.

**Configuring Notify Views**

The notify-view option is available for two reasons:

- If a group has a notify view that is set using SNMP, you may need to change the notify view.

- The **snmp-server host** command may have been configured before the **snmp-server group** command. In this case, you must either reconfigure the **snmp-server host** command, or specify the appropriate notify view.

Specifying a notify view when configuring an SNMP group is not recommended, for the following reasons:

- The **snmp-server host** command autogenerates a notify view for the user, and then adds it to the group associated with that user.
- Modifying the group's notify view will affect all users associated with that group.

Instead of specifying the notify view for a group as part of the **snmp-server group** command, use the following commands in the order specified:

1. **snmp-server user**—Configures an SNMP user.
2. **snmp-server group**—Configures an SNMP group, without adding a notify view .
3. **snmp-server host**—Autogenerates the notify view by specifying the recipient of a trap operation.

### SNMP Contexts

SNMP contexts provide VPN users with a secure way of accessing MIB data. When a VPN is associated with a context, that VPN's specific MIB data exists in that context. Associating a VPN with a context enables service providers to manage networks with multiple VPNs. Creating and associating a context with a VPN enables a provider to prevent the users of one VPN from accessing information about users of other VPNs on the same networking device.

Use this command with the **context** *context-name* keyword and argument to associate a read, write, or notify SNMP view with an SNMP context.

### Create an SNMP Group

The following example shows how to create the SNMP server group “public,” allowing read-only access for all objects to members of the standard named access list “lmnop”:

```
Device(config)# snmp-server group public v2c access lmnop
```

### Remove an SNMP Server Group

The following example shows how to remove the SNMP server group “public” from the configuration:

```
Device(config)# no snmp-server group public v2c
```

### Associate an SNMP Server Group with Specified Views

The following example shows SNMP context “A” associated with the views in SNMPv2c group “GROUP1”:

```
Device(config)# snmp-server context A
Device(config)# snmp mib community commA
```

```
Device(config)# snmp mib community-map commA context A target-list commAVpn
Device(config)# snmp-server group GROUP1 v2c context A read viewA write viewA notify viewB
```

**Related Commands**

Command	Description
<b>show snmp group</b>	Displays the names of groups on the device and the security model, the status of the different views, and the storage type of each group.
<b>snmp mib community-map</b>	Associates a SNMP community with an SNMP context, engine ID, security name, or VPN target list.
<b>snmp-server host</b>	Specifies the recipient of a SNMP notification operation.
<b>snmp-server user</b>	Configures a new user to a SNMP group.



## snmp-server host

To specify the recipient of a Simple Network Management Protocol (SNMP) notification operation, use the **snmp-server host** command in global configuration mode. To remove the specified host from the configuration, use the **no** form of this command.

```
snmp-server host ip-address [vrf vrf-name | informs | traps | version 1 | 2c | 3 [auth | noauth | priv]]
community-string [udp-port port [notification-type] notification-type]
no snmp-server host hostnameip-address [vrf vrf-name | informs | traps | version 1 | 2c | 3 [auth |
noauth | priv]] community-string [udp-port port [notification-type] notification-type]
```

### Syntax Description

<i>ip-address</i>	IPv4 address or IPv6 address of the SNMP notification host.
<b>vrf</b>	(Optional) Specifies that a VPN routing and forwarding (VRF) instance should be used to send SNMP notifications.
<i>vrf-name</i>	(Optional) VPN VRF instance used to send SNMP notifications.
<b>informs</b>	(Optional) Specifies that notifications should be sent as informs.
<b>traps</b>	(Optional) Specifies that notifications should be sent as traps. This is the default.
<b>version</b>	<p>(Optional) Specifies the version of the SNMP that is used to send the traps or informs. The default is 1.</p> <p>If you use the <b>version</b> keyword, one of the following keywords must be specified:</p> <ul style="list-style-type: none"> <li>• <b>1</b>—SNMPv1.</li> <li>• <b>2c</b>—SNMPv2C.</li> <li>• <b>3</b>—SNMPv3. The most secure model because it allows packet encryption with the <b>priv</b> keyword. The default is <b>noauth</b>.</li> </ul> <p>One of the following three optional security level keywords can follow the <b>3</b> keyword:</p> <ul style="list-style-type: none"> <li>• <b>auth</b>—Enables message digest algorithm 5 (MD5) and Secure Hash Algorithm (SHA) packet authentication.</li> <li>• <b>noauth</b>—Specifies that the noAuthNoPriv security level applies to this host. This is the default security level for SNMPv3.</li> <li>• <b>priv</b>—Enables Data Encryption Standard (DES) packet encryption (also called “privacy”).</li> </ul>
<i>community-string</i>	<p>Password-like community string sent with the notification operation.</p> <p><b>Note</b> You can set this string using the <b>snmp-server host</b> command by itself, but Cisco recommends that you define the string using the <b>snmp-server community</b> command prior to using the <b>snmp-server host</b> command.</p> <p><b>Note</b> The “at” sign (@) is used for delimiting the context information.</p>

<b>udp-port</b>	(Optional) Specifies that SNMP traps or informs are to be sent to a network management system (NMS) host.
<i>port</i>	(Optional) User Datagram Protocol (UDP) port number of the NMS host. The default is 162.
<i>notification-type</i>	(Optional) Type of notification to be sent to the host. If no type is specified, all available notifications are sent. See the “Usage Guidelines” section for more information about the keywords available.

**Command Default**

This command behavior is disabled by default. A recipient is not specified to receive notifications.

**Command Modes**

Global configuration (config)

**Command History**

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines**

If you enter this command with no optional keywords, the default is to send all notification-type traps to the host. No informs will be sent to the host.

The **no snmp-server host** command with no keywords disables traps, but not informs, to the host. To disable informs, use the **no snmp-server host informs** command.

**Note**

If a community string is not defined using the **snmp-server community** command prior to using this command, the default form of the **snmp-server community** command will automatically be inserted into the configuration. The password (community string) used for this automatic configuration of the **snmp-server community** command will be the same as that specified in the **snmp-server host** command. This automatic command insertion and use of passwords is the default behavior for Cisco IOS Release 12.0(3) and later releases. However, in Cisco IOS Release 12.2(33)SRE and later releases, you must manually configure the **snmp-server community** command. That is, the **snmp-server community** command will not be seen in the configuration.

SNMP notifications can be sent as traps or inform requests. Traps are unreliable because the receiver does not send acknowledgments when it receives traps. The sender cannot determine if the traps were received. However, an SNMP entity that receives an inform request acknowledges the message with an SNMP response protocol data unit (PDU). If the sender never receives the response, the inform request can be sent again. Thus, informs are more likely to reach their intended destination than traps.

Compared to traps, informs consume more resources in the agent and in the network. Unlike a trap, which is discarded as soon as it is sent, an inform request must be held in memory until a response is received or the request times out. Also, traps are sent only once; an inform may be tried several times. The retries increase traffic and contribute to a higher overhead on the network.

If you do not enter an **snmp-server host** command, no notifications are sent. To configure the device to send SNMP notifications, you must enter at least one **snmp-server host** command. If you enter the command with no optional keywords, all trap types are enabled for the host.

To enable multiple hosts, you must issue a separate **snmp-server host** command for each host. You can specify multiple notification types in the command for each host.

When multiple **snmp-server host** commands are given for the same host and kind of notification (trap or inform), each succeeding command overwrites the previous command. Only the last **snmp-server host** command will be in effect. For example, if you enter an **snmp-server host inform** command for a host and then enter another **snmp-server host inform** command for the same host, the second command will replace the first.

The **snmp-server host** command is used in conjunction with the **snmp-server enable** command. Use the **snmp-server enable** command to specify which SNMP notifications are sent globally. For a host to receive most notifications, at least one **snmp-server enable** command and the **snmp-server host** command for that host must be enabled.

Some notification types cannot be controlled with the **snmp-server enable** command. Some notification types are always enabled, and others are enabled by a different command. For example, the **linkUpDown** notifications are controlled by the **snmp trap link-status** command. These notification types do not require an **snmp-server enable** command.

The availability of notification-type options depends on the device type and the Cisco IOS software features supported on the device. For example, the **envmon** notification type is available only if the environmental monitor is part of the system. To see what notification types are available on your system, use the command **help ?** at the end of the **snmp-server host** command.

The **vrf** keyword allows you to specify the notifications being sent to a specified IP address over a specific VRF VPN. The VRF defines a VPN membership of a user so that data is stored using the VPN.

In the case of the NMS sending the query having a correct SNMP community but not having a read or a write view, the SNMP agent returns the following error values:

- For a get or a getnext query, returns **GEN\_ERROR** for SNMPv1 and **AUTHORIZATION\_ERROR** for SNMPv2C.
- For a set query, returns **NO\_ACCESS\_ERROR**.

### Notification-Type Keywords

The notification type can be one or more of the following keywords.



**Note** The available notification types differ based on the platform and Cisco IOS release. For a complete list of available notification types, use the question mark (?) online help function.

- **aaa server**—Sends SNMP authentication, authorization, and accounting (AAA) traps.
- **adsl**—Sends Asymmetric Digital Subscriber Line (ADSL) LINE-MIB traps.
- **atm**—Sends ATM notifications.
- **authenticate-fail**—Sends an SNMP 802.11 Authentication Fail trap.
- **auth-framework**—Sends SNMP CISCO-AUTH-FRAMEWORK-MIB notifications.
- **bgp**—Sends Border Gateway Protocol (BGP) state change notifications.
- **bridge**—Sends SNMP STP Bridge MIB notifications.

- **bstun**—Sends Block Serial Tunneling (BSTUN) event notifications.
- **bulkstat**—Sends Data-Collection-MIB notifications.
- **c6kxbar**—Sends SNMP crossbar notifications.
- **callhome**—Sends Call Home MIB notifications.
- **calltracker**—Sends Call Tracker call-start/call-end notifications.
- **casa**—Sends Cisco Appliances Services Architecture (CASA) event notifications.
- **ccme**—Sends SNMP Cisco netManager Event (CCME) traps.
- **cef**—Sends notifications related to Cisco Express Forwarding.
- **chassis**—Sends SNMP chassis notifications.
- **cnpd**—Sends Cisco Network-based Application Recognition (NBAR) Protocol Discovery (CNPD) traps.
- **config**—Sends configuration change notifications.
- **config-copy**—Sends SNMP config-copy notifications.
- **config-ctid**—Sends SNMP config-ctid notifications.
- **cpu**—Sends CPU-related notifications.
- **csg**—Sends SNMP Content Services Gateway (CSG) notifications.
- **deauthenticate**—Sends an SNMP 802.11 Deauthentication trap.
- **dhcp-snooping**—Sends DHCP snooping MIB notifications.
- **director**—Sends notifications related to DistributedDirector.
- **disassociate**—Sends an SNMP 802.11 Disassociation trap.
- **dls**—Sends data-link switching (DLSW) notifications.
- **dnis**—Sends SNMP Dialed Number Identification Service (DNIS) traps.
- **dot1x**—Sends 802.1X notifications.
- **dot11-mibs**—Sends dot11 traps.
- **dot11-qos**—Sends SNMP 802.11 QoS Change trap.
- **ds1**—Sends SNMP digital signaling 1 (DS1) notifications.
- **ds1-loopback**—Sends ds1-loopback traps.
- **dspu**—Sends downstream physical unit (DSPU) notifications.
- **eigrp**—Sends Enhanced Interior Gateway Routing Protocol (EIGRP) stuck-in-active (SIA) and neighbor authentication failure notifications.
- **energywise**—Sends SNMP energywise notifications.
- **entity**—Sends Entity MIB modification notifications.
- **entity-diag**—Sends SNMP entity diagnostic MIB notifications.

- **envmon**—Sends Cisco enterprise-specific environmental monitor notifications when an environmental threshold is exceeded.
- **errdisable**—Sends error disable notifications.
- **ethernet-cfm**—Sends SNMP Ethernet Connectivity Fault Management (CFM) notifications.
- **event-manager**—Sends SNMP Embedded Event Manager notifications.
- **firewall**—Sends SNMP Firewall traps.
- **flash**—Sends flash media insertion and removal notifications.
- **flexlinks**—Sends FLEX links notifications.
- **flowmon**—Sends flow monitoring notifications.
- **frame-relay**—Sends Frame Relay notifications.
- **fru-ctrl**—Sends entity field-replaceable unit (FRU) control notifications.
- **hsrp**—Sends Hot Standby Routing Protocol (HSRP) notifications.
- **icsudsu**—Sends SNMP ICSUDSU traps.
- **iplocalpool**—Sends IP local pool notifications.
- **ipmobile**—Sends Mobile IP notifications.
- **ipmulticast**—Sends IP multicast notifications.
- **ipsec**—Sends IP Security (IPsec) notifications.
- **isakmp**—Sends SNMP ISAKMP notifications.
- **isdn**—Sends ISDN notifications.
- **l2tc**—Sends SNMP L2 tunnel configuration notifications.
- **l2tun-pseudowire-status**—Sends pseudowire state change notifications.
- **l2tun-session**—Sends Layer 2 tunneling session notifications.
- **license**—Sends licensing notifications as traps or informs.
- **llc2**—Sends Logical Link Control, type 2 (LLC2) notifications.
- **mac-notification**—Sends SNMP MAC notifications.
- **memory**—Sends memory pool and memory buffer pool notifications.
- **module**—Sends SNMP module notifications.
- **module-auto-shutdown**—Sends SNMP module autosutdown MIB notifications.
- **mpls-fast-reroute**—Sends SNMP Multiprotocol Label Switching (MPLS) traffic engineering fast reroute notifications.
- **mpls-ldp**—Sends MPLS Label Distribution Protocol (LDP) notifications indicating status changes in LDP sessions.

- **mpls-traffic-eng**—Sends MPLS traffic engineering notifications, indicating changes in the status of MPLS traffic engineering tunnels.
- **mpls-vpn**—Sends MPLS VPN notifications.
- **msdp**—Sends SNMP Multicast Source Discovery Protocol (MSDP) notifications.
- **mvpn**—Sends multicast VPN notifications.
- **nhrp**—Sends Next Hop Resolution Protocol (NHRP) notifications.
- **ospf**—Sends Open Shortest Path First (OSPF) sham-link notifications.
- **pim**—Sends Protocol Independent Multicast (PIM) notifications.
- **port-security**—Sends SNMP port-security notifications.
- **power-ethernet**—Sends SNMP power Ethernet notifications.
- **public storm-control**—Sends SNMP public storm-control notifications.
- **pw-vc**—Sends SNMP pseudowire virtual circuit (VC) notifications.
- **p2mp-traffic-eng**—Sends SNMP MPLS Point to Multi-Point MPLS-TE notifications.
- **repeater**—Sends standard repeater (hub) notifications.
- **resource-policy**—Sends CISCO-ERM-MIB notifications.
- **rf**—Sends SNMP RF MIB notifications.
- **rogue-ap**—Sends an SNMP 802.11 Rogue AP trap.
- **rsrb**—Sends remote source-route bridging (RSRB) notifications.
- **rsvp**—Sends Resource Reservation Protocol (RSVP) notifications.
- **rtr**—Sends Response Time Reporter (RTR) notifications.
- **sdlc**—Sends Synchronous Data Link Control (SDLC) notifications.
- **sdllc**—Sends SDLC Logical Link Control (SDLLC) notifications.
- **slb**—Sends SNMP server load balancer (SLB) notifications.
- **snmp**—Sends any enabled RFC 1157 SNMP linkUp, linkDown, authenticationFailure, warmStart, and coldStart notifications.



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**Note** To enable RFC-2233-compliant link up/down notifications, you should use the **snmp server link trap** command.

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- **sonet**—Sends SNMP SONET notifications.
- **srp**—Sends Spatial Reuse Protocol (SRP) notifications.
- **stp**—Sends SNMP STP MIB notifications.
- **srst**—Sends SNMP Survivable Remote Site Telephony (SRST) traps.

- **stun**—Sends serial tunnel (STUN) notifications.
- **switch-over**—Sends an SNMP 802.11 Standby Switchover trap.
- **syslog**—Sends error message notifications (Cisco Syslog MIB). Use the **logging history level** command to specify the level of messages to be sent.
- **syslog**—Sends error message notifications (Cisco Syslog MIB). Use the **logging history level** command to specify the level of messages to be sent.
- **tty**—Sends Cisco enterprise-specific notifications when a TCP connection closes.
- **udp-port**—Sends the notification host's UDP port number.
- **vlan-mac-limit**—Sends SNMP L2 control VLAN MAC limit notifications.
- **vlancreate**—Sends SNMP VLAN created notifications.
- **vlandelete**—Sends SNMP VLAN deleted notifications.
- **voice**—Sends SNMP voice traps.
- **vrrp**—Sends Virtual Router Redundancy Protocol (VRRP) notifications.
- **vsimaster**—Sends Virtual Switch Interface (VSI) Master notifications.
- **vswitch**—Sends SNMP virtual switch notifications.
- **vtp**—Sends SNMP VLAN Trunking Protocol (VTP) notifications.
- **wlan-wep**—Sends an SNMP 802.11 Wireless LAN (WLAN) Wired Equivalent Privacy (WEP) trap.
- **x25**—Sends X.25 event notifications.
- **xgcp**—Sends External Media Gateway Control Protocol (XGCP) traps.

### SNMP-Related Notification-Type Keywords

The *notification-type* argument used in the **snmp-server host** command do not always match the keywords used in the corresponding **snmp-server enable traps** command. For example, the *notification-type* argument applicable to Multiprotocol Label Switching Protocol (MPLS) traffic engineering tunnels is specified as **mpls-traffic-eng** (containing two hyphens and no embedded spaces). The corresponding parameter in the **snmp-server enable traps** command is specified as **mpls traffic-eng** (containing an embedded space and a hyphen).

This syntax difference is necessary to ensure that the CLI interprets the *notification-type* keyword of the **snmp-server host** command as a unified, single-word construct, which preserves the capability of the **snmp-server host** command to accept multiple *notification-type* keywords in the command line. The **snmp-server enable traps** commands, however, often use two-word constructs to provide hierarchical configuration options and to maintain consistency with the command syntax of related commands. The table below maps some examples of **snmp-server enable traps** commands to the keywords used in the **snmp-server host** command.

**Table 171: snmp-server enable traps Commands and Corresponding Notification Keywords**

<b>snmp-server enable traps Command</b>	<b>snmp-server host Command Keyword</b>
<b>snmp-server enable traps l2tun session</b>	<b>l2tun-session</b>

snmp-server enable traps Command	snmp-server host Command Keyword
snmp-server enable traps mpls ldp	mpls-ldp
snmp-server enable traps mpls traffic-eng <sup>9</sup>	mpls-traffic-eng
snmp-server enable traps mpls vpn	mpls-vpn
snmp-server host <i>host-address community-string udp-port port</i> p2mp-traffic-eng	snmp-server enable traps mpls p2mp-traffic-eng [down   up]

<sup>9</sup> See the *Cisco IOS Multiprotocol Label Switching Command Reference* for documentation of this command.

## Examples

If you want to configure a unique SNMP community string for traps but prevent SNMP polling access with this string, the configuration should include an access list. The following example shows how to name a community string comaccess and number an access list 10:

```
Device(config)# snmp-server community comaccess ro 10
Device(config)# snmp-server host 10.0.0.0 comaccess
Device(config)# access-list 10 deny any
```



### Note

The “at” sign (@) is used as a delimiter between the community string and the context in which it is used. For example, specific VLAN information in BRIDGE-MIB may be polled using *community @VLAN-ID* (for example, public@100), where 100 is the VLAN number.

The following example shows how to send RFC 1157 SNMP traps to a specified host named myhost.cisco.com. Other traps are enabled, but only SNMP traps are sent because only **snmp** is specified in the **snmp-server host** command. The community string is defined as comaccess.

```
Device(config)# snmp-server enable traps
Device(config)# snmp-server host myhost.cisco.com comaccess snmp
```

The following example shows how to send the SNMP and Cisco environmental monitor enterprise-specific traps to address 10.0.0.0 using the community string public:

```
Device(config)# snmp-server enable traps snmp
Device(config)# snmp-server enable traps envmon
Device(config)# snmp-server host 10.0.0.0 public snmp envmon
```

The following example shows how to enable the device to send all traps to the host myhost.cisco.com using the community string public:

```
Device(config)# snmp-server enable traps
Device(config)# snmp-server host myhost.cisco.com public
```

The following example will not send traps to any host. The BGP traps are enabled for all hosts, but only the ISDN traps are enabled to be sent to a host. The community string is defined as public.



```
Device(config)# snmp-server enable traps bgp
Device(config)# snmp-server host myhost.cisco.com public isdn
```

The following example shows how to enable the device to send all inform requests to the host myhost.cisco.com using the community string public:

```
Device(config)# snmp-server enable traps
Device(config)# snmp-server host myhost.cisco.com informs version 2c public
```

The following example shows how to send HSRP MIB informs to the host specified by the name myhost.cisco.com. The community string is defined as public.

```
Device(config)# snmp-server enable traps hsrp
Device(config)# snmp-server host myhost.cisco.com informs version 2c public hsrp
```

The following example shows how to send all SNMP notifications to example.com over the VRF named trap-vrf using the community string public:

```
Device(config)# snmp-server host example.com vrf trap-vrf public
```

The following example shows how to configure an IPv6 SNMP notification server with the IPv6 address 2001:0DB8:0000:ABCD:1 using the community string public:

```
Device(config)# snmp-server host 2001:0DB8:0000:ABCD:1 version 2c public udp-port 2012
```

The following example shows how to specify VRRP as the protocol using the community string public:

```
Device(config)# snmp-server enable traps vrrp
Device(config)# snmp-server host myhost.cisco.com traps version 2c public vrrp
```

The following example shows how to send all Cisco Express Forwarding informs to the notification receiver with the IP address 10.0.1.1 using the community string public:

```
Device(config)# snmp-server enable traps cef
Device(config)# snmp-server host 10.0.1.1 informs version 2c public cef
```

The following example shows how to enable all NHRP traps, and how to send all NHRP traps to the notification receiver with the IP address 10.0.0.0 using the community string public:

```
Device(config)# snmp-server enable traps nhrp
Device(config)# snmp-server host 10.0.0.0 traps version 2c public nhrp
```

The following example shows how to enable all P2MP MPLS-TE SNMP traps, and send them to the notification receiver with the IP address 172.20.2.160 using the community string "comp2mppublic":

```
Device(config)# snmp-server enable traps mpls p2mp-traffic-eng
```

```
Device(config)# snmp-server host 172.20.2.160 comp2mppublic udp-port 162 p2mp-traffic-eng
```

### Related Commands

Command	Description
<b>show snmp host</b>	Displays recipient details configured for SNMP notifications.
<b>snmp-server enable peer-trap poor qov</b>	Enables poor quality of voice notifications for applicable calls associated with a specific voice dial peer.
<b>snmp-server enable traps</b>	Enables SNMP notifications (traps and informs).
<b>snmp-server enable traps nhrp</b>	Enables SNMP notifications (traps) for NHRP.
<b>snmp-server informs</b>	Specifies inform request options.
<b>snmp-server link trap</b>	Enables linkUp/linkDown SNMP traps that are compliant with RFC 2233.
<b>snmp-server trap-source</b>	Specifies the interface from which an SNMP trap should originate.
<b>snmp-server trap-timeout</b>	Defines how often to try resending trap messages on the retransmission queue.
<b>test snmp trap storm-control event-rev1</b>	Tests SNMP storm-control traps.

## snmp-server user

To configure a new user to a Simple Network Management Protocol (SNMP) group, use the **snmp-server user** command in global configuration mode. To remove a user from an SNMP group, use the **no** form of this command.

```
snmp-server user username group-name [remote host [udp-port port] [vrf vrf-name]] v1 | v2c | v3 [encrypted] [auth md5 | sha auth-password] [access [ipv6 nacl] [priv des | 3des | aes 128 | 192 | 256 privpassword] acl-numberacl-name]
```

```
no snmp-server user username group-name [remote host [udp-port port] [vrf vrf-name]] v1 | v2c | v3 [encrypted] [auth md5 | sha auth-password] [access [ipv6 nacl] [priv des | 3des | aes 128 | 192 | 256 privpassword] acl-numberacl-name]
```

### Syntax Description

<i>username</i>	Name of the user on the host that connects to the agent.
<i>group-name</i>	Name of the group to which the user belongs.
<b>remote</b>	(Optional) Specifies a remote SNMP entity to which the user belongs, and the hostname or IPv6 address or IPv4 IP address of that entity. If both an IPv6 address and IPv4 IP address are being specified, the IPv6 host must be listed first.
<i>host</i>	(Optional) Name or IP address of the remote SNMP host.
<b>udp-port</b>	(Optional) Specifies the User Datagram Protocol (UDP) port number of the remote host.
<i>port</i>	(Optional) Integer value that identifies the UDP port. The default is 162.
<b>vrf</b>	(Optional) Specifies an instance of a routing table.
<i>vrf-name</i>	(Optional) Name of the Virtual Private Network (VPN) routing and forwarding (VRF) table to use for storing data.
<b>v1</b>	Specifies that SNMPv1 should be used.
<b>v2c</b>	Specifies that SNMPv2c should be used.
<b>v3</b>	Specifies that the SNMPv3 security model should be used. Allows the use of the <b>encrypted</b> keyword or <b>auth</b> keyword or both.
<b>encrypted</b>	(Optional) Specifies whether the password appears in encrypted format.
<b>auth</b>	(Optional) Specifies which authentication level should be used.
<b>md5</b>	(Optional) Specifies the HMAC-MD5-96 authentication level.
<b>sha</b>	(Optional) Specifies the HMAC-SHA-96 authentication level.
<i>auth-password</i>	(Optional) String (not to exceed 64 characters) that enables the agent to receive packets from the host.
<b>access</b>	(Optional) Specifies an Access Control List (ACL) to be associated with this SNMP user.
<b>ipv6</b>	(Optional) Specifies an IPv6 named access list to be associated with this SNMP user.

<i>nacl</i>	(Optional) Name of the ACL. IPv4, IPv6, or both IPv4 and IPv6 access lists may be specified. If both are specified, the IPv6 named access list must appear first in the statement.
<b>priv</b>	(Optional) Specifies the use of the User-based Security Model (USM) for SNMP version 3 for SNMP message level security.
<b>des</b>	(Optional) Specifies the use of the 56-bit Digital Encryption Standard (DES) algorithm for encryption.
<b>3des</b>	(Optional) Specifies the use of the 168-bit 3DES algorithm for encryption.
<b>aes</b>	(Optional) Specifies the use of the Advanced Encryption Standard (AES) algorithm for encryption.
<b>128</b>	(Optional) Specifies the use of a 128-bit AES algorithm for encryption.
<b>192</b>	(Optional) Specifies the use of a 192-bit AES algorithm for encryption.
<b>256</b>	(Optional) Specifies the use of a 256-bit AES algorithm for encryption.
<i>privpassword</i>	(Optional) String (not to exceed 64 characters) that specifies the privacy user password.
<i>acl-number</i>	(Optional) Integer in the range from 1 to 99 that specifies a standard access list of IP addresses.
<i>acl-name</i>	(Optional) String (not to exceed 64 characters) that is the name of a standard access list of IP addresses.

**Command Default**

See the table in the “Usage Guidelines” section for default behaviors for encryption, passwords, and access lists.

**Command Modes**

Global configuration (config)

**Command History**

Release	Modification
Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines**

To configure a remote user, specify the IP address or port number for the remote SNMP agent of the device where the user resides. Also, before you configure remote users for a particular agent, configure the SNMP engine ID, using the **snmp-server engineID** command with the **remote** keyword. The remote agent’s SNMP engine ID is needed when computing the authentication and privacy digests from the password. If the remote engine ID is not configured first, the configuration command will fail.

For the *privpassword* and *auth-password* arguments, the minimum length is one character; the recommended length is at least eight characters, and should include both letters and numbers. The recommended maximum length is 64 characters.

The table below describes the default user characteristics for encryption, passwords, and access lists.

Table 172: snmp-server user Default Descriptions

Characteristic	Default
Access lists	Access from all IP access lists is permitted.
Encryption	Not present by default. The <b>encrypted</b> keyword is used to specify that the passwords are message digest algorithm 5 (MD5) digests and not text passwords.
Passwords	Assumed to be text strings.
Remote users	All users are assumed to be local to this SNMP engine unless you specify they are remote with the <b>remote</b> keyword.

SNMP passwords are localized using the SNMP engine ID of the authoritative SNMP engine. For informs, the authoritative SNMP agent is the remote agent. You need to configure the remote agent's SNMP engine ID in the SNMP database before you can send proxy requests or informs to it.



**Note** Changing the engine ID after configuring the SNMP user, does not allow to remove the user. To remove the user, you need to first reconfigure the SNMP user.

### Working with Passwords and Digests

No default values exist for authentication or privacy algorithms when you configure the command. Also, no default passwords exist. The minimum length for a password is one character, although Cisco recommends using at least eight characters for security. The recommended maximum length of a password is 64 characters. If you forget a password, you cannot recover it and will need to reconfigure the user. You can specify either a plain-text password or a localized MD5 digest.

If you have the localized MD5 or Secure Hash Algorithm (SHA) digest, you can specify that string instead of the plain-text password. The digest should be formatted as aa:bb:cc:dd where aa, bb, and cc are hexadecimal values. Also, the digest should be exactly 16 octets long.

### Examples

The following example shows how to add the user abcd to the SNMP server group named public. In this example, no access list is specified for the user, so the standard named access list applied to the group applies to the user.

```
Device(config)# snmp-server user abcd public v2c
```

The following example shows how to add the user abcd to the SNMP server group named public. In this example, access rules from the standard named access list qrst apply to the user.

```
Device(config)# snmp-server user abcd public v2c access qrst
```

In the following example, the plain-text password cisco123 is configured for the user abcd in the SNMP server group named public:

```
Device(config)# snmp-server user abcd public v3 auth md5 cisco123
```

When you enter a **show running-config** command, a line for this user will be displayed. To learn if this user has been added to the configuration, use the `show snmp user` command.



**Note** The **show running-config** command does not display any of the active SNMP users created in `authPriv` or `authNoPriv` mode, though it does display the users created in `noAuthNoPriv` mode. To display any active SNMPv3 users created in `authPriv`, `authNoPriv`, or `noAuthNoPriv` mode, use the **show snmp user** command.

If you have the localized MD5 or SHA digest, you can specify that string instead of the plain-text password. The digest should be formatted as `aa:bb:cc:dd` where `aa`, `bb`, and `cc` are hexadecimal values. Also, the digest should be exactly 16 octets long.

In the following example, the MD5 digest string is used instead of the plain-text password:

```
Device(config)# snmp-server user abcd public v3 encrypted auth md5
00:11:22:33:44:55:66:77:88:99:AA:BB:CC:DD:EE:FF
```

In the following example, the user `abcd` is removed from the SNMP server group named `public`:

```
Device(config)# no snmp-server user abcd public v2c
```

In the following example, the user `abcd` from the SNMP server group named `public` specifies the use of the 168-bit 3DES algorithm for privacy encryption with `secure3des` as the password.

```
Device(config)# snmp-server user abcd public priv v2c 3des secure3des
```

#### Related Commands

Command	Description
<b>show running-config</b>	Displays the contents of the currently running configuration file or the configuration for a specific interface, or map class information.
<b>show snmp user</b>	Displays information on each SNMP username in the group username table.
<b>snmp-server engineID</b>	Displays the identification of the local SNMP engine and all remote engines that have been configured on the device.

## snmp-server view

To create or update a view entry, use the **snmp-server view** command in global configuration mode. To remove the specified Simple Network Management Protocol (SNMP) server view entry, use the **no** form of this command.

**snmp-server view** *view-name oid-tree* **included** | **excluded**  
**no snmp-server view** *view-name*

Syntax Description	
<i>view-name</i>	Label for the view record that you are updating or creating. The name is used to reference the record.
<i>oid-tree</i>	Object identifier of the ASN.1 subtree to be included or excluded from the view. To identify the subtree, specify a text string consisting of numbers, such as 1.3.6.2.4, or a word, such as system. Replace a single subidentifier with the asterisk (*) wildcard to specify a subtree family; for example 1.3.*.4.
<b>included</b>	Configures the OID (and subtree OIDs) specified in <i>oid-tree</i> argument to be included in the SNMP view.
<b>excluded</b>	Configures the OID (and subtree OIDs) specified in <i>oid-tree</i> argument to be explicitly excluded from the SNMP view.

**Command Default** No view entry exists.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Fuji 16.8.1a	This command was introduced.

**Usage Guidelines** Other SNMP commands require an SMP view as an argument. You use this command to create a view to be used as arguments for other commands.

Two standard predefined views can be used when a view is required, instead of defining a view. One is *everything*, which indicates that the user can see all objects. The other is *restricted*, which indicates that the user can see three groups: system, snmpStats, and snmpParties. The predefined views are described in RFC 1447.

The first **snmp-server** command that you enter enables SNMP on your routing device.

### Examples

The following example creates a view that includes all objects in the MIB-II subtree:

```
snmp-server view mib2 mib-2 included
```

The following example creates a view that includes all objects in the MIB-II system group and all objects in the Cisco enterprise MIB:

```
snmp-server view root_view system included
snmp-server view root_view cisco included
```

The following example creates a view that includes all objects in the MIB-II system group except for sysServices (System 7) and all objects for interface 1 in the MIB-II interfaces group:

```
snmp-server view agon system included
snmp-server view agon system.7 excluded
snmp-server view agon ifEntry.*.1 included
```

In the following example, the USM, VACM, and Community MIBs are explicitly included in the view “test” with all other MIBs under the root parent “internet”:

```
! -- include all MIBs under the parent tree "internet"
snmp-server view test internet included
! -- include snmpUsmMIB
snmp-server view test 1.3.6.1.6.3.15 included
! -- include snmpVacmMIB
snmp-server view test 1.3.6.1.6.3.16 included
! -- exclude snmpCommunityMIB
snmp-server view test 1.3.6.1.6.3.18 excluded
```

#### Related Commands

Command	Description
<b>snmp-server community</b>	Sets up the community access string to permit access to the SNMP protocol.
<b>snmp-server manager</b>	Starts the SNMP manager process.



# storm-control

To enable broadcast, multicast, or unicast storm control and to set threshold levels on an interface, use the **storm-control** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

**storm-control action shutdown | trap | broadcast | multicast | unicast level level [level-low] | bps bps [bps-low] | pps pps [pps-low]**  
**no storm-control action shutdown | trap | broadcast | multicast | unicast level**

## Syntax Description

<b>action</b>	Specifies the action taken when a storm occurs on a port. The default action is to filter traffic and to not send an Simple Network Management Protocol (SNMP) trap.
<b>shutdown</b>	Disables the port during a storm.
<b>trap</b>	Sends an SNMP trap when a storm occurs.
<b>broadcast</b>	Enables broadcast storm control on the interface.
<b>multicast</b>	Enables multicast storm control on the interface.
<b>unicast</b>	Enables unicast storm control on the interface.
<b>level</b>	Specifies the rising and falling suppression levels as a percentage of total bandwidth of the port.
<i>level</i>	Rising suppression level, up to two decimal places. The range is 0.00 to 100.00. Block the flooding of storm packets when the value specified for level is reached.
<i>level-low</i>	(Optional) Falling suppression level, up to two decimal places. The range is 0.00 to 100.00. This value must be less than or equal to the rising suppression value. If you do not configure a falling suppression level, it is set to the rising suppression level.
<b>level bps</b>	Specifies the rising and falling suppression levels as a rate in bits per second at which traffic is received on the port.
<i>bps</i>	Rising suppression level, up to 1 decimal place. The range is 0.0 to 10000000000.0. Block the flooding of storm packets when the value specified for bps is reached.  You can use metric suffixes such as k, m, and g for large number thresholds.
<i>bps-low</i>	(Optional) Falling suppression level, up to 1 decimal place. The range is 0.0 to 10000000000.0. This value must be equal to or less than the rising suppression value.  You can use metric suffixes such as k, m, and g for large number thresholds.
<b>level pps</b>	Specifies the rising and falling suppression levels as a rate in packets per second at which traffic is received on the port.
<i>pps</i>	Rising suppression level, up to 1 decimal place. The range is 0.0 to 10000000000.0. Block the flooding of storm packets when the value specified for pps is reached.  You can use metric suffixes such as k, m, and g for large number thresholds.

*pps-low* (Optional) Falling suppression level, up to 1 decimal place. The range is 0.0 to 1000000000.0. This value must be equal to or less than the rising suppression value.

You can use metric suffixes such as k, m, and g for large number thresholds.

#### Command Default

Broadcast, multicast, and unicast storm control are disabled.

The default action is to filter traffic and to not send an SNMP trap.

#### Command Modes

Interface configuration

#### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

#### Usage Guidelines

The storm-control suppression level can be entered as a percentage of total bandwidth of the port, as a rate in packets per second at which traffic is received, or as a rate in bits per second at which traffic is received.

When specified as a percentage of total bandwidth, a suppression value of 100 percent means that no limit is placed on the specified traffic type. A value of **level 0 0** means that all broadcast, multicast, or unicast traffic on that port is blocked. Storm control is enabled only when the rising suppression level is less than 100 percent. If no other storm-control configuration is specified, the default action is to filter the traffic causing the storm and to send no SNMP traps.



#### Note

When the storm control threshold for multicast traffic is reached, all multicast traffic except control traffic, such as bridge protocol data unit (BPDU) and Cisco Discovery Protocol (CDP) frames, are blocked. However, the switch does not differentiate between routing updates, such as Open Shortest Path First (OSPF) and regular multicast data traffic, so both types of traffic are blocked.

The **trap** and **shutdown** options are independent of each other.

If you configure the action to be taken as shutdown (the port is error-disabled during a storm) when a packet storm is detected, you must use the **no shutdown** interface configuration command to bring the interface out of this state. If you do not specify the **shutdown** action, specify the action as **trap** (the switch generates a trap when a storm is detected).

When a storm occurs and the action is to filter traffic, if the falling suppression level is not specified, the switch blocks all traffic until the traffic rate drops below the rising suppression level. If the falling suppression level is specified, the switch blocks traffic until the traffic rate drops below this level.



#### Note

Storm control is supported on physical interfaces. You can also configure storm control on an EtherChannel. When storm control is configured on an EtherChannel, the storm control settings propagate to the EtherChannel physical interfaces.

When a broadcast storm occurs and the action is to filter traffic, the switch blocks only broadcast traffic.

For more information, see the software configuration guide for this release.

This example shows how to enable broadcast storm control with a 75.5-percent rising suppression level:

```
Device(config-if)# storm-control broadcast level 75.5
```

This example shows how to enable unicast storm control on a port with a 87-percent rising suppression level and a 65-percent falling suppression level:

```
Device(config-if)# storm-control unicast level 87 65
```

This example shows how to enable multicast storm control on a port with a 2000-packets-per-second rising suppression level and a 1000-packets-per-second falling suppression level:

```
Device(config-if)# storm-control multicast level pps 2k 1k
```

This example shows how to enable the **shutdown** action on a port:

```
Device(config-if)# storm-control action shutdown
```

You can verify your settings by entering the **show storm-control** privileged EXEC command.

# switchport port-security aging

To set the aging time and type for secure address entries or to change the aging behavior for secure addresses on a particular port, use the **switchport port-security aging** command in interface configuration mode. To disable port security aging or to set the parameters to their default states, use the **no** form of this command.

**switchport port-security aging static | time *time* | type absolute | inactivity**  
**no switchport port-security aging static | time | type**

Syntax Description	
<b>static</b>	Enables aging for statically configured secure addresses on this port.
<b>time</b> <i>time</i>	Specifies the aging time for this port. The range is 0 to 1440 minutes. If the time is 0, aging is disabled for this port.
<b>type</b>	Sets the aging type.
<b>absolute</b>	Sets absolute aging type. All the secure addresses on this port age out exactly after the time (minutes) specified and are removed from the secure address list.
<b>inactivity</b>	Sets the inactivity aging type. The secure addresses on this port age out only if there is no data traffic from the secure source address for the specified time period.

**Command Default**

The port security aging feature is disabled. The default time is 0 minutes.

The default aging type is absolute.

The default static aging behavior is disabled.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

To enable secure address aging for a particular port, set the aging time to a value other than 0 for that port.

To allow limited time access to particular secure addresses, set the aging type as **absolute**. When the aging time lapses, the secure addresses are deleted.

To allow continuous access to a limited number of secure addresses, set the aging type as **inactivity**. This removes the secure address when it become inactive, and other addresses can become secure.

To allow unlimited access to a secure address, configure it as a secure address, and disable aging for the statically configured secure address by using the **no switchport port-security aging static** interface configuration command.

This example sets the aging time as 2 hours for absolute aging for all the secure addresses on the port:

```
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# switchport port-security aging time 120
```

This example sets the aging time as 2 minutes for inactivity aging type with aging enabled for configured secure addresses on the port:

```
Device(config)# interface gigabitethernet1/0/2  
Device(config-if)# switchport port-security aging time 2  
Device(config-if)# switchport port-security aging type inactivity  
Device(config-if)# switchport port-security aging static
```

This example shows how to disable aging for configured secure addresses:

```
Device(config)# interface gigabitethernet1/0/2  
Device(config-if)# no switchport port-security aging static
```

# switchport port-security mac-address

To configure secure MAC addresses or sticky MAC address learning, use the **switchport port-security mac-address** interface configuration command. To return to the default setting, use the **no** form of this command.

```
switchport port-security mac-address mac-address [vlan vlan-id access | voice] | sticky [mac-address
| vlan vlan-id access | voice]
no switchport port-security mac-address mac-address [vlan vlan-id access | voice] | sticky
[mac-address | vlan vlan-id access | voice]
```

## Syntax Description

**mac-address** A secure MAC address for the interface by entering a 48-bit MAC address. You can add additional secure MAC addresses up to the maximum value configured.

**vlan vlan-id** (Optional) On a trunk port only, specifies the VLAN ID and the MAC address. If no VLAN ID is specified, the native VLAN is used.

**vlan access** (Optional) On an access port only, specifies the VLAN as an access VLAN.

**vlan voice** (Optional) On an access port only, specifies the VLAN as a voice VLAN.

**Note** The **voice** keyword is available only if voice VLAN is configured on a port and if that port is not the access VLAN.

**sticky** Enables the interface for sticky learning. When sticky learning is enabled, the interface adds all secure MAC addresses that are dynamically learned to the running configuration and converts these addresses to sticky secure MAC addresses.

**mac-address** (Optional) A MAC address to specify a sticky secure MAC address.

## Command Default

No secure MAC addresses are configured.  
Sticky learning is disabled.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

A secure port has the following limitations:

- A secure port can be an access port or a trunk port; it cannot be a dynamic access port.
- A secure port cannot be a routed port.
- A secure port cannot be a protected port.
- A secure port cannot be a destination port for Switched Port Analyzer (SPAN).
- A secure port cannot belong to a Gigabit or 10-Gigabit EtherChannel port group.

- You cannot configure static secure or sticky secure MAC addresses in the voice VLAN.
- When you enable port security on an interface that is also configured with a voice VLAN, set the maximum allowed secure addresses on the port to two. When the port is connected to a Cisco IP phone, the IP phone requires one MAC address. The Cisco IP phone address is learned on the voice VLAN, but is not learned on the access VLAN. If you connect a single PC to the Cisco IP phone, no additional MAC addresses are required. If you connect more than one PC to the Cisco IP phone, you must configure enough secure addresses to allow one for each PC and one for the Cisco IP phone.
- Voice VLAN is supported only on access ports and not on trunk ports.

Sticky secure MAC addresses have these characteristics:

- When you enable sticky learning on an interface by using the **switchport port-security mac-address sticky** interface configuration command, the interface converts all the dynamic secure MAC addresses, including those that were dynamically learned before sticky learning was enabled, to sticky secure MAC addresses and adds all sticky secure MAC addresses to the running configuration.
- If you disable sticky learning by using the **no switchport port-security mac-address sticky** interface configuration command or the running configuration is removed, the sticky secure MAC addresses remain part of the running configuration but are removed from the address table. The addresses that were removed can be dynamically reconfigured and added to the address table as dynamic addresses.
- When you configure sticky secure MAC addresses by using the **switchport port-security mac-address sticky mac-address** interface configuration command, these addresses are added to the address table and the running configuration. If port security is disabled, the sticky secure MAC addresses remain in the running configuration.
- If you save the sticky secure MAC addresses in the configuration file, when the switch restarts or the interface shuts down, the interface does not need to relearn these addresses. If you do not save the sticky secure addresses, they are lost. If sticky learning is disabled, the sticky secure MAC addresses are converted to dynamic secure addresses and are removed from the running configuration.
- If you disable sticky learning and enter the **switchport port-security mac-address sticky mac-address** interface configuration command, an error message appears, and the sticky secure MAC address is not added to the running configuration.

You can verify your settings by using the **show port-security** privileged EXEC command.

This example shows how to configure a secure MAC address and a VLAN ID on a port:

```
Device(config)# interface gigabitethernet 2/0/2
Device(config-if)# switchport mode trunk
Device(config-if)# switchport port-security
Device(config-if)# switchport port-security mac-address 1000.2000.3000 vlan 3
```

This example shows how to enable sticky learning and to enter two sticky secure MAC addresses on a port:

```
Device(config)# interface gigabitethernet 2/0/2
Device(config-if)# switchport port-security mac-address sticky
Device(config-if)# switchport port-security mac-address sticky 0000.0000.4141
Device(config-if)# switchport port-security mac-address sticky 0000.0000.000f
```

# switchport port-security maximum

To configure the maximum number of secure MAC addresses, use the **switchport port-security maximum** command in interface configuration mode. To return to the default settings, use the **no** form of this command.

**switchport port-security maximum** *value* [**vlan** [*vlan-list* | [**access** | **voice**]]]  
**no switchport port-security maximum** *value* [**vlan** [*vlan-list* | [**access** | **voice**]]]

## Syntax Description

<b>value</b>	Sets the maximum number of secure MAC addresses for the interface. The default setting is 1.
<b>vlan</b>	(Optional) For trunk ports, sets the maximum number of secure MAC addresses on a VLAN or range of VLANs. If the <b>vlan</b> keyword is not entered, the default value is used.
<b>vlan-list</b>	(Optional) Range of VLANs separated by a hyphen or a series of VLANs separated by commas. For nonspecified VLANs, the per-VLAN maximum value is used.
<b>access</b>	(Optional) On an access port only, specifies the VLAN as an access VLAN.
<b>voice</b>	(Optional) On an access port only, specifies the VLAN as a voice VLAN.
<b>Note</b>	The <b>voice</b> keyword is available only if voice VLAN is configured on a port and if that port is not the access VLAN.

## Command Default

When port security is enabled and no keywords are entered, the default maximum number of secure MAC addresses is 1.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The maximum number of secure MAC addresses that you can configure on a switch or switch stack is set by the maximum number of available MAC addresses allowed in the system. This number is determined by the active Switch Database Management (SDM) template. See the **sdm prefer** command. This number represents the total of available MAC addresses, including those used for other Layer 2 functions and any other secure MAC addresses configured on interfaces.

A secure port has the following limitations:

- A secure port can be an access port or a trunk port; it cannot be a dynamic access port.
- A secure port cannot be a routed port.
- A secure port cannot be a protected port.
- A secure port cannot be a destination port for Switched Port Analyzer (SPAN).
- A secure port cannot belong to a Gigabit or 10-Gigabit EtherChannel port group.



- When you enable port security on an interface that is also configured with a voice VLAN, set the maximum allowed secure addresses on the port to two. When the port is connected to a Cisco IP phone, the IP phone requires one MAC address. The Cisco IP phone address is learned on the voice VLAN, but is not learned on the access VLAN. If you connect a single PC to the Cisco IP phone, no additional MAC addresses are required. If you connect more than one PC to the Cisco IP phone, you must configure enough secure addresses to allow one for each PC and one for the Cisco IP phone.

Voice VLAN is supported only on access ports and not on trunk ports.

- When you enter a maximum secure address value for an interface, if the new value is greater than the previous value, the new value overrides the previously configured value. If the new value is less than the previous value and the number of configured secure addresses on the interface exceeds the new value, the command is rejected.

Setting a maximum number of addresses to one and configuring the MAC address of an attached device ensures that the device has the full bandwidth of the port.

When you enter a maximum secure address value for an interface, this occurs:

- If the new value is greater than the previous value, the new value overrides the previously configured value.
- If the new value is less than the previous value and the number of configured secure addresses on the interface exceeds the new value, the command is rejected.

You can verify your settings by using the **show port-security** privileged EXEC command.

This example shows how to enable port security on a port and to set the maximum number of secure addresses to 5. The violation mode is the default, and no secure MAC addresses are configured.

```
Device(config)# interface gigabitethernet 2/0/2
Device(config-if)# switchport mode access
Device(config-if)# switchport port-security
Device(config-if)# switchport port-security maximum 5
```

# switchport port-security violation

To configure secure MAC address violation mode or the action to be taken if port security is violated, use the **switchport port-security violation** command in interface configuration mode. To return to the default settings, use the **no** form of this command.

**switchport port-security violation protect | restrict | shutdown | shutdown vlan**  
**no switchport port-security violation protect | restrict | shutdown | shutdown vlan**

Syntax Description		
	<b>protect</b>	Sets the security violation protect mode.
	<b>restrict</b>	Sets the security violation restrict mode.
	<b>shutdown</b>	Sets the security violation shutdown mode.
	<b>shutdown vlan</b>	Sets the security violation mode to per-VLAN shutdown.

**Command Default** The default violation mode is **shutdown**.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** In the security violation protect mode, when the number of port secure MAC addresses reaches the maximum limit allowed on the port, packets with unknown source addresses are dropped until you remove a sufficient number of secure MAC addresses to drop below the maximum value or increase the number of maximum allowable addresses. You are not notified that a security violation has occurred.



**Note** We do not recommend configuring the protect mode on a trunk port. The protect mode disables learning when any VLAN reaches its maximum limit, even if the port has not reached its maximum limit.

In the security violation restrict mode, when the number of secure MAC addresses reaches the limit allowed on the port, packets with unknown source addresses are dropped until you remove a sufficient number of secure MAC addresses or increase the number of maximum allowable addresses. An SNMP trap is sent, a syslog message is logged, and the violation counter increments.

In the security violation shutdown mode, the interface is error-disabled when a violation occurs and the port LED turns off. An SNMP trap is sent, a syslog message is logged, and the violation counter increments. When a secure port is in the error-disabled state, you can bring it out of this state by entering the **errdisable recovery cause psecure-violation** global configuration command, or you can manually re-enable it by entering the **shutdown** and **no shutdown** interface configuration commands.

When the security violation mode is set to per-VLAN shutdown, only the VLAN on which the violation occurred is error-disabled.

A secure port has the following limitations:

- A secure port can be an access port or a trunk port; it cannot be a dynamic access port.
- A secure port cannot be a routed port.
- A secure port cannot be a protected port.
- A secure port cannot be a destination port for Switched Port Analyzer (SPAN).
- A secure port cannot belong to a Gigabit or 10-Gigabit EtherChannel port group.

A security violation occurs when the maximum number of secure MAC addresses are in the address table and a station whose MAC address is not in the address table attempts to access the interface or when a station whose MAC address is configured as a secure MAC address on another secure port attempts to access the interface.

When a secure port is in the error-disabled state, you can bring it out of this state by entering the **errdisable recovery cause psecure-violation** global configuration command. You can manually re-enable the port by entering the **shutdown** and **no shutdown** interface configuration commands or by using the **clear errdisable interface** privileged EXEC command.

You can verify your settings by using the **show port-security** privileged EXEC command.

This example show how to configure a port to shut down only the VLAN if a MAC security violation occurs:

```
Device(config)# interface gigabitethernet2/0/2
Device(config)# switchport port-security violation shutdown vlan
```

## tacacs server

To configure the TACACS+ server for IPv6 or IPv4 and enter TACACS+ server configuration mode, use the **tacacs server** command in global configuration mode. To remove the configuration, use the **no** form of this command.

**tacacs server** *name*  
**no tacacs server**

<b>Syntax Description</b>	<b>name</b> Name of the private TACACS+ server host.
---------------------------	--

**Command Default** No TACACS+ server is configured.

**Command Modes** Global configuration (config)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **tacacs server** command configures the TACACS server using the *name* argument and enters TACACS+ server configuration mode. The configuration is applied once you have finished configuration and exited TACACS+ server configuration mode.

**Examples** The following example shows how to configure the TACACS server using the name server1 and enter TACACS+ server configuration mode to perform further configuration:

```
Device(config)# tacacs server server1
Device(config-server-tacacs)#
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<b>address ipv6 (TACACS+)</b>	Configures the IPv6 address of the TACACS+ server.
	<b>key (TACACS+)</b>	Configures the per-server encryption key on the TACACS+ server.
	<b>port (TACACS+)</b>	Specifies the TCP port to be used for TACACS+ connections.
	<b>send-nat-address (TACACS+)</b>	Sends a client's post-NAT address to the TACACS+ server.
	<b>single-connection (TACACS+)</b>	Enables all TACACS packets to be sent to the same server using a single TCP connection.
	<b>timeout (TACACS+)</b>	Configures the time to wait for a reply from the specified TACACS server.

## tracking (IPv6 snooping)

To override the default tracking policy on a port, use the **tracking** command in IPv6 snooping policy configuration mode.

**tracking** { **enable** [**reachable-lifetime** { *value* | **infinite** } ] | **disable** [**stale-lifetime** { *value* | **infinite** } ] }

Syntax Description		
<b>enable</b>		Enables tracking.
<b>reachable-lifetime</b>		(Optional) Specifies the maximum amount of time a reachable entry is considered to be directly or indirectly reachable without proof of reachability. <ul style="list-style-type: none"> <li>The <b>reachable-lifetime</b> keyword can be used only with the <b>enable</b> keyword.</li> <li>Use of the <b>reachable-lifetime</b> keyword overrides the global reachable lifetime configured by the <b>ipv6 neighbor binding reachable-lifetime</b> command.</li> </ul>
<i>value</i>		Lifetime value, in seconds. The range is from 1 to 86400, and the default is 300.
<b>infinite</b>		Keeps an entry in a reachable or stale state for an infinite amount of time.
<b>disable</b>		Disables tracking.
<b>stale-lifetime</b>		(Optional) Keeps the time entry in a stale state, which overwrites the global stale-lifetime configuration. <ul style="list-style-type: none"> <li>The stale lifetime is 86,400 seconds.</li> <li>The <b>stale-lifetime</b> keyword can be used only with the <b>disable</b> keyword.</li> <li>Use of the <b>stale-lifetime</b> keyword overrides the global stale lifetime configured by the <b>ipv6 neighbor binding stale-lifetime</b> command.</li> </ul>

**Command Default** The time entry is kept in a reachable state.

**Command Modes** IPv6 snooping configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **tracking** command overrides the default tracking policy set by the **ipv6 neighbor tracking** command on the port on which this policy applies. This function is useful on trusted ports where, for example, you may not want to track entries but want an entry to stay in the binding table to prevent it from being stolen.

The **reachable-lifetime** keyword is the maximum time an entry will be considered reachable without proof of reachability, either directly through tracking or indirectly through IPv6 snooping. After the **reachable-lifetime** value is reached, the entry is moved to stale. Use of the **reachable-lifetime** keyword with the tracking command overrides the global reachable lifetime configured by the **ipv6 neighbor binding reachable-lifetime** command.

The **stale-lifetime** keyword is the maximum time an entry is kept in the table before it is deleted or the entry is proven to be reachable, either directly or indirectly. Use of the **reachable-lifetime** keyword with the **tracking** command overrides the global stale lifetime configured by the **ipv6 neighbor binding stale-lifetime** command.

This example shows how to define an IPv6 snooping policy name as policy1, place the switch in IPv6 snooping policy configuration mode, and configure an entry to stay in the binding table for an infinite length of time on a trusted port:

```
Device(config)# ipv6 snooping policy policy1  
Device(config-ipv6-snooping)# tracking disable stale-lifetime infinite
```

# trusted-port

To configure a port to become a trusted port, use the **trusted-port** command in IPv6 snooping policy mode or ND inspection policy configuration mode. To disable this function, use the **no** form of this command.

**trusted-port**  
**no trusted-port**

## Syntax Description

This command has no arguments or keywords.

## Command Default

No ports are trusted.

## Command Modes

ND inspection policy configuration  
 IPv6 snooping configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

When the **trusted-port** command is enabled, limited or no verification is performed when messages are received on ports that have this policy. However, to protect against address spoofing, messages are analyzed so that the binding information that they carry can be used to maintain the binding table. Bindings discovered from these ports will be considered more trustworthy than bindings received from ports that are not configured to be trusted.

This example shows how to define an NDP policy name as policy1, place the switch in NDP inspection policy configuration mode, and configure the port to be trusted:

```
Device(config)# ipv6 nd inspection policy1
Device(config-nd-inspection)# trusted-port
```

This example shows how to define an IPv6 snooping policy name as policy1, place the switch in IPv6 snooping policy configuration mode, and configure the port to be trusted:

```
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# trusted-port
```

# vlan access-map

To create or modify a VLAN map entry for VLAN packet filtering, and change the mode to the VLAN access-map configuration, use the **vlan access-map** command in global configuration mode on the switch stack or on a standalone switch. To delete a VLAN map entry, use the **no** form of this command.

```
vlan access-map name [number]
no vlan access-map name [number]
```



## Note

This command is not supported on switches running the LAN Base feature set.

## Syntax Description

*name* Name of the VLAN map.

*number* (Optional) The sequence number of the map entry that you want to create or modify (0 to 65535). If you are creating a VLAN map and the sequence number is not specified, it is automatically assigned in increments of 10, starting from 10. This number is the sequence to insert to, or delete from, a VLAN access-map entry.

## Command Default

There are no VLAN map entries and no VLAN maps applied to a VLAN.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

In global configuration mode, use this command to create or modify a VLAN map. This entry changes the mode to VLAN access-map configuration, where you can use the **match** access-map configuration command to specify the access lists for IP or non-IP traffic to match and use the **action** command to set whether a match causes the packet to be forwarded or dropped.

In VLAN access-map configuration mode, these commands are available:

- **action**—Sets the action to be taken (forward or drop).
- **default**—Sets a command to its defaults.
- **exit**—Exits from VLAN access-map configuration mode.
- **match**—Sets the values to match (IP address or MAC address).
- **no**—Negates a command or set its defaults.

When you do not specify an entry number (sequence number), it is added to the end of the map.

There can be only one VLAN map per VLAN and it is applied as packets are received by a VLAN.

You can use the **no vlan access-map name [number]** command with a sequence number to delete a single entry.



Use the **vlan filter** interface configuration command to apply a VLAN map to one or more VLANs. For more information about VLAN map entries, see the software configuration guide for this release.

This example shows how to create a VLAN map named vac1 and apply matching conditions and actions to it. If no other entries already exist in the map, this will be entry 10.

```
Device(config)# vlan access-map vac1  
Device(config-access-map)# match ip address acl1  
Device(config-access-map)# action forward
```

This example shows how to delete VLAN map vac1:

```
Device(config)# no vlan access-map vac1
```

# vlan dot1Q tag native

To enable dot1q (IEEE 802.1Q) tagging for a native VLAN on a trunk port, use the **vlan dot1Q tag native** command in global configuration mode.

To disable this function, use the **no** form of this command.

**vlan dot1Q tag native**  
**no vlan dot1Q tag native**

**Syntax Description** This command has no arguments or keywords.

**Command Default** Disabled

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Typically, you configure 802.1Q trunks with a native VLAN ID which strips tagging from all packets on that VLAN.

To maintain the tagging on the native VLAN and drop untagged traffic, use the **vlan dot1q tag native** command. The device will tag the traffic received on the native VLAN and admit only 802.1Q-tagged frames, dropping any untagged traffic, including untagged traffic in the native VLAN.

Control traffic continues to be accepted as untagged on the native VLAN on a trunked port, even when the **vlan dot1q tag native** command is enabled.



**Note** If the **dot1q tag vlan native** command is configured at global level, dot1x reauthentication will fail on trunk ports.

This example shows how to enable dot1q (IEEE 802.1Q) tagging for native VLANs on all trunk ports on a device:

```
Device(config)# vlan dot1q tag native
Device(config)#
```

## Related Commands

Command	Description
<b>show vlan dot1q tag native</b>	Displays the status of tagging on the native VLAN.

# vlan filter

To apply a VLAN map to one or more VLANs, use the **vlan filter** command in global configuration mode on the switch stack or on a standalone switch. To remove the map, use the **no** form of this command.

```
vlan filter mapname vlan-list list | all
no vlan filter mapname vlan-list list | all
```



**Note** This command is not supported on switches running the LAN Base feature set.

## Syntax Description

<i>mapname</i>	Name of the VLAN map entry.
<b>vlan-list</b>	Specifies which VLANs to apply the map to.
<i>list</i>	The list of one or more VLANs in the form tt, uu-vv, xx, yy-zz, where spaces around commas and dashes are optional. The range is 1 to 4094.
<b>all</b>	Adds the map to all VLANs.

## Command Default

There are no VLAN filters.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

To avoid accidentally dropping too many packets and disabling connectivity in the middle of the configuration process, we recommend that you completely define the VLAN access map before applying it to a VLAN.

For more information about VLAN map entries, see the software configuration guide for this release.

This example applies VLAN map entry `map1` to VLANs 20 and 30:

```
Device(config)# vlan filter map1 vlan-list 20, 30
```

This example shows how to delete VLAN map entry `map1` from VLAN 20:

```
Device(config)# no vlan filter map1 vlan-list 20
```

You can verify your settings by entering the **show vlan filter** privileged EXEC command.

# vlan group

To create or modify a VLAN group, use the **vlan group** command in global configuration mode. To remove a VLAN list from the VLAN group, use the **no** form of this command.

**vlan group** *group-name* **vlan-list** *vlan-list*  
**no vlan group** *group-name* **vlan-list** *vlan-list*

## Syntax Description

<i>group-name</i>	Name of the VLAN group. The group name may contain up to 32 characters and must begin with a letter.
<b>vlan-list</b> <i>vlan-list</i>	Specifies one or more VLANs to be added to the VLAN group. The <i>vlan-list</i> argument can be a single VLAN ID, a list of VLAN IDs, or VLAN ID range. Multiple entries are separated by a hyphen (-) or a comma (,).

## Command Default

None

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

If the named VLAN group does not exist, the **vlan group** command creates the group and maps the specified VLAN list to the group. If the named VLAN group exists, the specified VLAN list is mapped to the group.

The **no** form of the **vlan group** command removes the specified VLAN list from the VLAN group. When you remove the last VLAN from the VLAN group, the VLAN group is deleted.

A maximum of 100 VLAN groups can be configured, and a maximum of 4094 VLANs can be mapped to a VLAN group.

This example shows how to map VLANs 7 through 9 and 11 to a VLAN group:

```
Device(config)# vlan group group1 vlan-list 7-9,11
```

This example shows how to remove VLAN 7 from the VLAN group:

```
Device(config)# no vlan group group1 vlan-list 7
```



## PART **XII**

# System Management

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## System Management Commands

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# arp

To display the contents of the Address Resolution Protocol (ARP) table, use the **arp** command in boot loader mode.

```
arp [ip_address]
```

---

<b>Syntax Description</b>	<i>ip_address</i> (Optional) Shows the ARP table or the mapping for a specific IP address.
---------------------------	--

---

---

<b>Command Default</b>	No default behavior or values.
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<b>Command Modes</b>	Boot loader
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---

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

<b>Usage Guidelines</b>	The ARP table contains the IP-address-to-MAC-address mappings.
-------------------------	--

---

---

<b>Examples</b>	This example shows how to display the ARP table:
-----------------	--

```
Device: arp 172.20.136.8  
arp'ing 172.20.136.8...  
172.20.136.8 is at 00:1b:78:d1:25:ae, via port 0
```

# boot

To load and boot an executable image and display the command-line interface (CLI), use the **boot** command in boot loader mode.

**boot** [-post | -n | -p | *flag*] *filesystem:/file-url...*

Syntax Description	
<b>-post</b>	(Optional) Run the loaded image with an extended or comprehensive power-on self-test (POST). Using this keyword causes POST to take longer to complete.
<b>-n</b>	(Optional) Pause for the Cisco IOS Debugger immediately after launching.
<b>-p</b>	(Optional) Pause for the JTAG Debugger right after loading the image.
<i>filesystem:</i>	Alias for a file system. Use <b>flash:</b> for the system board flash device; use <b>usbflash0:</b> for USB memory sticks.
<i>/file-url</i>	Path (directory) and name of a bootable image. Separate image names with a semicolon.

**Command Default** No default behavior or values.

**Command Modes** Boot loader

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** When you enter the **boot** command without any arguments, the attempts to automatically boot the system by using the information in the BOOT environment variable, if any.

If you supply an image name for the *file-url* variable, the **boot** command attempts to boot the specified image.

When you specify boot loader **boot** command options, they are executed immediately and apply only to the current boot loader session.

These settings are not saved for the next boot operation.

Filenames and directory names are case sensitive.

## Example

This example shows how to boot the using the *new-image.bin* image:

```
Device: set BOOT flash:/new-images/new-image.bin
Device: boot
```

After entering this command, you are prompted to start the setup program.

# cat

To display the contents of one or more files, use the **cat** command in boot loader mode.

**cat** *filesystem:/file-url...*

## Syntax Description

*filesystem*: Specifies a file system.

*/file-url* Specifies the path (directory) and name of the files to display. Separate each filename with a space.

## Command Default

No default behavior or values.

## Command Modes

Boot loader

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Filenames and directory names are case sensitive.

If you specify a list of files, the contents of each file appears sequentially.

## Examples

This example shows how to display the contents of an image file:

```
Device: cat flash:image_file_name
version_suffix: universal-122-xx.SEx
version_directory: image_file_name
image_system_type_id: 0x00000002
image_name: image_file_name.bin
ios_image_file_size: 8919552
total_image_file_size: 11592192
image_feature: IP|LAYER_3|PLUS|MIN_DRAM_MEG=128
image_family: family
stacking_number: 1.34
board_ids: 0x00000068 0x00000069 0x0000006a 0x0000006b
info_end:
```

# copy

To copy a file from a source to a destination, use the **copy** command in boot loader mode.

**copy** *filesystem:/source-file-url filesystem:/destination-file-url*

<b>Syntax Description</b>	<i>filesystem:</i>	Alias for a file system. Use <b>usbflash0:</b> for USB memory sticks.
	<i>/source-file-url</i>	Path (directory) and filename (source) to be copied.
	<i>/destination-file-url</i>	Path (directory) and filename of the destination.

**Command Default** No default behavior or values.

**Command Modes** Boot loader

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Filenames and directory names are case sensitive.

Directory names are limited to 127 characters between the slashes (/); the name cannot contain control characters, spaces, deletes, slashes, quotes, semicolons, or colons.

Filenames are limited to 127 characters; the name cannot contain control characters, spaces, deletes, slashes, quotes, semicolons, or colons.

If you are copying a file to a new directory, the directory must already exist.

## Examples

This example shows how to copy a file at the root:

```
Device: copy usbflash0:test1.text usbflash0:test4.text
File "usbflash0:test1.text" successfully copied to "usbflash0:test4.text"
```

You can verify that the file was copied by entering the **dir filesystem:** boot loader command.

## copy startup-config tftp:

To copy the configuration settings from a switch to a TFTP server, use the **copy startup-config tftp:** command in Privileged EXEC mode.

**copy startup-config tftp:** *remote host {ip-address}/{name}*

<b>Syntax Description</b>	<i>remote host {ip-address}/{name}</i> Host name or IP-address of Remote host.
---------------------------	--

<b>Command Default</b>	No default behavior or values.
------------------------	--------------------------------

<b>Command Modes</b>	Privileged EXEC
----------------------	-----------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Release 16.1	This command was introduced.

<b>Usage Guidelines</b>	To copy your current configurations from the switch, run the command <b>copy startup-config tftp:</b> and follow the instructions. The configurations are copied onto the TFTP server.
-------------------------	--

Then, login to another switch and run the command **copy tftp: startup-config** and follow the instructions. The configurations are now copied onto the other switch.

### Examples

This example shows how to copy the configuration settings onto a TFTP server:

```
Device: copy startup-config tftp:
Address or name of remote host []?
```

## copy tftp: startup-config

To copy the configuration settings from a TFTP server onto a new switch, use the **copy tftp: startup-config** command in Privileged EXEC mode on the new switch.

**copy tftp: startup-config** *remote host {ip-address}/{name}*

<b>Syntax Description</b>	<i>remote host {ip-address}/{name}</i> Host name or IP-address of Remote host.
---------------------------	--

<b>Command Default</b>	No default behavior or values.
------------------------	--------------------------------

<b>Command Modes</b>	Privileged EXEC
----------------------	-----------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Release 16.1	This command was introduced.

<b>Usage Guidelines</b>	After the configurations are copied, to save your configurations, use <b>write memory</b> command and then either reload the switch or run the <b>copy startup-config running-config</b> command.
-------------------------	---

<b>Examples</b>	This example shows how to copy the configuration settings from the TFTP server onto a switch:
-----------------	---

```
Device: copy tftp: startup-config
Address or name of remote host []?
```

# debug voice diagnostics mac-address

To enable debugging of voice diagnostics for voice clients, use the **debug voice diagnostics mac-address** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

**debug voice diagnostics mac-address** *mac-address1* **verbose** **mac-address** *mac-address2* **verbose**  
**no debug voice diagnostics mac-address** *mac-address1* **verbose** **mac-address** *mac-address2* **verbose**

Syntax Description		
<b>voice diagnostics</b>		Configures voice debugging for voice clients.
<b>mac-address</b> <i>mac-address1</i> <b>mac-address</b> <i>mac-address2</i>		Specifies MAC addresses of the voice clients.
<b>verbose</b>		Enables verbose mode for voice diagnostics.

**Command Default** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

The following is sample output from the **debug voice diagnostics mac-address** command and shows how to enable debugging of voice diagnostics for voice client with MAC address of 00:1f:ca:cf:b6:60:

```
Device# debug voice diagnostics mac-address 00:1f:ca:cf:b6:60
```

# delete

To delete one or more files from the specified file system, use the **delete** command in boot loader mode.

**delete** *filesystem:/file-url...*

## Syntax Description

*filesystem:* Alias for a file system. Use **usbflash0:** for USB memory sticks.

*/file-url...* Path (directory) and filename to delete. Separate each filename with a space.

## Command Default

No default behavior or values.

## Command Modes

Boot loader

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Filenames and directory names are case sensitive.

The **delete** prompts you for confirmation before deleting each file.

## Examples

This example shows how to delete two files:

```
Device: delete usbflash0:test2.text usbflash0:test5.text
Are you sure you want to delete "usbflash0:test2.text" (y/n)?y
File "usbflash0:test2.text" deleted
Are you sure you want to delete "usbflash0:test5.text" (y/n)?y
File "usbflash0:test2.text" deleted
```

You can verify that the files were deleted by entering the **dir usbflash0:** boot loader command.



# dir

To display the list of files and directories on the specified file system, use the **dir** command in boot loader mode.

**dir** *filesystem:/file-url*

<b>Syntax Description</b>	<i>filesystem:</i> Alias for a file system. Use <b>flash:</b> for the system board flash device; use <b>usbflash0:</b> for USB memory sticks.				
	<i>/file-url</i> (Optional) Path (directory) and directory name that contain the contents you want to display. Separate each directory name with a space.				
<b>Command Default</b>	No default behavior or values.				
<b>Command Modes</b>	Boot Loader Privileged EXEC				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				
<b>Usage Guidelines</b>	Directory names are case sensitive.				
<b>Examples</b>	This example shows how to display the files in flash memory:				

```
Device: dir flash:
Directory of flash:/
  2  -rwx      561   Mar 01 2013 00:48:15  express_setup.debug
  3  -rwx    2160256  Mar 01 2013 04:18:48  c2960x-dmon-mz-150-2r.EX
  4  -rwx      1048   Mar 01 2013 00:01:39  multiple-fs
  6  drwx      512   Mar 01 2013 23:11:42  c2960x-universalk9-mz.150-2.EX
645 drwx      512   Mar 01 2013 00:01:11  dc_profile_dir
647 -rwx     4316   Mar 01 2013 01:14:05  config.text
648 -rwx        5   Mar 01 2013 00:01:39  private-config.text

96453632 bytes available (25732096 bytes used)
```

**Table 173: dir Field Descriptions**

Field	Description
2	Index number of the file.
-rwx	File permission, which can be any or all of the following: <ul style="list-style-type: none"> <li>• d—directory</li> <li>• r—readable</li> <li>• w—writable</li> <li>• x—executable</li> </ul>

Field	Description
1644045	Size of the file.
<date>	Last modification date.
env_vars	Filename.



```
Bootloader: Done loading app on core_mask: 0xf
```

```
### Launching Linux Kernel (flags = 0x5)
```

```
Initiating Emergency Installation of bundle  
tftp:<url>
```

```
Downloading bundle tftp:<url>...
```

```
Validating bundle tftp:<url>...
```

```
Installing bundle tftp:<url>...
```

```
Verifying bundle tftp:<url>...
```

```
Package cat3k_caa-base.SPA.03.02.00SE.pkg is Digitally Signed
```

```
Package cat3k_caa-drivers.SPA.03.02.00.SE.pkg is Digitally Signed
```

```
Package cat3k_caa-infra.SPA.03.02.00SE.pkg is Digitally Signed
```

```
Package cat3k_caa-iosd-universalk9.SPA.150-1.EX.pkg is Digitally Signed
```

```
Package cat3k_caa-platform.SPA.03.02.00.SE.pkg is Digitally Signed
```

```
Package cat3k_caa-wcm.SPA.10.0.100.0.pkg is Digitally Signed
```

```
Preparing flash...
```

```
Syncing device...
```

```
Emergency Install successful... Rebooting
```

```
Restarting system.\ufffd
```

```
Booting...(use DDR clock 667 MHz)Initializing and Testing RAM
```

```
+++@@@###...+@@+@@+@@+@@+@@+@@+@@+@@+@@+@@done.
```

```
Memory Test Pass!
```

```
Base ethernet MAC Address: 20:37:06:ce:25:80
```

```
Initializing Flash...
```

```
flashfs[7]: 0 files, 1 directories
```

```
flashfs[7]: 0 orphaned files, 0 orphaned directories
```

```
flashfs[7]: Total bytes: 6784000
```

```
flashfs[7]: Bytes used: 1024
```

```
flashfs[7]: Bytes available: 6782976
```

```
flashfs[7]: flashfs fsck took 1 seconds....done Initializing Flash.
```

```
The system is not configured to boot automatically. The  
following command will finish loading the operating system  
software:
```

```
boot
```

# exit

To return to the previous mode or exit from the CLI EXEC mode, use the **exit** command.

## exit

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** No default behavior or values.

---

**Command Modes** Privileged EXEC  
Global configuration

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

This example shows how to exit the configuration mode:

```
Device(config)# exit  
Device#
```

# flash\_init

To initialize the flash: file system, use the **flash\_init** command in boot loader mode.

## flash\_init

---

### Syntax Description

This command has no arguments or keywords.

---

### Command Default

The flash: file system is automatically initialized during normal system operation.

---

### Command Modes

Boot loader

---

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

### Usage Guidelines

During the normal boot process, the flash: file system is automatically initialized.

Use this command to manually initialize the flash: file system. For example, you use this command during the recovery procedure for a lost or forgotten password.

# help

To display the available commands, use the **help** command in boot loader mode.

## help

<b>Syntax Description</b>	This command has no arguments or keywords.	
<b>Command Default</b>	No default behavior or values.	
<b>Command Modes</b>	Boot loader	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Example

This example shows how to display a list of available boot loader commands:

```
Device:help
? -- Present list of available commands
arp -- Show arp table or arp-resolve an address
boot -- Load and boot an executable image
cat -- Concatenate (type) file(s)
copy -- Copy a file
delete -- Delete file(s)
dir -- List files in directories
emergency-install -- Initiate Disaster Recovery
...
...
...
unset -- Unset one or more environment variables
version -- Display boot loader version
```

# install

To install Software Maintenance Upgrade (SMU) packages, use the **install** command in privileged EXEC mode.

**install** **abort** | **activate** | **file** **bootflash:** | **flash:** | **harddisk:** | **webui:** [**auto-abort-timer** **timer** *timer* **prompt-level** **all** | **none**] | **add** **file** **bootflash:** | **flash:** | **ftp:** | **harddisk:** | **http:** | **https:** | **pram:** | **rcp:** | **scp:** | **tftp:** | **webui:** [**activate** [**auto-abort-timer** *timer* **prompt-level** **all** | **noncommit**]] | **commit** | **auto-abort-timer** **stop** | **deactivate** **file** **bootflash:** | **flash:** | **harddisk:** | **webui:** | **label** *iddescription* *description* | **label-name** *name* | **remove** **file** **bootflash:** | **flash:** | **harddisk:** | **webui:** | **inactive** | **rollback** **to base** | **committed** | **id** *install-ID* | **label** *label-name*

## Syntax Description

<b>abort</b>	Terminates the current install operation.
<b>activate</b>	Validates whether the SMU is added through the <b>install add</b> command.  This keyword runs a compatibility check, updates package status, and if the package can be restarted, it triggers post-install scripts to restart the necessary processes, or triggers a reload for non-restartable packages.
<b>file</b>	Specifies the package to be activated.
{ <b>bootflash:</b>   <b>flash:</b>   <b>harddisk:</b>   <b>webui:</b> }	Specifies the location of the installed package.
<b>auto-abort-timer</b> <i>timer</i>	(Optional) Installs an automatic timer to terminate the installation.
<b>prompt-level</b> { <b>all</b>   <b>none</b> }	(Optional) Prompts the user about installation activities.  For example, the <b>activate</b> keyword, automatically triggers a reload for packages that require a reload. Before activating the package, a message will prompt users as to whether they want to continue.  The <b>all</b> keyword allows you to enable prompts. The <b>none</b> keyword disables prompts.
<b>add</b>	Copies files from a remote location (via FTP, TFTP) to a device and performs Software Maintenance Upgrade (SMU) compatibility check for the platform and image versions.  This keyword runs base compatibility checks to ensure that a specified package is supported on a platform. It also adds an entry in the package file, so that the status can be monitored and maintained.
{ <b>bootflash:</b>   <b>flash:</b>   <b>ftp:</b>   <b>harddisk:</b>   <b>http:</b>   <b>https:</b>   <b>pram:</b>   <b>rcp:</b>   <b>scp:</b>   <b>tftp:</b>   <b>webui:</b> }	Specifies the package to be added.



<b>commit</b>	Makes SMU changes persistent over reloads.  You can do a commit after activating a package, while the system is up, or after the first reload. If a package is activated, but not committed, it remains active after the first reload, but not after the second reload.
<b>auto-abort-timer stop</b>	Stops the automatic timer for installation.
<b>deactivate</b>	Deactivates an installed package.  Deactivating a package also updates the package status and triggers a process restart or a reload.
<b>label <i>id</i></b>	Specifies the id of the install point to label.
<b>description</b>	Adds a description to specified install point.
<b>label-name <i>name</i></b>	Adds a description to specified install point.
<b>remove</b>	Remove installed packages.  The package file is removed from the file system. The <b>remove</b> keyword can only be used on packages that are currently inactive.
<b>inactive</b>	Removes all inactive packages from the device.
<b>rollback</b>	Rollbacks the data model interface (DMI) package (DMP) SMU to the base version, the last committed version, or a known commit ID.
<b>to base</b>	Returns to the base image.
<b>committed</b>	Returns to the installation state when the last commit operation was performed.
<b>id <i>install-ID</i></b>	Returns to the specific install point ID. Valid values are from 1 to 4294967295.

**Command Default** Packages are not installed.

**Command Modes** Privileged EXEC (#)

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.6.1	This command was introduced.

**Usage Guidelines** An SMU is a package that can be installed on a system to provide a patch fix or security resolution to a released image. This package contain a minimal set of files for patching the release along with some metadata that describes the contents of the package.

Packages must be added prior to activating the SMU.

A package must be deactivated, before it is removed from the bootflash. A removed packaged must be added again.

### Example

The following example shows how to add an install package on a device:

```
Device# install add file tftp://172.16.0.1/tftpboot/folder1/cat3k-
universalk9.2017-01-10_13.15.1.CSCxxxxxxx.SSA.dmp.bin

install_add: START Sun Feb 26 05:57:04 UTC 2017
Downloading file tftp://172.16.0.1/tftpboot/folder1/cat3k-universalk9.2017-01-10_13.15.1.
CSCvb12345.SSA.dmp.bin
Finished downloading file
tftp://172.16.0.1/tftpboot/folder1/cat3k-universalk9.2017-01-10_13.15.1.
CSCxxxxxxx.SSA.dmp.bin to
bootflash:cat3k-universalk9.2017-01-10_13.15.1.CSCxxxxxxx.SSA.dmp.bin
SUCCESS: install_add /bootflash/cat3k-universalk9.2017-01-10_13.15.1.CSCxxxxxxx.SSA.dmp.bin

Sun Feb 26 05:57:22 UTC 2017
```

The following example shows how to activate an install package:

```
Device# install activate file bootflash:cat3k-universalk9.2017-01-10_13.15.1.
CSCxxxxxxx.SSA.dmp.bin

install_activate: START Sun Feb 26 05:58:41 UTC 2017
DMP package.
Netconf processes stopped
SUCCESS: install_activate
/bootflash/cat3k-universalk9.2017-01-10_13.15.1.CSCxxxxxxx.SSA.dmp.bin
Sun Feb 26 05:58:58 UTC 2017
*Feb 26 05:58:47.655: %DMI-4-CONTROL_SOCKET_CLOSED: SIP0: nescd:
ConfD control socket closed Lost connection to ConfD (45): EOF on socket to ConfD.
*Feb 26 05:58:47.661: %DMI-4-SUB_READ_FAIL: SIP0: vtyserverutild:
ConfD subscription socket read failed Lost connection to ConfD (45):
EOF on socket to ConfD.
*Feb 26 05:58:47.667: %DMI-4-CONTROL_SOCKET_CLOSED: SIP0: syncfd:
ConfD control socket closed Lost connection to ConfD (45): EOF on socket to ConfD.
*Feb 26 05:59:43.269: %DMI-5-SYNC_START: SIP0: syncfd:
External change to running configuration detected.
The running configuration will be synchronized to the NETCONF running data store.
*Feb 26 05:59:44.624: %DMI-5-SYNC_COMPLETE: SIP0: syncfd:
The running configuration has been synchronized to the NETCONF running data store.
```

The following example shows how to commit an installed package:

```
Device# install commit

install_commit: START Sun Feb 26 06:46:48 UTC 2017
SUCCESS: install_commit Sun Feb 26 06:46:52 UTC 2017
```

The following example shows how to rollback to the base SMU package:

```
Device# install rollback to base

install_rollback: START Sun Feb 26 06:50:29 UTC 2017
7 install_rollback: Restarting impacted processes to take effect
7 install_rollback: restarting confd

*Feb 26 06:50:34.957: %DMI-4-CONTROL_SOCKET_CLOSED: SIP0: syncfd:
```

```
Confd control socket closed Lost connection to Confd (45): EOF on socket to Confd.
*Feb 26 06:50:34.962: %DMI-4-CONTROL_SOCKET_CLOSED: SIP0: nescd:
Confd control socket closed Lost connection to Confd (45): EOF on socket to Confd.
*Feb 26 06:50:34.963: %DMI-4-SUB_READ_FAIL: SIP0: vtyserverutild:
Confd subscription socket read failed Lost connection to Confd (45):
EOF on socket to Confd.Netconf processes stopped
7 install_rollback: DMP activate complete
SUCCESS: install_rollback Sun Feb 26 06:50:41 UTC 2017
*Feb 26 06:51:28.901: %DMI-5-SYNC_START: SIP0: syncfd:
External change to running configuration detected.
The running configuration will be synchronized to the NETCONF running data store.
*Feb 26 06:51:30.339: %DMI-5-SYNC_COMPLETE: SIP0: syncfd:
The running configuration has been synchronized to the NETCONF running data store.
```

**Related Commands**

Command	Description
<b>show install</b>	Displays information about install packages.

# I2 traceroute

To enable the Layer 2 traceroute server, use the **I2 traceroute** command in global configuration mode. Use the **no** form of this command to disable the Layer 2 traceroute server.

**I2 traceroute**  
**no I2 traceroute**

**Syntax Description** This command has no arguments or keywords.

**Command Modes** Global configuration (config#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	The command was introduced.

**Usage Guidelines** Layer 2 traceroute is enabled by default and opens a listening socket on User Datagram Protocol (UDP) port 2228. To close the UDP port 2228 and disable Layer 2 traceroute, use the **no I2 traceroute** command in global configuration mode.

The following example shows how to configure Layer 2 traceroute using the **I2 traceroute** command.

```
Device# configure terminal
Device(config)# I2 traceroute
```

# license right-to-use

To configure right-to-use licenses on the , use the **license right-to-use** command in privileged EXEC mode.

```
license right-to-use [activate | deactivate] [network-essentials | network-advantage] [ all |
evaluation | subscription {all | slot <1-8>}] [acceptEULA]
license right-to-use [activate | deactivate] addon [dna-essentials | dna-advantage] [ all |
evaluation | subscription {all | slot <1-8>}] [acceptEULA]
```

Syntax Description		
<b>activate</b>		Activates permanent, evaluation or subscription licenses.
<b>deactivate</b>		Deactivates permanent, evaluation or subscription licenses.
<b>network-essentials</b>		Activates the network-essentials license on the switch.
<b>network-advantage</b>		Activates the network-advantage license on the switch.
<b>addon</b>		Activates addon licenses on the switch.
<b>dna-essentials</b>		Activates the dna-essentials addon license on the switch.
<b>dna-advantage</b>		Activates the dna-advantage addon license on the switch.
<b>evaluation</b>		Activates evaluation licenses on the switch.
<b>subscription</b>		Activates subscription licenses such as dna-essentials or dna-advantage on the switch.
<b>acceptEULA</b>		Accepts End User License Agreement.
<b>slot</b> <i>switch-number</i>		Specifies the switch number.
<b>all</b>		Specifies all switches in the stack.

**Command Default** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This example shows how to activate a network-essentials evaluation license:

```
Device# license right-to-use activate network-essentials evaluation
Device# end
```

This example shows how to deactivate a network-essentials evaluation license:

```
Device# license right-to-use deactivate network-essentials evaluation
Device# end
```

This example shows how to activate a network-essentials license with acceptEULA:

```
Device# license right-to-use activate network-essentials slot 1 acceptEULA
Device# end
```

# location

To configure location information for an endpoint, use the **location** command in global configuration mode. To remove the location information, use the **no** form of this command.

**location admin-tag** *string* | **civic-location identifier** *hostid* | **civic-location identifier** *hostid* | **elin-location** {*string* | **identifier** *id*} | **geo-location identifier** *hostid* | **prefer** {**cdp weight** *priority-value* | **lldp-med weight** *priority-value* | **static config weight** *priority-value*}

**no location admin-tag** *string* | **civic-location identifier** *hostid* | **civic-location identifier** *hostid* | **elin-location** {*string* | **identifier** *id*} | **geo-location identifier** *hostid* | **prefer** {**cdp weight** *priority-value* | **lldp-med weight** *priority-value* | **static config weight** *priority-value*}

Syntax Description		
<b>admin-tag</b> <i>string</i>		Configures administrative tag or site information. Site or location information in alphanumeric format.
<b>civic-location</b>		Configures civic location information.
<b>identifier</b>		Specifies the name of the civic location, emergency, or geographical location.
<b>host</b>		Defines the host civic or geo-spatial location.
<i>id</i>		Name of the civic, emergency, or geographical location.
	<b>Note</b>	The identifier for the civic location in the LLDP-MED switch TLV is limited to 250 bytes or less. To avoid error messages about available buffer space during switch configuration, be sure that the total length of all civic-location information specified for each civic-location identifier does not exceed 250 bytes.
<b>elin-location</b>		Configures emergency location information (ELIN).
<b>geo-location</b>		Configures geo-spatial location information.
<b>prefer</b>		Sets location information source priority.

**Command Default** No default behavior or values.

**Command Modes** Global configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** After entering the **location civic-location identifier** global configuration command, you enter civic location configuration mode. After entering the **location geo-location identifier** global configuration command, you enter geo location configuration mode.

The civic-location identifier must not exceed 250 bytes.

The host identifier configures the host civic or geo-spatial location. If the identifier is not a host, the identifier only defines a civic location or geo-spatial template that can be referenced on the interface.

The **host** keyword defines the device location. The civic location options available for configuration using the **identifier** and the **host** keyword are the same. You can specify the following civic location options in civic location configuration mode:

- **additional-code**—Sets an additional civic location code.
- **additional-location-information**—Sets additional civic location information.
- **branch-road-name**—Sets the branch road name.
- **building**—Sets building information.
- **city**—Sets the city name.
- **country**—Sets the two-letter ISO 3166 country code.
- **county**—Sets the county name.
- **default**—Sets a command to its defaults.
- **division**—Sets the city division name.
- **exit**—Exits from the civic location configuration mode.
- **floor**—Sets the floor number.
- **landmark**—Sets landmark information.
- **leading-street-dir**—Sets the leading street direction.
- **name**—Sets the resident name.
- **neighborhood**—Sets neighborhood information.
- **no**—Negates the specified civic location data and sets the default value.
- **number**—Sets the street number.
- **post-office-box**—Sets the post office box.
- **postal-code**—Sets the postal code.
- **postal-community-name**—Sets the postal community name.
- **primary-road-name**—Sets the primary road name.
- **road-section**—Sets the road section.
- **room**—Sets room information.
- **seat**—Sets seat information.
- **state**—Sets the state name.
- **street-group**—Sets the street group.
- **street-name-postmodifier**—Sets the street name postmodifier.
- **street-name-premodifier**—Sets the street name premodifier.
- **street-number-suffix**—Sets the street number suffix.
- **street-suffix**—Sets the street suffix.
- **sub-branch-road-name**—Sets the sub-branch road name.
- **trailing-street-suffix**—Sets the trailing street suffix.
- **type-of-place**—Sets the type of place.
- **unit**—Sets the unit.

You can specify the following geo-spatial location information in geo-location configuration mode:

- **altitude**—Sets altitude information in units of floor, meters, or feet.
- **latitude**—Sets latitude information in degrees, minutes, and seconds. The range is from -90 degrees to 90 degrees. Positive numbers indicate locations north of the equator.



- **longitude**—Sets longitude information in degrees, minutes, and seconds. The range is from -180 degrees to 180 degrees. Positive numbers indicate locations east of the prime meridian.
- **resolution**—Sets the resolution for latitude and longitude. If the resolution value is not specified, default value of 10 meters is applied to latitude and longitude resolution parameters. For latitude and longitude, the resolution unit is measured in meters. The resolution value can also be a fraction.
- **default**—Sets the geographical location to its default attribute.
- **exit**—Exits from geographical location configuration mode.
- **no**—Negates the specified geographical parameters and sets the default value.

Use the **no lldp med-tlv-select location information** interface configuration command to disable the location TLV. The location TLV is enabled by default.

This example shows how to configure civic location information on the switch:

```
Device(config)# location civic-location identifier 1
Device(config-civic)# number 3550
Device(config-civic)# primary-road-name "Cisco Way"
Device(config-civic)# city "San Jose"
Device(config-civic)# state CA
Device(config-civic)# building 19
Device(config-civic)# room C6
Device(config-civic)# county "Santa Clara"
Device(config-civic)# country US
Device(config-civic)# end
```

You can verify your settings by entering the **show location civic-location** privileged EXEC command.

This example shows how to configure the emergency location information on the switch:

```
Device(config)# location elin-location 14085553881 identifier 1
```

You can verify your settings by entering the **show location elin** privileged EXEC command.

The example shows how to configure geo-spatial location information on the switch:

```
Device(config)# location geo-location identifier host
Device(config-geo)# latitude 12.34
Device(config-geo)# longitude 37.23
Device(config-geo)# altitude 5 floor
Device(config-geo)# resolution 12.34
```

You can use the **show location geo-location identifier** command to display the configured geo-spatial location details.

# location plm calibrating

To configure path loss measurement (CCX S60) request for calibrating clients, use the **location plm calibrating** command in global configuration mode.

**location plm calibrating multiband | uniband**

<b>Syntax Description</b>	<b>multiband</b>	Specifies the path loss measurement request for calibrating clients on the associated 802.11a or 802.11b/g radio.
	<b>uniband</b>	Specifies the path loss measurement request for calibrating clients on the associated 802.11a/b/g radio.

**Command Default** No default behavior or values.

**Command Modes** Global configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The uniband is useful for single radio clients (even if the radio is a dual band and can operate in the 2.4-GHz and the 5-GHz bands). The multiband is useful for multiple radio clients.

This example shows how to configure the path loss measurement request for calibrating clients on the associated 802.11a/b/g radio:

```
Device# configure terminal
Device(config)# location plm calibrating uniband
Device(config)# end
```

# mac address-table move update

To enable the MAC address table move update feature, use the **mac address-table move update** command in global configuration mode on the switch stack or on a standalone switch. To return to the default setting, use the **no** form of this command.

**mac address-table move update receive | transmit**  
**no mac address-table move update receive | transmit**

<b>Syntax Description</b>	<b>receive</b>	Specifies that the switch processes MAC address-table move update messages.
	<b>transmit</b>	Specifies that the switch sends MAC address-table move update messages to other switches in the network if the primary link goes down and the standby link comes up.
<b>Command Default</b>	By default, the MAC address-table move update feature is disabled.	
<b>Command Modes</b>	Global configuration	
<b>Command History</b>		
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The MAC address-table move update feature allows the switch to provide rapid bidirectional convergence if a primary (forwarding) link goes down and the standby link begins forwarding traffic.

You can configure the access switch to send the MAC address-table move update messages if the primary link goes down and the standby link comes up. You can configure the uplink switches to receive and process the MAC address-table move update messages.

## Examples

This example shows how to configure an access switch to send MAC address-table move update messages:

```
Device# configure terminal
Device(config)# mac address-table move update transmit
Device(config)# end
```

This example shows how to configure an uplink switch to get and process MAC address-table move update messages:

```
Device# configure terminal
Device(config)# mac address-table move update receive
Device(config)# end
```

You can verify your setting by entering the **show mac address-table move update** privileged EXEC command.

# mgmt\_init

To initialize the Ethernet management port, use the **mgmt\_init** command in boot loader mode.

## **mgmt\_init**

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** No default behavior or values.

---

**Command Modes** Boot loader

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

**Usage Guidelines** Use the **mgmt\_init** command only during debugging of the Ethernet management port.

---

**Examples** This example shows how to initialize the Ethernet management port:

```
Device: mgmt_init
```

# mkdir

To create one or more directories on the specified file system, use the **mkdir** command in boot loader mode.

**mkdir** *filesystem:/directory-url...*

<b>Syntax Description</b>	<i>filesystem:</i> Alias for a file system. Use <b>usbflash0:</b> for USB memory sticks.
	<i>/directory-url...</i> Name of the directories to create. Separate each directory name with a space.

<b>Command Default</b>	No default behavior or values.
------------------------	--------------------------------

<b>Command Modes</b>	Boot loader
----------------------	-------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	<p>Directory names are case sensitive.</p> <p>Directory names are limited to 127 characters between the slashes (/); the name cannot contain control characters, spaces, deletes, slashes, quotes, semicolons, or colons.</p>
-------------------------	---

## Example

This example shows how to make a directory called Saved\_Configs:

```
Device: mkdir usbflash0:Saved_Configs
Directory "usbflash0:Saved_Configs" created
```

## more

To display the contents of one or more files, use the **more** command in boot loader mode.

**more** *filesystem:/file-url...*

---

### Syntax Description

*filesystem:* Alias for a file system. Use **flash:** for the system board flash device.

*/file-url...* Path (directory) and name of the files to display. Separate each filename with a space.

---



---

### Command Default

No default behavior or values.

---

### Command Modes

Boot loader

---

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

---



---

### Usage Guidelines

Filenames and directory names are case sensitive.

If you specify a list of files, the contents of each file appears sequentially.

---

### Examples

This example shows how to display the contents of a file:

```
Device: more flash:image_file_name
version_suffix: universal-122-xx.SEx
version_directory: image_file_name
image_system_type_id: 0x00000002
image_name: image_file_name.bin
ios_image_file_size: 8919552
total_image_file_size: 11592192
image_feature: IP|LAYER_3|PLUS|MIN_DRAM_MEG=128
image_family: family
stacking_number: 1.34
board_ids: 0x00000068 0x00000069 0x0000006a 0x0000006b
info_end:
```

# no debug all

To disable debugging on a switch, use the **no debug all** command in Privileged EXEC mode.

## **no debug all**

---

**Command Default** No default behavior or values.

---

**Command Modes** Privileged EXEC

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Release 16.1	This command was introduced.

---

---

## **Examples**

This example shows how to disable debugging on a switch.

```
Device: no debug all
All possible debugging has been turned off.
```

# rename

To rename a file, use the **rename** command in boot loader mode.

**rename** *filesystem:/source-file-url filesystem:/destination-file-url*

Syntax Description	
<i>filesystem:</i>	Alias for a file system. Use <b>usbflash0:</b> for USB memory sticks.
<i>/source-file-url</i>	Original path (directory) and filename.
<i>/destination-file-url</i>	New path (directory) and filename.

**Command Default** No default behavior or values.

**Command Modes** Boot loader

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

Filenames and directory names are case sensitive.

Directory names are limited to 127 characters between the slashes (/); the name cannot contain control characters, spaces, deletes, slashes, quotes, semicolons, or colons.

Filenames are limited to 127 characters; the name cannot contain control characters, spaces, deletes, slashes, quotes, semicolons, or colons.

**Examples**

This example shows a file named *config.text* being renamed to *config1.text*:

```
Device: rename usbflash0:config.text usbflash0:config1.text
```

You can verify that the file was renamed by entering the **dir filesystem:** boot loader command.



# request platform software console attach switch

To start a session on a member switch, use the **request platform software console attach switch** command in privileged EXEC mode.



**Note** On stacking switches (Catalyst 3650/3850/9200/9300 switches), this command can only be used to start a session on the standby console. On Catalyst 9500 switches, this command is supported only in a stackwise virtual setup. You cannot start a session on member switches. By default, all consoles are already active, so a request to start a session on the active console will result in an error.

**request platform software console attach switch** { *switch-number* | **active** | **standby** } { **0/0** | **R0** }

## Syntax Description

*switch-number* Specifies the switch number. The range is from 1 to 9.

**active** Specifies the active switch.

**Note** This argument is not supported on Catalyst 9500 switches.

**standby** Specifies the standby switch.

**0/0** Specifies that the SPA-Inter-Processor slot is 0, and bay is 0.

**Note** Do not use this option with stacking switches. It will result in an error.

**R0** Specifies that the Route-Processor slot is 0.

## Command Default

By default, all switches in the stack are active.

## Command Modes

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

To start a session on the standby switch, you must first enable it in the configuration.

## Examples

This example shows how to session to the standby switch:

```
Device# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Device(config)# redundancy
Device(config-red)# main-cpu
Device(config-r-mc)# standby console enable
Device(config-r-mc)# end
Device# request platform software console attach switch standby R0
```

```
#  
# Connecting to the IOS console on the route-processor in slot 0.  
# Enter Control-C to exit.  
#  
Device-stby> enable  
Device-stby#
```

# reset

To perform a hard reset on the system, use the **reset** command in boot loader mode. A hard reset is similar to power-cycling the ; it clears the processor, registers, and memory.

**reset**

---

<b>Syntax Description</b>	This command has no arguments or keywords.
---------------------------	--

---

<b>Command Default</b>	No default behavior or values.
------------------------	--------------------------------

---

<b>Command Modes</b>	Boot loader
----------------------	-------------

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

## Examples

This example shows how to reset the system:

```
Device: reset  
Are you sure you want to reset the system (y/n)? y  
System resetting...
```

# rmdir

To remove one or more empty directories from the specified file system, use the **rmdir** command in boot loader mode.

**rmdir** *filesystem:/directory-url...*

## Syntax Description

*filesystem:* Alias for a file system. Use **usbflash0:** for USB memory sticks.

*/directory-url...* Path (directory) and name of the empty directories to remove. Separate each directory name with a space.

## Command Default

No default behavior or values.

## Command Modes

Boot loader

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Directory names are case sensitive and limited to 45 characters between the slashes (/); the name cannot contain control characters, spaces, deletes, slashes, quotes, semicolons, or colons.

Before removing a directory, you must first delete all of the files in the directory.

The **rmdir** prompts you for confirmation before deleting each directory.

## Example

This example shows how to remove a directory:

```
Device: rmdir usbflash0:Test
```

You can verify that the directory was deleted by entering the **dir filesystem:** boot loader command.

# sdm prefer

To specify the SDM template for use on the switch, use the **sdm prefer** command in global configuration mode.

```
sdm prefer
{ advanced }
```

<b>Syntax Description</b>	<b>advanced</b> Supports advanced features such as NetFlow.
---------------------------	---

<b>Command Default</b>	No default behavior or values.
------------------------	--------------------------------

<b>Command Modes</b>	Global configuration
----------------------	----------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	<p>In a stack, all stack members must use the same SDM template that is stored on the active .</p> <p>When a new is added to a stack, the SDM configuration that is stored on the active overrides the template configured on an individual .</p>
-------------------------	---

## Example

This example shows how to configure the advanced template:

```
Device(config)# sdm prefer advanced
Device(config)# exit
Device# reload
```

# service private-config-encryption

To enable private configuration file encryption, use the **service private-config-encryption** command. To disable this feature, use the **no** form of this command.

**service private-config-encryption**  
**no service private-config-encryption**

**Syntax Description** This command has no arguments or keywords.

**Command Default** No default behavior or values.

**Command Modes** Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.8.1a	This command was introduced.

## Examples

The following example shows how to enable private configuration file encryption:

```
Device> enable
Device# configure terminal
Device(config)# service private-config-encryption
```

## Related Commands

Command	Description
<b>show parser encrypt file status</b>	Displays the private configuration encryption status.

# set

To set or display environment variables, use the **set** command in boot loader mode. Environment variables can be used to control the boot loader or any other software running on the .

**set** *variable value*

## Syntax Description

<i>variable</i> <i>value</i>	<p>Use one of the following keywords for <i>variable</i> and the appropriate value for <i>value</i>:</p> <p><b>MANUAL_BOOT</b>—Decides whether the automatically or manually boots.</p> <p>Valid values are 1/Yes and 0/No. If it is set to 0 or No, the boot loader attempts to automatically boot the system. If it is set to anything else, you must manually boot the from the boot loader mode.</p>
	<p><b>BOOT</b> <i>filesystem:/file-url</i>—Identifies a semicolon-separated list of executable files to try to load and execute when automatically booting.</p> <p>If the BOOT environment variable is not set, the system attempts to load and execute the first executable image it can find by using a recursive, depth-first search through the flash: file system. If the BOOT variable is set but the specified images cannot be loaded, the system attempts to boot the first bootable file that it can find in the flash: file system.</p>
	<p><b>ENABLE_BREAK</b>—Allows the automatic boot process to be interrupted when the user presses the <b>Break</b> key on the console.</p> <p>Valid values are 1, Yes, On, 0, No, and Off. If set to 1, Yes, or On, you can interrupt the automatic boot process by pressing the <b>Break</b> key on the console after the flash: file system has initialized.</p>
	<p><b>HELPER</b> <i>filesystem:/file-url</i>—Identifies a semicolon-separated list of loadable files to dynamically load during the boot loader initialization. Helper files extend or patch the functionality of the boot loader.</p>
	<p><b>PS1</b> <i>prompt</i>—Specifies a string that is used as the command-line prompt in boot loader mode.</p>
	<p><b>CONFIG_FILE flash:</b> <i>/file-url</i>—Specifies the filename that Cisco IOS uses to read and write a nonvolatile copy of the system configuration.</p>
	<p><b>BAUD</b> <i>rate</i>—Specifies the number of bits per second (b/s) that is used for the baud rate for the console. The Cisco IOS software inherits the baud rate setting from the boot loader and continues to use this value unless the configuration file specifies another setting. The range is from 0 to 128000 b/s. Valid values are 50, 75, 110, 150, 300, 600, 1200, 1800, 2000, 2400, 3600, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 56000, 57600, 115200, and 128000.</p> <p>The most commonly used values are 300, 1200, 2400, 9600, 19200, 57600, and 115200.</p>
	<p><b>SWITCH_NUMBER</b> <i>stack-member-number</i>—Changes the member number of a stack member.</p>
	<p><b>SWITCH_PRIORITY</b> <i>priority-number</i>—Changes the priority value of a stack member.</p>

## Command Default

The environment variables have these default values:

MANUAL\_BOOT: No (0)

BOOT: Null string

ENABLE\_BREAK: No (Off or 0) (the automatic boot process cannot be interrupted by pressing the **Break** key on the console).

HELPER: No default value (helper files are not automatically loaded).

PS1 :

CONFIG\_FILE: config.text

BAUD: 9600 b/s

SWITCH\_NUMBER: 1

SWITCH\_PRIORITY: 1




---

**Note** Environment variables that have values are stored in the flash: file system in various files. Each line in the files contains an environment variable name and an equal sign followed by the value of the variable.

A variable has no value if it is not listed in these files; it has a value if it is listed even if the value is a null string. A variable that is set to a null string (for example, “”) is a variable with a value.

Many environment variables are predefined and have default values.

---

#### Command Modes

Boot loader

#### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

#### Usage Guidelines

Environment variables are case sensitive and must be entered as documented.

Environment variables that have values are stored in flash memory outside of the flash: file system.

Under typical circumstances, it is not necessary to alter the setting of the environment variables.

The MANUAL\_BOOT environment variable can also be set by using the **boot manual** global configuration command.

The BOOT environment variable can also be set by using the **boot system** *filesystem:/file-url* global configuration command.

The ENABLE\_BREAK environment variable can also be set by using the **boot enable-break** global configuration command.

The HELPER environment variable can also be set by using the **boot helper** *filesystem: /file-url* global configuration command.

The CONFIG\_FILE environment variable can also be set by using the **boot config-file flash:** */file-url* global configuration command.

The SWITCH\_NUMBER environment variable can also be set by using the **switch** *current-stack-member-number* **renumber** *new-stack-member-number* global configuration command.



The SWITCH\_PRIORITY environment variable can also be set by using the *stack-member-number* **priority** *priority-number* global configuration command.

The boot loader prompt string (PS1) can be up to 120 printable characters not including the equal sign (=).

### Example

This example shows how to set the SWITCH\_PRIORITY environment variable:

```
Device: set SWITCH_PRIORITY 2
```

You can verify your setting by using the **set** boot loader command.

# show avc client

To display information about top number of applications, use the **show avc client** command in privileged EXEC mode.

**show avc client** *client-mac* **top n application** [**aggregate** | **upstream** | **downstream**]

<b>Syntax Description</b>	<b>client</b> <i>client-mac</i> Specifies the client MAC address.				
	<b>top n application</b> Specifies the number of top "N" applications for the given client.				
<b>Command Default</b>	No default behavior or values.				
<b>Command Modes</b>	Privileged EXEC				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td></td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification		This command was introduced.
Release	Modification				
	This command was introduced.				

The following is sample output from the **show avc client** command:

```
Device# sh avc client 0040.96ae.65ec top 10 application aggregate
```

Cumulative Stats:

No.	AppName	Packet-Count	Byte-Count	AvgPkt-Size	usage%
1	skinny	7343	449860	61	94
2	unknown	99	13631	137	3
3	dhcp	18	8752	486	2
4	http	18	3264	181	1
5	tftp	9	534	59	0
6	dns	2	224	112	0

Last Interval(90 seconds) Stats:

No.	AppName	Packet-Count	Byte-Count	AvgPkt-Size	usage%
1	skinny	9	540	60	100

# show debug

To display all the debug commands available on a switch, use the **show debug** command in Privileged EXEC mode.

**show debug**

**show debug condition** *Condition identifier* / *All conditions*

<b>Syntax Description</b>	<i>Condition identifier</i>	Sets the value of the condition identifier to be used. Range is between 1 and 1000.
	<i>All conditions</i>	Shows all conditional debugging options available.

**Command Default** No default behavior or values.

**Command Modes** Privileged EXEC

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Release 16.1	This command was introduced.

**Usage Guidelines** Because debugging output is assigned high priority in the CPU process, it can render the system unusable. For this reason, use debug commands only to troubleshoot specific problems or during troubleshooting sessions with Cisco technical support staff. Moreover, it is best to use debug commands during periods of lower network traffic and fewer users. Debugging during these periods decreases the likelihood that increased debug command processing overhead will affect system use.

**Examples** This example shows the output of a **show debug** command:

```
Device# show debug condition all
```

To disable debugging, use the **no debug all** command.

# show env

To display fan, temperature, and power information for the switch (standalone switch, active switch, or standby switch), use the **show env** command in EXEC modes.

```
show env { all | fan | power [all | switch [switch-number]] | stack [stack-number] |
temperature [status] }
```

## Syntax Description

<b>all</b>	Displays fan, temperature and power environmental status.
<b>fan</b>	Displays the switch fan status.
<b>power</b>	Displays the power supply status.
<b>all</b>	(Optional) Displays the status for all power supplies.
<b>switch</b> <i>switch-number</i>	(Optional) Displays the power supply status for a specific switch.
<b>stack</b> <i>switch-number</i>	(Optional) Displays all environmental status for each switch in the stack or for a specified switch. The range is 1 to 9, depending on the switch member numbers in the stack.
<b>temperature</b>	Displays the switch temperature status.
<b>status</b>	(Optional) Displays the temperature status and threshold values.

## Command Default

No default behavior or values.

## Command Modes

User EXEC  
Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Use the **show env stack** [*switch-number*] command to display information about any switch in the stack from any member switch.

Use the **show env temperature status** command to display the switch temperature states and threshold levels.

## Example

This example shows how to display information about stack member 1 from the active switch:

```
Device> show env stack 1
Device :1
Device 1 Fan 1 is OK
Device 1 Fan 2 is OK
```

```
Device 1 Fan 3 is OK
FAN-PS1 is OK
FAN-PS2 is NOT PRESENT
Device 1: SYSTEM TEMPERATURE is OK
Inlet Temperature Value: 32 Degree Celsius
Temperature State: GREEN
Yellow Threshold : 46 Degree Celsius
Red Threshold : 56 Degree Celsius

Hotspot Temperature Value: 43 Degree Celsius
Temperature State: GREEN
Yellow Threshold : 105 Degree Celsius
Red Threshold : 125 Degree Celsius

Device>
```

This example shows how to display temperature value, state, and threshold values:

```
Device> show env temperature status
Temperature Value: 26 Degree Celsius
Temperature State: GREEN
Yellow Threshold : 46 Degree Celsius
Red Threshold : 56 Degree Celsius

Hotspot Temperature Value: 43 Degree Celsius
Temperature State: GREEN
Yellow Threshold : 105 Degree Celsius
Red Threshold : 125 Degree Celsius

Device>
```

## Examples

This example shows how to display information about member switch 1 from the active switch:

```
Device> show env stack 1
Device 1:
Device Fan 1 is OK
Device Fan 2 is OK
Device Fan 3 is OK
FAN-PS1 is OK
FAN-PS2 is NOT PRESENT
Device 1: SYSTEM TEMPERATURE is OK
Temperature Value: 32 Degree Celsius
Temperature State: GREEN
Yellow Threshold : 41 Degree Celsius
Red Threshold : 56 Degree Celsius

Device>
```

This example shows how to display temperature value, state, and threshold values:

```
Device> show env temperature status
Temperature Value: 32 Degree Celsius
Temperature State: GREEN
Yellow Threshold : 41 Degree Celsius
Red Threshold : 56 Degree Celsius
```

Device>

**Table 174: States in the show env temperature status Command Output**

State	Description
Green	The switch temperature is in the <i>normal</i> operating range.
Yellow	The temperature is in the <i>warning</i> range. You should check the external temperature around the switch.
Red	The temperature is in the <i>critical</i> range. The switch might not run properly if the temperature is in this range.

# show env xps

To display budgeting, configuration, power, and system power information for the Cisco eXpandable Power System (XPS) 2200, use the **show env xps** command in privileged EXEC mode.

```
show env xps { budgeting | configuration | port [ all | number ] | power | system |
thermal | upgrade | version }
```

Syntax Description		
<b>budgeting</b>		Displays XPS power budgeting, the allocated and budgeted power of all switches in the power stack.
<b>configuration</b>		Displays the configuration resulting from the power xps privileged EXEC commands. The XPS configuration is stored in the XPS. Enter the show env xps configuration command to retrieve the non-default configuration.
<b>port</b> [all   number ]		Displays the configuration and status of all ports or the specified XPS port. Port numbers are from 1 to 9.
<b>power</b>		Displays the status of the XPS power supplies.
<b>system</b>		Displays the XPS system status.
<b>thermal</b>		Displays the XPS thermal status.
<b>upgrade</b>		Displays the XPS upgrade status.
<b>version</b>		Displays the XPS version details.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(55)SE1	This command was introduced.

**Usage Guidelines** Use the **show env xps** privileged EXEC command to display the information for XPS 2200.

## Examples

This is an example of output from the show env xps budgeting command:

```
Switch#
=====

XPS 0101.0100.0000 :
=====
Data          Current   Power    Power Port  Switch #  PS A  PS B  Role-State
Committed
Budget
-----
223          1543
----- 1 - - 715 SP-PS
```

```

2      -      -      -      SP-PS      223      223
3      -      -      -      -          -          -
4      -      -      -      -          -          -
5      -      -      -      -          -          -
6      -      -      -      -          -          -
7      -      -      -      -          -          -
8      -      -      -      -          -          -
9      1      1100 -      RPS-NB      223      070
XPS   -      -      1100 -      -          -          -

```

This is an example of output from the show env xps configuration command:

```

Switch# show env xps configuration
=====
XPS 0101.0100.0000 :
=====
power xps port 4 priority 5
power xps port 5 mode disable
power xps port 5 priority 6
power xps port 6 priority 7
power xps port 7 priority 8
power xps port 8 priority 9
power xps port 9 priority 4

```

This is an example of output from the show env xps port all command:

```

Switch#
XPS 010

-----
Port name          : -
Connected          : Yes
Mode               : Enabled (On)
Priority           : 1
Data stack switch # : - Configured role      : Auto-SP
Run mode           : SP-PS : Stack Power Power-Sharing Mode
Cable faults       : 0x0 XPS 0101.0100.0000 Port 2
-----
Port name          : -
Connected          : Yes
Mode               : Enabled (On)
Priority           : 2
Data stack switch # : - Configured role      : Auto-SP
Run mode           : SP-PS : Stack Power Power-Sharing Mode
Cable faults       : 0x0 XPS 0101.0100.0000 Port 3
-----
Port name          : -
Connected          : No
Mode               : Enabled (On)
Priority           : 3
Data stack switch # : - Configured role      : Auto-SP Run mode           : -
Cable faults       :
<output truncated>

```

This is an example of output from the show env xps power command:

```

=====
XPS 0101.0100.0000 :
=====
Port-Supply SW PID          Serial#      Status      Mode Watts
-----
XPS-A          Not present
XPS-B          NG3K-PWR-1100WAC  LIT13320NTV OK          SP   1100
1-A           -      -          -          -

```



```

1-B      - -          - -          SP    715
2-A      - -          - -          -
2-B      - -          - -          -
9-A      - -          100WAC    LIT141307RK OK    RPS    1100
9-B      - -          esent

```

This is an example of output from the show env xps system command:

```

Switch#
=====

XPS 0101.0100.0000 :
=====
XPS          Cfg Cfg      RPS Switch  Current  Data Port  XPS Port Name
-----
Mode Role    Pri Conn  Role-State  Switch #
-----
1      -          On  Auto-SP  1  Yes      SP-PS      -
2      -          On  Auto-SP  2  Yes      SP-PS      -
3      -          On  Auto-SP  3  No       -          -
4      none         On  Auto-SP  5  No       -          -
5      -          Off  Auto-SP  6  No       -          -
6      -          On  Auto-SP  7  No       -          -
7      -          On  Auto-SP  8  No       -          -
8      -          On  Auto-SP  9  No       -          -
9      test         On  Auto-SP  4  Yes      RPS-NB

```

This is an example of output from the show env xps thermal command:

```

Switch#
=====

XPS 0101.0100.0000 :
=====
Fan  Status
----
1    OK
2    OK
3    NOT PRESENT PS-1  NOT PRESENT PS-2  OK Temperature is OK

```

This is an example of output from the show env xps upgrade command when no upgrade is occurring:

```

Switch# show env xps upgrade
No XPS is connected and upgrading.

```

These are examples of output from the show env xps upgrade command when an upgrade is in process:

```

Switch# show env xps upgrade
XPS Upgrade Xfer

SW Status Prog
--
1 Waiting 0%
Switch#
*Mar 22 03:12:46.723: %PLATFORM_XPS-6-UPGRADE_START: XPS 0022.bdd7.9b14 upgrade has
started through the Service Port.
Switch# show env xps upgrade
XPS Upgrade Xfer
SW Status Prog
--
1 Receiving 1%
Switch# show env xps upgrade

```

```

XPS Upgrade Xfer
SW Status Prog
-- -----
1 Receiving 5%
Switch# show env xps upgrade
XPS Upgrade Xfer
SW Status Prog
-- -----
1 Reloading 100%
Switch#
*Mar 22 03:16:01.733: %PLATFORM_XPS-6-UPGRADE_DONE: XPS 0022.bdd7.9b14 upgrade has
completed and the XPS is reloading.

```

This is an example of output from the show env xps version command:

```

Switch# show env xps version
=====
XPS 0022.bdd7.9b14:
=====
Serial Number: FDO13490KUT
Hardware Version: 8
Bootloader Version: 7
Software Version: 18

```

**Table 175: Related Commands**

Command	Description
power xps(global configuration command)	Configures XPS and XPS port names.
power xps(privileged EXEC command)	Configures the XPS ports and system.

# show flow monitor

To display the status and statistics for a flow monitor, use the **show flow monitor** command in privileged EXEC mode.

Syntax Description	name	(Optional) Specifies the name of a flow monitor.
	<i>monitor-name</i>	(Optional) Name of a flow monitor that was previously configured.
	<b>cache</b>	(Optional) Displays the contents of the cache for the flow monitor.
	<b>format</b>	(Optional) Specifies the use of one of the format options for formatting the display output.
	<b>csv</b>	(Optional) Displays the flow monitor cache contents in comma-separated variables (CSV) format.
	<b>record</b>	(Optional) Displays the flow monitor cache contents in record format.
	<b>table</b>	(Optional) Displays the flow monitor cache contents in table format.
	<b>statistics</b>	(Optional) Displays the statistics for the flow monitor.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **cache** keyword uses the record format by default.

The uppercase field names in the display output of the **show flowmonitor monitor-name cache** command are key fields that uses to differentiate flows. The lowercase field names in the display output of the **show flow monitor monitor-name cache** command are nonkey fields from which collects values as additional data for the cache.

## Examples

The following example displays the status for a flow monitor:

```
Device# show flow monitor FLOW-MONITOR-1

Flow Monitor FLOW-MONITOR-1:
  Description:      Used for basic traffic analysis
  Flow Record:     flow-record-1
  Flow Exporter:   flow-exporter-1
                  flow-exporter-2

Cache:
  Type:            normal
  Status:         allocated
  Size:           4096 entries / 311316 bytes
  Inactive Timeout: 15 secs
  Active Timeout: 1800 secs
```

This table describes the significant fields shown in the display.

**Table 176: show flow monitor monitor-name Field Descriptions**

Field	Description
Flow Monitor	Name of the flow monitor that you configured.
Description	Description that you configured or the monitor, or the default description User defined.
Flow Record	Flow record assigned to the flow monitor.
Flow Exporter	Exporters that are assigned to the flow monitor.
Cache	Information about the cache for the flow monitor.
Type	Flow monitor cache type. The value is always normal, as it is the only supported cache type.
Status	Status of the flow monitor cache. The possible values are: <ul style="list-style-type: none"> <li>• allocated—The cache is allocated.</li> <li>• being deleted—The cache is being deleted.</li> <li>• not allocated—The cache is not allocated.</li> </ul>
Size	Current cache size.
Inactive Timeout	Current value for the inactive timeout in seconds.
Active Timeout	Current value for the active timeout in seconds.

The following example displays the status, statistics, and data for the flow monitor named FLOW-MONITOR-1:

This table describes the significant fields shown in the display.

The following example displays the status, statistics, and data for the flow monitor named FLOW-MONITOR-1 in a table format:

The following example displays the status, statistics, and data for the flow monitor named FLOW-MONITOR-IPv6 (the cache contains IPv6 data) in record format:

The following example displays the status and statistics for a flow monitor:

# show install

To display information about install packages, use the **show install** command in privileged EXEC mode.

**show install active | committed | inactive | log | package bootflash: | flash: | webui: | rollback | summary | uncommitted**

Syntax	Description
<b>active</b>	Displays information about active packages.
<b>committed</b>	Displays package activations that are persistent.
<b>inactive</b>	Displays inactive packages.
<b>log</b>	Displays entries stored in the logging installation buffer.
<b>package</b>	Displays metadata information about the package, including description, restart information, components in the package, and so on.
<b>{bootflash:   flash:   harddisk:   webui:}</b>	Specifies the location of the install package.
<b>rollback</b>	Displays the software set associated with a saved installation.
<b>summary</b>	Displays information about the list of active, inactive, committed, and superseded packages.
<b>uncommitted</b>	Displays package activations that are nonpersistent.

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.6.1	This command was introduced.

**Usage Guidelines** Use the show commands to view the status of the install package.

## Example

The following is sample output from the **show install package** command:

```
Device# show install package bootflash:cat3k-universalk9.2017-01-10_13.15.1.
CSCxxx.SSA.dmp.bin
Name: cat3k-universalk9.2017-01-10_13.15.1.CSCxxx.SS
Version: 16.6.1.0.199.1484082952..Everest
Platform: Catalyst3k
Package Type: dmp
Defect ID: CSCxxx
Package State: Added
Supersedes List: {}
Smu ID: 1
```

The following is sample output from the **show install summary** command:

```
Device# show install summary

Active Packages:
  bootflash:cat3k-universalk9.2017-01-10_13.15.1.CSCxxx.SSA.dmp.bin
Inactive Packages:
  No packages
Committed Packages:
  bootflash:cat3k-universalk9.2017-01-10_13.15.1.CSCxxx.SSA.dmp.bin
Uncommitted Packages:
  No packages
Device#
```

The table below lists the significant fields shown in the display.

**Table 177: show install summary Field Descriptions**

Field	Description
Active Packages	Name of the active install package.
Inactive Packages	List of inactive packages.
Committed Packages	Install packages that have saved or committed changes to the harddisk, so that the changes become persistent across reloads.
Uncommitted Packages	Intall package activations that are nonpersistent.

The following is sample output from the **show install log** command:

```
Device# show install log

[0|install_op_boot]: START Fri Feb 24 19:20:19 Universal 2017
[0|install_op_boot]: END SUCCESS Fri Feb 24 19:20:23 Universal 2017
[3|install_add]: START Sun Feb 26 05:55:31 UTC 2017
[3|install_add(FATAL)]: File path (scp) is not yet supported for this command
[4|install_add]: START Sun Feb 26 05:57:04 UTC 2017
[4|install_add]: END SUCCESS
/bootflash/cat3k-universalk9.2017-01-10_13.15.1.CSCvb12345.SSA.dmp.bin
Sun Feb 26 05:57:22 UTC 2017
[5|install_activate]: START Sun Feb 26 05:58:41 UTC 2017
```

#### Related Commands

Command	Description
<b>install</b>	Installs SMU packages.

# show license right-to-use

To display detailed information for licenses installed on the , use the **show license right-to-use** command in EXEC modes.

**show license right-to-use default | detail | eula | mismatch | slot | summary | usage**

Syntax Description	default	Displays the default license information.
	<b>detail</b>	Displays details of all the licenses in the stack.
	<b>eula</b>	Displays the EULA text.
	<b>mismatch</b>	Displays mismatch license information.
	<b>slot</b>	Specifies the switch number.
	<b>summary</b>	Displays consolidated stack-wide license information.
	<b>usage</b>	Displays the usage details of all licenses.

**Command Default** No default behavior or values.

**Command Modes** User EXEC  
Privileged EXEC

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

The following is sample output from the **show license right-to-use usage** command and displays all the detailed information:

```
Device# show license right-to-use usage
```

Slot#	License Name	Type	usage-duration (y:m:d)	In-Use	EULA
1	ipservices	Permanent	00:00:00	no	no
1	ipservices	Evaluation	00:00:00	no	no
1	ibase	Permanent	01:11:12	yes	yes
1	ibase	Evaluation	00:00:00	no	no
1	lanbase	Permanent	00:00:00	no	no

The following is sample output from the **show license right-to-use detail** command and displays the detailed information of licenses:

```
Device# show license right-to-use detail

show license right-to-use detail
Index 1
```

```

License Name      : ipservices
Period left      : Lifetime
License Type     : Permanent
License State    : Not Activated
License Location : Slot 1
Index 2
License Name      : ipservices
Period left      : 90
License Type     : Evaluation
License State    : Not Activated
License Location : Slot 1
Index 3
License Name      : ipbase
Period left      : Lifetime
License Type     : Permanent
License State    : Active, In use
License Location : Slot 1
Index 4
License Name      : ipbase
Period left      : 90
License Type     : Evaluation
License State    : Not Activated
License Location : Slot 1
Index 5
License Name      : lanbase
Period left      : Lifetime
License Type     : Permanent
License State    : Not Activated
License Location : Slot 1

```

The following is sample output from the **show license right-to-use summary** command when the evaluation license is active:

```

Device# show license right-to-use summary

License Name      Type      Period left
-----
          ipbase Permanent      Lifetime
dna-advantage Subscription Subscription  Active
-----

License Level In Use: ipbase+dna-advantage Subscription
License Level on Reboot: ipbase+dna-advantage Subscription

```



# show location

To display location information for an endpoint, use the **show location** command in privileged EXEC mode.

## show location

[**admin-tag** | **civic-location***identifier identifier-string* | **interface** *type number* | **static** | **custom-location***identifier identifier-string* | **interface** *type number* | **static** | **elin-location***identifier identifier-string* | **interface** *type number* | **static** | **geo-location***identifier identifier-string* | **interface** *type number* | **static** | **host**]

Syntax Description		
<b>admin-tag</b>		Displays administrative tag or site information.
<b>civic-location</b>		Specifies civic location information.
<b>identifier</b> <i>identifier-string</i>		Information identifier of the civic location, custom location, or geo-spatial location.
<b>interface</b> <i>type number</i>		Interface type and number.  For information about the numbering syntax for your device, use the question mark (?) online help function.
<b>static</b>		Displays configured civic, custom, or geo-spatial location information.
<b>custom-location</b>		Specifies custom location information.
<b>elin-location</b>		Specifies emergency location information (ELIN).
<b>geo-location</b>		Specifies geo-spatial location information.
<b>host</b>		Specifies the civic, custom, or geo-spatial host location information.

**Command Default** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

The following sample output of the **show location civic-location** command displays civic location information for the specified identifier (*identifier 1*):

```
Device# show location civic-location identifier 1
Civic location information
-----
Identifier           : 1
County              : Santa Clara
Street number       : 3550
Building            : 19
Room                : C6
Primary road name   : Example
```

## show location

```
City           : San Jose
State          : CA
Country       : US
```

---

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>location</b>	Configures location information for an endpoint.

## show mac address-table

To display the MAC address table, use the **show mac address-table** command in privileged EXEC mode.

```
show mac address-table [ address mac-addr [ interface type/number | vlan vlan-id ] | aging-time
[ routed-mac | vlan vlan-id ] | control-packet-learn | count [ summary | vlan vlan-id ] | [ dynamic
| secure | static ] [ address mac-addr ] [ interface type/number | vlan vlan-id ] | interface type/number
| learning [ vlan vlan-id ] | multicast [ count ] [ igmp-snooping | mld-snooping | user ] [ vlan
vlan-id ] | notification change [ interface [ type/number ] ] | mac-move | threshold | vlan vlan-id
]
```

Syntax	Description
<b>address</b> <i>mac-addr</i>	(Optional) Displays information about the MAC address table for a specific MAC address.
<b>interface</b> <i>type/number</i>	(Optional) Displays addresses for a specific interface.
<b>vlan</b> <i>vlan-id</i>	(Optional) Displays addresses for a specific VLAN.
<b>aging-time</b> [ <b>routed-mac</b>   <b>vlan</b> <i>vlan-id</i> ]	(Optional) Displays the aging time for the routed MAC or VLAN.
<b>control-packet-learn</b>	(Optional) Displays the controlled packet MAC learning parameters.
<b>count</b>	(Optional) Displays the number of entries that are currently in the MAC address table.
<b>dynamic</b>	(Optional) Displays only the dynamic addresses.
<b>secure</b>	(Optional) Displays only the secure addresses.
<b>static</b>	(Optional) Displays only the static addresses.
<b>learning</b>	(Optional) Displays learnings of a VLAN or interface.
<b>multicast</b>	(Optional) Displays information about the multicast MAC address table entries only.
<b>igmp-snooping</b>	(Optional) Displays the addresses learned by Internet Group Management Protocol (IGMP) snooping.
<b>mld-snooping</b>	(Optional) Displays the addresses learned by Multicast Listener Discover version 2 (MLDv2) snooping.
<b>user</b>	(Optional) Displays the manually entered (static) addresses.
<b>notification change</b>	Displays the MAC notification parameters and history table.
<b>notification mac-move</b>	Displays the MAC-move notification status.
<b>notification threshold</b>	Displays the Counter-Addressable Memory (CAM) table utilization notification status.

## show mac address-table

**Command Modes** Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The *mac-addr* value is a 48-bit MAC address. The valid format is H.H.H.

The interface *number* argument designates the module and port number. Valid values depend on the specified interface type and the chassis and module that are used. For example, if you specify a Gigabit Ethernet interface and have a 48-port 10/100BASE-T Ethernet module that is installed in a 13-slot chassis, valid values for the module number are from 1 to 13 and valid values for the port number are from 1 to 48.

The following is sample output from the **show mac address-table** command:

```
Device# show mac address-table

          Mac Address Table
-----
Vlan      Mac Address      Type      Ports
-----
  All     0100.0ccc.cccc   STATIC    CPU
  All     0100.0ccc.cccd   STATIC    CPU
  All     0180.c200.0000   STATIC    CPU
  All     0180.c200.0001   STATIC    CPU
  All     0180.c200.0002   STATIC    CPU
  All     0180.c200.0003   STATIC    CPU
  All     0180.c200.0004   STATIC    CPU
  All     0180.c200.0005   STATIC    CPU
  All     0180.c200.0006   STATIC    CPU
  All     0180.c200.0007   STATIC    CPU
  All     0180.c200.0008   STATIC    CPU
  All     0180.c200.0009   STATIC    CPU
  All     0180.c200.000a   STATIC    CPU
  All     0180.c200.000b   STATIC    CPU
  All     0180.c200.000c   STATIC    CPU
  All     0180.c200.000d   STATIC    CPU
  All     0180.c200.000e   STATIC    CPU
  All     0180.c200.000f   STATIC    CPU
  All     0180.c200.0010   STATIC    CPU
  All     0180.c200.0021   STATIC    CPU
  All     ffff.ffff.ffff   STATIC    CPU
    1     780c.f0e1.1dc3   STATIC    Vl1
    51    0000.1111.2222   STATIC    Vl51
    51     780c.f0e1.1dc6   STATIC    Vl51
  1021    0000.0c9f.f45c   STATIC    Vl1021
  1021    0002.02cc.0002   STATIC    Gi6/0/2
  1021    0002.02cc.0003   STATIC    Gi6/0/3
  1021    0002.02cc.0004   STATIC    Gi6/0/4
  1021    0002.02cc.0005   STATIC    Gi6/0/5
  1021    0002.02cc.0006   STATIC    Gi6/0/6
  1021    0002.02cc.0007   STATIC    Gi6/0/7
  1021    0002.02cc.0008   STATIC    Gi6/0/8
  1021    0002.02cc.0009   STATIC    Gi6/0/9
  1021    0002.02cc.000a   STATIC    Gi6/0/10
```

<output truncated>

The following example shows how to display MAC address table information for a specific MAC address:

```
Device# show mac address-table address fc58.9a02.7382
```

```

                Mac Address Table
-----
Vlan    Mac Address      Type        Ports
----    -
1       fc58.9a02.7382  DYNAMIC    Te1/0/1
Total Mac Addresses for this criterion: 1

```

The following example shows how to display the currently configured aging time for a specific VLAN:

```
Device# show mac address-table aging-time vlan 1
```

```

Global Aging Time: 300
Vlan    Aging Time
----    -
1       300

```

The following example shows how to display the information about the MAC address table for a specific interface:

```
Device# show mac address-table interface TenGigabitEthernet1/0/1
```

```

                Mac Address Table
-----
Vlan    Mac Address      Type        Ports
----    -
1       fc58.9a02.7382  DYNAMIC    Te1/0/1
Total Mac Addresses for this criterion: 1

```

The following example shows how to display the MAC-move notification status:

```
Device# show mac address-table notification mac-move
```

```
MAC Move Notification: Enabled
```

The following example shows how to display the CAM-table utilization-notification status:

```
Device# show mac address-table notification threshold
```

```

      Status      limit      Interval
-----+-----+-----
enabled          50          120

```

The following example shows how to display the MAC notification parameters and history table for a specific interface:

```
Device# show mac address-table notification change interface tenGigabitEthernet1/0/1
```

```

MAC Notification Feature is Disabled on the switch
Interface                                     MAC Added Trap  MAC Removed Trap
-----
TenGigabitEthernet1/0/1                       Disabled        Disabled

```

The following example shows how to display the information about the MAC-address table for a specific VLAN:

```
Device# show mac address-table vlan 1021
```

```

-----
                Mac Address Table
-----
Vlan      Mac Address      Type      Ports
----      -
1021     0000.0c9f.f45c   STATIC    Vl1021
1021     0002.02cc.0002   STATIC    Gi6/0/2
1021     0002.02cc.0003   STATIC    Gi6/0/3
1021     0002.02cc.0004   STATIC    Gi6/0/4
1021     0002.02cc.0005   STATIC    Gi6/0/5
1021     0002.02cc.0006   STATIC    Gi6/0/6
1021     0002.02cc.0007   STATIC    Gi6/0/7
1021     0002.02cc.0008   STATIC    Gi6/0/8
1021     0002.02cc.0009   STATIC    Gi6/0/9
1021     0002.02cc.000a   STATIC    Gi6/0/10
1021     0002.02cc.000b   STATIC    Gi6/0/11
1021     0002.02cc.000c   STATIC    Gi6/0/12
1021     0002.02cc.000d   STATIC    Gi6/0/13
1021     0002.02cc.000e   STATIC    Gi6/0/14
1021     0002.02cc.000f   STATIC    Gi6/0/15
1021     0002.02cc.0010   STATIC    Gi6/0/16
1021     0002.02cc.0011   STATIC    Gi6/0/17
1021     0002.02cc.0012   STATIC    Gi6/0/18
1021     0002.02cc.0013   STATIC    Gi6/0/19
1021     0002.02cc.0014   STATIC    Gi6/0/20

```

<output truncated>

The table below describes the significant fields shown in the **show mac address-table** display.

**Table 178: show mac address-table Field Descriptions**

Field	Description
VLAN	VLAN number.
Mac Address	MAC address of the entry.
Type	Type of address.
Ports	Port type.
Total MAC addresses	Total MAC addresses in the MAC address table.

#### Related Commands

Command	Description
<b>clear mac address-table</b>	Deletes dynamic entries from the MAC address table.

# show mac address-table move update

To display the MAC address-table move update information on the , use the **show mac address-table move update** command in EXEC mode.

## show mac address-table move update

**Syntax Description** This command has no arguments or keywords.

**Command Default** No default behavior or values.

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Example

This example shows the output from the **show mac address-table move update** command:

```
Device# show mac address-table move update

Switch-ID : 010b.4630.1780
Dst mac-address : 0180.c200.0010
Vlans/Macs supported : 1023/8320
Default/Current settings: Rcv Off/On, Xmt Off/On
Max packets per min : Rcv 40, Xmt 60
Rcv packet count : 10
Rcv conforming packet count : 5
Rcv invalid packet count : 0
Rcv packet count this min : 0
Rcv threshold exceed count : 0
Rcv last sequence# this min : 0
Rcv last interface : Po2
Rcv last src-mac-address : 0003.fd6a.8701
Rcv last switch-ID : 0303.fd63.7600
Xmt packet count : 0
Xmt packet count this min : 0
Xmt threshold exceed count : 0
Xmt pak buf unavail cnt : 0
Xmt last interface : None
```

# show parser encrypt file status

To view the private configuration encryption status, use the **show parser encrypt file status** command.

## show parser encrypt file status

**Syntax Description** This command has no arguments or keywords.

**Command Default** None

**Command Modes** User EXEC

Command History	Release	Modification
	Cisco IOS XE Fuji 16.8.1a	This command was introduced.

## Examples

The following command output indicates that the feature is available and the file is encrypted. The file is in 'cipher text' format.

```
Device> enable
Device# show parser encrypt file status
Feature:           Enabled
File Format:       Cipher text
Encryption Version: ver1
```

## Related Commands

Command	Description
<b>service private-config-encryption</b>	Enables private configuration file encryption.



# show platform integrity

To display checksum record for the boot stages , use the **show platform integrity** command in privileged EXEC mode.

```
show platform integrity [sign [nonce <nonce>]]
```

<b>Syntax Description</b>	<b>sign</b>	(Optional) Show signature
	<b>nonce</b>	(Optional) Enter a nonce value
<b>Command Modes</b>	Privileged EXEC (#)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.

## Examples

This example shows how to view the checksum record for boot stages :

```
Device# show platform integrity sign

PCR0: EE47F8644C2887D9BD4DE3E468DD27EB93F4A606006A0B7006E2928C50C7C9AB
PCR8: E7B61EC32AFA43DA1FF4D77F108CA266848B32924834F5E41A9F6893A9CB7A38
Signature version: 1
Signature:
816C5A29741BBAC1961C109FFC36DA5459A44DBF211025F539AFB4868EF91834C05789
5DAFBC7474F301916B7D0D08ABE5E05E66598426A73E921024C21504383228B6787B74
8526A305B17DAD3CF8705BACFD51A2D55A333415CABC73DAFDEEFD8777AA77F482EC4B
731A09826A41FB3EFC46DC02FBA666534DBEC7DCC0C029298DB8462A70DBA26833C2A
1472D1F08D721BA941CB94A418E43803699174572A5759445B3564D8EAE57D64AE304
EE1D2A9C53E93E05B24A92387E261199CED8D8A0CE7134596FF8D2D6E6DA773757C70C
D3BA91C43A591268C248DF32658999276FB972153ABE823F0ACFE9F3B6F0AD1A00E257
4A4CC41C954015A59FB8FE
Platform: WS-C3650-12X48UZ
```

# show platform sudi certificate

To display checksum record for the specific SUDI, use the **show platform sudi certificate** command in privileged EXEC mode.

**show platform sudi certificate** [**sign** [**nonce** <nonce> ]]

<b>Syntax Description</b>	<b>sign</b>	(Optional) Show signature
	<b>nonce</b>	(Optional) Enter a nonce value
<b>Command Modes</b>	Privileged EXEC (#)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
		This command was introduced.

## Examples

This example shows how to view the checksum record for a specific SUDI :

```
Device# show platform sudi certificate

-----BEGIN CERTIFICATE-----
MIIDQzCCAiuqAwIBAgIQX/h7KctU3I1CoxW1aMmt/zANBgkqhkiG9w0BAQUFADA1
MRYwFAYDVQQKEw1DaXNjbyBTeXN0ZW1zMRswGQYDVQQDExJDaXNjbyBSb290IENB
IDIwNDgwHhcNMMDQwNTE0MjAxNzEyWhcNMjkwNTE0MjAyNTQyWjA1MRYwFAYDVQQK
Ew1DaXNjbyBTeXN0ZW1zMRswGQYDVQQDExJDaXNjbyBSb290IENBIDIwNDgwggEg
MA0GCSqGSIb3DQEBAQUAA4IBDQAwggEIAoIBAQCwmrmrp68Kd6ficba0ZmKUEIhH
xmJVhEAYv8CrLqUccda8bnuoqrpu0hWISEwDovyD0My5jOamaHBKeN8hF570YQXJ
FcjPFto1YYmUQ6iEqDGYeJu5Tm8sUxJsZR2tKys7McQr/4NEb7Y9JHcJ6r8qqB9q
VvYgDxFU14F1pyXOWWqCZe+36ufijXWLBvLdT6ZeYpzPEApk0E5tziVMW/VgpSDH
jWn0f84bcN5wGyDWbs2mAg8EtKpP6BrXruOIIt6ke01a06g58QBdKhTcYtKmg9l
Eg6CTY5j/e/rmxxrbU6YTYK/CfdFhbBcl1HP7R2RQgYCUTOG/rksc35LtLgXfAgED
o1EwtzALBgnVHQ8EBAMCAyYwDwYDVR0TAQH/BAUwAwEB/zAdBgnVHQ4EFgQUJ/PI
FR5umgIJFq0roIlgX9p7L6owEAYJKwYBBAGCNxUBBAMCAQAwDQYJKoZIhvcNAQEF
BQADggEBAJ2dhIsjQal8dwy3U8pORFbi71R803UXHOjgkxhLtv5M0hmBvRbW7hmW
Yqpao2TB9k5UM8Z3/sUcuVdJcr18JOagEu5sv4dEX+5wW4q+ffY0vhN4TauYuX
cB7w4ovXsNgOnbFp1iqRe6lJT37mjpxYgyc81WhJdTsd9i7rp77rMKsSH0T8lasz
Bvt9YAretIpjsJyp8qS5UwGH0GikJ3+r/+n6yUA4iGe00caEb1fJU9u6ju7Aq7L4
CYNu/2bPPu8Xs1gYJQk0XuPL1hS27PKSb3TkL4Eq1ZKR4OCXPDJoBYVL0fdX41Id
kxpUnwVwwEpxYB5DC2Ae/qPOgRnhCzU=
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
MIIEPDCCAYsGAWIBAgIKYQ1ufQAAAAAADANBgkqhkiG9w0BAQUFADA1MRYwFAYD
VQQKEw1DaXNjbyBTeXN0ZW1zMRswGQYDVQQDExJDaXNjbyBSb290IENBIDIwNDgw
HhcNMTEwNjMwMTc1NjU3WhcNMjkwNTE0MjAyNTQyWjA1MRYwFAYDVQQKEw1DaXNj
bzEVMBMGA1UEAxMMQUNUMiBTVURJENBMIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8A
MIIBCgKCAQEAM5l3THIx9tN/hS5qR/6UZRpdd+9aE2JbFkNjht6gfHKd477Aks
5XAtUs5oxDYvt/zEbs1Zq3+LR6qrqKQVU6JYvH05UYLBqCj38s76NLk53905Wzp
9pRcmRCPuX+a6tHF/qRuOiJ44mdeDYZo3qPCpxzprWJDPc1M4iYKHUMMQmqmgmg+
xghHIooWS80BOccdiynEbeP5rZ7qRuewKmp11TiI3WdBNjZjnpfjg66F+P4SaDkGb
BXdg13oVeF+EyFWLrFjj97fL2+8oauV43Qrvnf3d/GfqXj7ew+z/sX1XtEOjSXJ
URsyMEj53Rdd9tJwHky8neapszS+r+kdVQIDAQABO4IBWjCCAVYwCwYDVR0PBAQD
AgHGMB0GA1UdDgQWBbRI2PHxwnDVW7t8cwmTr7i4MAP4fzAfBgnVHSMEGDAWgBQn
88gVHm6aAgkWrSugiWBF2nsvqjBDBgnVHR8EPDA6MDiGnQA0hjJodHRwOi8vd3d3
LmNpc2NvLmNvbS9zZW51cml0eS9wa2kvY3JsL2NyY2EyMDQ4LmNybDBQBggrBgEF
```

```

BQcBAQREMEIwQAYIKwYBBQUHMAKGNgh0dHA6Ly93d3cuY2l2Y28uY29tL3N1Y3Vy
aXR5L3BraS9jZXJ0cy9jcmNhMjA0OC5jZXIwXAYDVR0gBFUwUzBRBgorBgEAAQkV
AQwAMEMwQQYIKwYBBQUHAgEWNWh0dHA6Ly93d3cuY2l2Y28uY29tL3N1Y3VyXR5
L3BraS9wb2xpY2l1cy9pbmRleC5odG1sMBIGAlUdEwEB/wQIMAYBAf8CAQAwdQYJ
KoZlIhvcNAQEFBQADggEBAGh1qclr9tx4hzWgDERm371yeuEmqcIfi9b9+GbMSJbi
ZHc/CcC101Ju0a9zTXA9w47H9/t61eduGxb4WeLxcwCiUgvFtCa51Iklt8nNbcKY
/4dw1ex+7amATUQO4QggIE67wVlPu6bgAE3Ja/nRS3xKYSnj8H5TehimBSv6TECi
i5jUhOwryAK4dVo8hCjkjEkzu3ufBTJapnv89g9OE+H3VKM4L+/KdkUO+52djFKn
hyl47d7cZR4DY4LIuFM2P1As8YyjoNpK/urSRI14WdI1plR1nH7KND15618yfVp
0IFJZBGrooCRBjOSwFv8cpWCbmWdPaCQT2nwIjTfY8c=
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
MIIDhjCCAm6gAwIBAgIDctWkMA0GCSqGSIb3DQEBCwUAMCcxDjAMBgNVBAoTBUNp
c2NvMRUwEwYDVQQDEwxQ1QyIFNVREkgQ0EwHhcNMjUwODA2MDgwODI5WhcNMjUw
ODA2MDgwODI5WjBzMSwwKgYDVQQFEyNQSUQ6V1MtQzM2NTAtMTJYNDhVWjBTtjPjG
RE8xOTMyWDAwQzEOMAwGA1UEChMFQ2l2Y28xGDAwBGNVBASTDFDVC0yIExpDGUg
U1VESTZMBcGA1UEAxMQV1MtQzM2NTAtMTJYNDhVWjCCASIwDQYJKoZIhvcNAQEB
BQADggEPADCCAQoCggEBANZxOGYI0eUl4HcSwjL4HO75qTj19C2BHG3ufce9ikkN
xwGX18qq8vKxub9tRYRaJC5bP1Wmoq7+ZJtQA079xE4X14soNbkq5NaUhh7RB1wD
iRUJvTfCOzVICbNfbzvtB30I75tCarFNmpd0K6AFrIa41U988QGqaCj7R1JrYNaj
nc73UXXM/hc0HtNR5mhyqer5Y2qjjzo6tHZYqrrx2eS1X0a262ZSQriAxmaH/KLC
K97ywyRbdJlxBRX3hGtKlog8nASB8WpXqB9NVCERzUajwU3L/kg2BsCqw9Y2m7HW
U1cerTxgthuyUkdNI+Jg6iGAp2+s8E9hsHPBPMCdIsCAwEAAANvMG0wDgYDVR0P
AQH/BAQDAgXgMAWGA1UdEwEB/wQCMAAwTQYDVR0RBeywRKBCBgkrBgEAAQkVAgOg
NRMzQ2hpcE1EPVVZSk5ORmRRR1FvN1ZIVmxJRTlqZENBeU9DQXhPRG93T1RveE1T
QVg5eWc9MA0GCSqGSIb3DQEBCwUAA4IBAQBKicTRZbVCRjVIR5MQcWXUT086v6Ej
HahDHTts3YpQoyAVfioNg2x8J6EXcEau4voyVu+eMUuoNL4szPhmmDcULfiCGBcA
/R3EFuoVMIzNT0geziytsCf728KGw1oGuosgvjNGOOahUELu4+F/My7bIJNBH+PD
KjIFmhJpJg0F3q17yClAeXvd13g3W393i35d0Lm5L1WbBfQTyBaOLAbxsHvutrX
ulVZ5sdqSTwTkk09vKMaQjh7a8J/AmJi93jvzM69pe5711P1zqZfYfpiJ3cyJ0xf
I4brQ1smdczl0FD4asF7A+1vor5e4VDBP0ppmeFAJvCQ52JTpj0M0o1D
-----END CERTIFICATE-----

```

# show running-config

To display the contents of the current running configuration file or the configuration for a specific module, Layer 2 VLAN, class map, interface, map class, policy map, or virtual circuit (VC) class, use the **show running-config** command in privileged EXEC mode.

**show running-config** [*options*]

---

## Syntax Description

*options* (Optional) Keywords used to customize output. You can enter more than one keyword.

- **aaa** [**accounting** | **attribute** | **authentication** | **authorization** | **diameter** | **group** | **ldap** | **miscellaneous** | **radius-server** | **server** | **tacacs-server** | **user-name** | **username**]: Displays AAA configurations.
  - **all**: Expands the output to include the commands that are configured with default parameters. If the **all** keyword is not used, the output does not display commands configured with default parameters.
  - **bridge-domain** {**id** | **parameterized vlan**}: Displays the running configuration for bridge domains.
  - **brief**: Displays the configuration without certification data and encrypted filter details.
  - **class-map** [*name*] [**linenum**]: Displays class map information.
  - **cts** [**interface** | **policy-server** | **rbm-rbac** | **server** | **sxp**]: Displays Cisco TrustSec configurations.
  - **deprecated**: Displays deprecated configuration along with the running configuration.
  - **eap** {**method** | **profiles**}: Displays EAP method configurations and profiles.
  - **flow** {**exporter** | **monitor** | **record**}: Displays global flow configuration commands.
  - **full**: Displays the full configuration.
  - **identity** {**policy** | **profile**}: Displays identity profile or policy information.
-

- **interface** *type number*: Displays interface-specific configuration information. If you use the **interface** keyword, you must specify the interface type and the interface number (for example, **interface GigabitEthernet 1/0/1**). Use the **show run interface ?** command to determine the interfaces available on your system.
- **ip dhcp pool** [*name*]: Displays IPv4 DHCP pool configuration.
- **ipv6 dhcp pool** [*name*]: Displays IPv6 DHCP pool configuration.
- **linenum** [**brief** | **full** | **partition**]: Displays line numbers in the output.
- **map-class** [**atm** | **dialer** | **frame-relay**] [*name*]: Displays map class information.
- **mdns-sd** [**gateway** | **location-group** | **service-definition** | **service-list** | **service-peer** | **service-policy**]: Displays Multicast DNS Service Discovery (mDNS-SD) configurations.
- **partition** {**access-list** | **class-map** | **common** | **global-cdp** | **interface** | **ip-as-path** | **ip-community** | **ip-prefix-list** | **ip-static-routes** | **line** | **policy-map** | **route-map** | **router** | **snmp** | **tacacs**}: Displays the configuration corresponding to a partition.
- **policy-map** [*name*] [**linenum**]: Displays policy map information.
- **switch** *number*: Displays configuration for the specified switch.
- **view** [**full**]: Enables the display of a full running configuration. This is for view-based users who typically can only view the configuration commands that they are entitled to access for that particular view.
- **vlan** [*vlan-id*]: Displays the specific VLAN information; valid values are from 1 to 4094.
- **vrf** [*vrf-name*]: Displays the Virtual routing and forwarding (VRF)-aware configuration module number .

**Command Default**

The default syntax, **show running-config**, displays the contents of the running configuration file, except commands configured using the default parameters.

**Command Modes**

Privileged EXEC (#)

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

The **show running-config** command is technically a command alias (substitute or replacement syntax) of the **more system:running-config** command. Although the use of more commands is recommended (because of their uniform structure across platforms and their expandable syntax), the **show running-config** command remains enabled to accommodate its widespread use, and to allow typing shortcuts such as **show run**.

The **show running-config interface** command is useful when there are multiple interfaces and you want to look at the configuration of a specific interface.

The **linenum** keyword causes line numbers to be displayed in the output. This option is useful for identifying a particular portion of a very large configuration.

You can enter additional output modifiers in the command syntax by including a pipe character (|) after the optional keyword. For example, **show running-config interface GigabitEthernet 1/0/1 linenum | begin 3**.

To display the output modifiers that are available for a keyword, enter `| ?` after the keyword. Depending on the platform you are using, the keywords and the arguments for the *options* argument may vary.

The **show running-config all** command displays complete configuration information, including the default settings and values. For example, if the Cisco Discovery Protocol (abbreviated as CDP in the output) hold-time value is set to its default of 180:

- The **show running-config** command does not display this value.
- The **show running-config all** displays the following output: `cdp holdtime 180`.

If the Cisco Discovery Protocol holdtime is changed to a nondefault value (for example, 100), the output of the **show running-config** and **show running-config all** commands is the same; that is, the configured parameter is displayed.

The **show running-config** command displays ACL information. To exclude ACL information from the output, use the **show running | section exclude ip access | access list** command.

## Examples

The following example shows the configuration for GigabitEthernet0/0 interface. The fields are self-explanatory.

```
Device# show running-config interface gigabitEthernet0/0

Building configuration...

Current configuration : 130 bytes
!
interface GigabitEthernet0/0
 vrf forwarding Mgmt-vrf
 ip address 10.5.20.10 255.255.0.0
 negotiation auto
 ntp broadcast
end
```

The following example shows how to set line numbers in the command output and then use the output modifier to start the display at line 10. The fields are self-explanatory.

```
Device# show running-config linenum | begin 10

 10 : boot-start-marker
 11 : boot-end-marker
 12 : !
 13 : no logging buffered
 14 : enable password #####
 15 : !
 16 : spe 1/0 1/7
 17 :  firmware location bootflash:mica-modem-pw.10.16.0.0.bin
 18 : !
 19 : !
 20 : resource-pool disable
 21 : !
 22 : no aaa new-model
 23 : ip subnet-zero
 24 : ip domain name cisco.com
 25 : ip name-server 172.16.11.48
 26 : ip name-server 172.16.2.133
 27 : !
 28 : !
 29 : isdn switch-type primary-5ess
 30 : !
.
```

```
.
.
126 : end
```

In the following sample output from the **show running-config** command, the **shape average** command indicates that the traffic shaping overhead accounting for ATM is enabled. The BRAS-DSLAM encapsulation type is qinq and the subscriber line encapsulation type is snap-rbe based on the ATM adaptation layer 5 (AAL5) service. The fields are self-explanatory.

```
Device# show running-config
.
.
.
subscriber policy recording rules limit 64
no mpls traffic-eng auto-bw timers frequency 0
call rsvp-sync
!
controller T1 2/0
framing sf
linecode ami
!
controller T1 2/1
framing sf
linecode ami
!
!
policy-map unit-test
class class-default
shape average percent 10 account qinq aal5 snap-rbe
!
```

The following is sample output from the **show running-config class-map** command. The fields in the display are self-explanatory.

```
Device# show running-config class-map

Building configuration...

Current configuration : 2157 bytes
!
class-map match-any system-cpp-police-ewlc-control
  description EWLC Control
class-map match-any system-cpp-police-topology-control
  description Topology control
class-map match-any system-cpp-police-sw-forward
  description Sw forwarding, L2 LVX data packets, LOGGING, Transit Traffic
class-map match-any system-cpp-default
  description EWLC Data, Inter FED Traffic
class-map match-any system-cpp-police-sys-data
  description Openflow, Exception, EGR Exception, NFL Sampled Data, RPF Failed
class-map match-any system-cpp-police-punt-webauth
  description Punt Webauth
class-map match-any system-cpp-police-l2lvx-control
  description L2 LVX control packets
class-map match-any system-cpp-police-forus
  description Forus Address resolution and Forus traffic
class-map match-any system-cpp-police-multicast-end-station
  description MCAST END STATION
class-map match-any system-cpp-police-high-rate-app
  description High Rate Applications
class-map match-any system-cpp-police-multicast
  description MCAST Data
class-map match-any system-cpp-police-l2-control
  description L2 control
```

```

class-map match-any system-cpp-police-dot1x-auth
  description DOT1X Auth
class-map match-any system-cpp-police-data
  description ICMP redirect, ICMP_GEN and BROADCAST
class-map match-any system-cpp-police-stackwise-virt-control
  description Stackwise Virtual OOB
...

```

The following example shows that the teletype (tty) line 2 is reserved for communicating with the second core:

```

Device# show running

Building configuration...

Current configuration:
!
version 12.0
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname device
!
enable password lab
!
no ip subnet-zero
!
!
!
interface Ethernet0
 ip address 10.25.213.150 255.255.255.128
 no ip directed-broadcast
 no logging event link-status
!
interface Serial0
 no ip address
 no ip directed-broadcast
 no ip mroute-cache
 shutdown
 no fair-queue
!
interface Serial1
 no ip address
 no ip directed-broadcast
 shutdown
!
ip default-gateway 10.25.213.129
ip classless
ip route 0.0.0.0 0.0.0.0 10.25.213.129
!
!
line con 0
 transport input none
line 1 6
 no exec
 transport input all
line 7
 no exec
 exec-timeout 300 0
 transport input all
line 8 9
 no exec
 transport input all

```



```

line 10
  no exec
  transport input all
  stopbits 1
line 11 12
  no exec
  transport input all
line 13
  no exec
  transport input all
  speed 115200
line 14 16
  no exec
  transport input all
line aux 0
line vty 0 4
  password cisco
  login
!
end

```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>copy running-config startup-config</b>	Copies the running configuration to the startup configuration. (Command alias for the <b>copy system:running-config nvram:startup-config</b> command.)
<b>show startup-config</b>	Displays the contents of NVRAM (if present and valid) or displays the configuration file pointed to by the CONFIG_FILE environment variable. (Command alias for the <b>more:nvram startup-config</b> command.)

# show sdm prefer

To display information about the templates that can be used to maximize system resources for a particular feature, use the **show sdm prefer** command in privileged EXEC mode. To display the current template, use the command without a keyword.

**show sdm prefer** [**advanced**]

<b>Syntax Description</b>	<b>advanced</b> (Optional) Displays information on the advanced template.
---------------------------	---

<b>Command Default</b>	No default behavior or values.
------------------------	--------------------------------

<b>Command Modes</b>	Privileged EXEC
----------------------	-----------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

<b>Usage Guidelines</b>	If you did not reload the switch after entering the <b>sdm prefer</b> global configuration command, the <b>show sdm prefer</b> privileged EXEC command displays the template currently in use and not the newly configured template.
-------------------------	--

The numbers displayed for each template represent an approximate maximum number for each feature resource. The actual number might vary, depending on the actual number of other features configured. For example, in the default template if your had more than 16 routed interfaces (subnet VLANs), the number of possible unicast MAC addresses might be less than 6000.

## Example

The following is sample output from the **show sdm prefer** command:

```
Device# show sdm prefer

Showing SDM Template Info

This is the Advanced template.
Number of VLANs:                               4094
Unicast MAC addresses:                          32768
Overflow Unicast MAC addresses:                 512
IGMP and Multicast groups:                     8192
Overflow IGMP and Multicast groups:             512
Directly connected routes:                     32768
Indirect routes:                               7680
Security Access Control Entries:                3072
QoS Access Control Entries:                    3072
Policy Based Routing ACEs:                     1024
Netflow ACEs:                                  1024
Input Microflow policer ACEs:                  256
Output Microflow policer ACEs:                 256
Flow SPAN ACEs:                               256
Tunnels:                                       256
```

```
Control Plane Entries:          512
Input Netflow flows:           8192
Output Netflow flows:         16384
SGT/DGT entries:               4096
SGT/DGT Overflow entries:      512
These numbers are typical for L2 and IPv4 features.
Some features such as IPv6, use up double the entry size;
so only half as many entries can be created.
```

```
Device#
```

# system env temperature threshold yellow

To configure the difference between the yellow and red temperature thresholds that determines the value of yellow threshold, use the **system env temperature threshold yellow** command in global configuration mode. To return to the default value, use the **no** form of this command.

**system env temperature threshold yellow** *value*  
**no system env temperature threshold yellow** *value*

---

**Syntax Description**     *value* Specifies the difference between the yellow and red threshold values (in Celsius). The range is 10 to 25.

---



---

**Command Default**     These are the default values

*Table 179: Default Values for the Temperature Thresholds*

Device	Difference between Yellow and Red	Red <sup>10</sup>
Catalyst 9500	14°C	60°C

<sup>10</sup> You cannot configure the red temperature threshold.

---

**Command Modes**     Global configuration

---

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---



---

**Usage Guidelines**     You cannot configure the green and red thresholds but can configure the yellow threshold. Use the **system env temperature threshold yellow** *value* global configuration command to specify the difference between the yellow and red thresholds and to configure the yellow threshold. For example, if the red threshold is 66 degrees C and you want to configure the yellow threshold as 51 degrees C, set the difference between the thresholds as 15 by using the **system env temperature threshold yellow 15** command. For example, if the red threshold is 60 degrees C and you want to configure the yellow threshold as 51 degrees C, set the difference between the thresholds as 15 by using the **system env temperature threshold yellow 9** command.




---

**Note**     The internal temperature sensor in the `measures` measures the internal system temperature and might vary  $\pm 5$  degrees C.

---



---

## Examples

This example sets 15 as the difference between the yellow and red thresholds:

```
Device(config)# system env temperature threshold yellow 15
Device(config)#
```



## tracroute mac

To display the Layer 2 path taken by the packets from the specified source MAC address to the specified destination MAC address, use the **tracroute mac** command in privileged EXEC mode.

```
tracroute mac [interface interface-id] source-mac-address [interface interface-id]
destination-mac-address [vlan vlan-id] [detail]
```

### Syntax Description

<b>interface</b> <i>interface-id</i>	(Optional) Specifies an interface on the source or destination .
<i>source-mac-address</i>	The MAC address of the source in hexadecimal format.
<i>destination-mac-address</i>	The MAC address of the destination in hexadecimal format.
<b>vlan</b> <i>vlan-id</i>	(Optional) Specifies the VLAN on which to trace the Layer 2 path that the packets take from the source to the destination . Valid VLAN IDs are 1 to 4094.
<b>detail</b>	(Optional) Specifies that detailed information appears.

### Command Default

No default behavior or values.

### Command Modes

Privileged EXEC

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

For Layer 2 traceroute to function properly, Cisco Discovery Protocol (CDP) must be enabled on all of the es in the network. Do not disable CDP.

When the detects a device in the Layer 2 path that does not support Layer 2 traceroute, the continues to send Layer 2 trace queries and lets them time out.

The maximum number of hops identified in the path is ten.

Layer 2 traceroute supports only unicast traffic. If you specify a multicast source or destination MAC address, the physical path is not identified, and an error message appears.

The **tracroute mac** command output shows the Layer 2 path when the specified source and destination addresses belong to the same VLAN.

If you specify source and destination addresses that belong to different VLANs, the Layer 2 path is not identified, and an error message appears.

If the source or destination MAC address belongs to multiple VLANs, you must specify the VLAN to which both the source and destination MAC addresses belong.

If the VLAN is not specified, the path is not identified, and an error message appears.

The Layer 2 traceroute feature is not supported when multiple devices are attached to one port through hubs (for example, multiple CDP neighbors are detected on a port).

When more than one CDP neighbor is detected on a port, the Layer 2 path is not identified, and an error message appears.

This feature is not supported in Token Ring VLANs.

### Examples

This example shows how to display the Layer 2 path by specifying the source and destination MAC addresses:

```
Device# traceroute mac 0000.0201.0601 0000.0201.0201
Source 0000.0201.0601 found on con6[WS-C3750E-24PD] (2.2.6.6)
con6 (2.2.6.6) :Gi0/0/1 => Gi0/0/3
con5          (2.2.5.5      ) :   Gi0/0/3 => Gi0/0/1
con1          (2.2.1.1      ) :   Gi0/0/1 => Gi0/0/2
con2          (2.2.2.2      ) :   Gi0/0/2 => Gi0/0/1
Destination 0000.0201.0201 found on con2[WS-C3550-24] (2.2.2.2)
Layer 2 trace completed
```

This example shows how to display the Layer 2 path by using the **detail** keyword:

```
Device# traceroute mac 0000.0201.0601 0000.0201.0201 detail
Source 0000.0201.0601 found on con6[WS-C3750E-24PD] (2.2.6.6)
con6 / WS-C3750E-24PD / 2.2.6.6 :
    Gi0/0/2 [auto, auto] => Gi0/0/3 [auto, auto]
con5 / WS-C2950G-24-EI / 2.2.5.5 :
    Fa0/3 [auto, auto] => Gi0/1 [auto, auto]
con1 / WS-C3550-12G / 2.2.1.1 :
    Gi0/1 [auto, auto] => Gi0/2 [auto, auto]
con2 / WS-C3550-24 / 2.2.2.2 :
    Gi0/2 [auto, auto] => Fa0/1 [auto, auto]
Destination 0000.0201.0201 found on con2[WS-C3550-24] (2.2.2.2)
Layer 2 trace completed.
```

This example shows how to display the Layer 2 path by specifying the interfaces on the source and destination es:

```
Device# traceroute mac interface fastethernet0/1 0000.0201.0601 interface fastethernet0/3
0000.0201.0201
Source 0000.0201.0601 found on con6[WS-C3750E-24PD] (2.2.6.6)
con6 (2.2.6.6) :Gi0/0/1 => Gi0/0/3
con5          (2.2.5.5      ) :   Gi0/0/3 => Gi0/0/1
con1          (2.2.1.1      ) :   Gi0/0/1 => Gi0/0/2
con2          (2.2.2.2      ) :   Gi0/0/2 => Gi0/0/1
Destination 0000.0201.0201 found on con2[WS-C3550-24] (2.2.2.2)
Layer 2 trace completed
```

This example shows the Layer 2 path when the is not connected to the source :

```
Device# traceroute mac 0000.0201.0501 0000.0201.0201 detail
Source not directly connected, tracing source .....
```

```
Source 0000.0201.0501 found on con5[WS-C3750E-24TD] (2.2.5.5)
con5 / WS-C3750E-24TD / 2.2.5.5 :
    Gi0/0/1 [auto, auto] => Gi0/0/3 [auto, auto]
```

```
con1 / WS-C3550-12G / 2.2.1.1 :
    Gi0/1 [auto, auto] => Gi0/2 [auto, auto]
con2 / WS-C3550-24 / 2.2.2.2 :
    Gi0/2 [auto, auto] => Fa0/1 [auto, auto]
Destination 0000.0201.0201 found on con2[WS-C3550-24] (2.2.2.2)
Layer 2 trace completed.
```

This example shows the Layer 2 path when the cannot find the destination port for the source MAC address:

```
Device# tracroute mac 0000.0011.1111 0000.0201.0201
Error:Source Mac address not found.
Layer2 trace aborted.
```

This example shows the Layer 2 path when the source and destination devices are in different VLANs:

```
Device# tracroute mac 0000.0201.0601 0000.0301.0201
Error:Source and destination macs are on different vlans.
Layer2 trace aborted.
```

This example shows the Layer 2 path when the destination MAC address is a multicast address:

```
Device# tracroute mac 0000.0201.0601 0100.0201.0201
Invalid destination mac address
```

This example shows the Layer 2 path when source and destination es belong to multiple VLANs:

```
Device# tracroute mac 0000.0201.0601 0000.0201.0201
Error:Mac found on multiple vlans.
Layer2 trace aborted.
```



## traceroute mac ip

To display the Layer 2 path taken by the packets from the specified source IP address or hostname to the specified destination IP address or hostname, use the **traceroute mac ip** command in privileged EXEC mode.

**traceroute mac ip** *source-ip-address source-hostname destination-ip-address destination-hostname* [detail]

Syntax Description		
<i>source-ip-address</i>	The IP address of the source	as a 32-bit quantity in dotted-decimal format.
<i>source-hostname</i>	The IP hostname of the source	.
<i>destination-ip-address</i>	The IP address of the destination	as a 32-bit quantity in dotted-decimal format.
<i>destination-hostname</i>	The IP hostname of the destination	.
<b>detail</b>	(Optional)	Specifies that detailed information appears.

**Command Default** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** For Layer 2 traceroute to function properly, Cisco Discovery Protocol (CDP) must be enabled on each in the network. Do not disable CDP.

When the detects a device in the Layer 2 path that does not support Layer 2 traceroute, the continues to send Layer 2 trace queries and lets them time out.

The maximum number of hops identified in the path is ten.

The **traceroute mac ip** command output shows the Layer 2 path when the specified source and destination IP addresses are in the same subnet.

When you specify the IP addresses, the uses Address Resolution Protocol (ARP) to associate the IP addresses with the corresponding MAC addresses and the VLAN IDs.

- If an ARP entry exists for the specified IP address, the uses the associated MAC address and identifies the physical path.
- If an ARP entry does not exist, the sends an ARP query and tries to resolve the IP address. The IP addresses must be in the same subnet. If the IP address is not resolved, the path is not identified, and an error message appears.

The Layer 2 traceroute feature is not supported when multiple devices are attached to one port through hubs (for example, multiple CDP neighbors are detected on a port).

When more than one CDP neighbor is detected on a port, the Layer 2 path is not identified, and an error message appears.

This feature is not supported in Token Ring VLANs.

### Examples

This example shows how to display the Layer 2 path by specifying the source and destination IP addresses and by using the **detail** keyword:

```
Device# tracroute mac ip 2.2.66.66 2.2.22.22 detail
Translating IP to mac .....
2.2.66.66 => 0000.0201.0601
2.2.22.22 => 0000.0201.0201

Source 0000.0201.0601 found on con6[WS-C2950G-24-EI] (2.2.6.6)
con6 / WS-C3750E-24TD / 2.2.6.6 :
    Gi0/0/1 [auto, auto] => Gi0/0/3 [auto, auto]
con5 / WS-C2950G-24-EI / 2.2.5.5 :
    Fa0/3 [auto, auto] => Gi0/1 [auto, auto]
con1 / WS-C3550-12G / 2.2.1.1 :
    Gi0/1 [auto, auto] => Gi0/2 [auto, auto]
con2 / WS-C3550-24 / 2.2.2.2 :
    Gi0/2 [auto, auto] => Fa0/1 [auto, auto]
Destination 0000.0201.0201 found on con2[WS-C3550-24] (2.2.2.2)
Layer 2 trace completed.
```

This example shows how to display the Layer 2 path by specifying the source and destination hostnames:

```
Device# tracroute mac ip con6 con2
Translating IP to mac .....
2.2.66.66 => 0000.0201.0601
2.2.22.22 => 0000.0201.0201

Source 0000.0201.0601 found on con6
con6 (2.2.6.6) :Gi0/0/1 => Gi0/0/3
con5          (2.2.5.5      ) :   Gi0/0/3 => Gi0/1
con1          (2.2.1.1      ) :   Gi0/0/1 => Gi0/2
con2          (2.2.2.2      ) :   Gi0/0/2 => Fa0/1
Destination 0000.0201.0201 found on con2
Layer 2 trace completed
```

This example shows the Layer 2 path when ARP cannot associate the source IP address with the corresponding MAC address:

```
Device# tracroute mac ip 2.2.66.66 2.2.77.77
Arp failed for destination 2.2.77.77.
Layer2 trace aborted.
```

# type

To display the contents of one or more files, use the **type** command in boot loader mode.

**type** *filesystem:/file-url...*

<b>Syntax Description</b>	<i>filesystem:</i> Alias for a file system. Use <b>flash:</b> for the system board flash device; use <b>usbflash0:</b> for USB memory sticks.
---------------------------	---

<i>/file-url...</i> Path (directory) and name of the files to display. Separate each filename with a space.
---

<b>Command Default</b>	No default behavior or values.
------------------------	--------------------------------

<b>Command Modes</b>	Boot loader
----------------------	-------------

<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

<b>Usage Guidelines</b>	<p>Filenames and directory names are case sensitive.</p> <p>If you specify a list of files, the contents of each file appear sequentially.</p>
-------------------------	--

<b>Examples</b>	<p>This example shows how to display the contents of a file:</p>
-----------------	--

```
Device: type flash:image_file_name
version_suffix: universal-122-xx.SEx
version_directory: image_file_name
image_system_type_id: 0x00000002
image_name: image_file_name.bin
ios_image_file_size: 8919552
total_image_file_size: 11592192
image_feature: IP|LAYER_3|PLUS|MIN_DRAM_MEG=128
image_family: family
stacking_number: 1.34
board_ids: 0x00000068 0x00000069 0x0000006a 0x0000006b
info_end:
```

# unset

To reset one or more environment variables, use the **unset** command in boot loader mode.

**unset** *variable...*

## Syntax Description

*variable*

Use one of these keywords for *variable*:

**MANUAL\_BOOT**—Specifies whether the automatically or manually boots.

**BOOT**—Resets the list of executable files to try to load and execute when automatically booting. If the BOOT environment variable is not set, the system attempts to load and execute the first executable image it can find by using a recursive, depth-first search through the flash: file system. If the BOOT variable is set but the specified images cannot be loaded, the system attempts to boot the first bootable file that it can find in the flash: file system.

**ENABLE\_BREAK**—Specifies whether the automatic boot process can be interrupted by using the **Break** key on the console after the flash: file system has been initialized.

**HELPER**—Identifies the semicolon-separated list of loadable files to dynamically load during the boot loader initialization. Helper files extend or patch the functionality of the boot loader.

**PS1**—Specifies the string that is used as the command-line prompt in boot loader mode.

**CONFIG\_FILE**—Resets the filename that Cisco IOS uses to read and write a nonvolatile copy of the system configuration.

**BAUD**—Resets the rate in bits per second (b/s) used for the console. The Cisco IOS software inherits the baud rate setting from the boot loader and continues to use this value unless the configuration file specifies another setting.

## Command Default

No default behavior or values.

## Command Modes

Boot loader

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

Under typical circumstances, it is not necessary to alter the setting of the environment variables.

The **MANUAL\_BOOT** environment variable can also be reset by using the **no boot manual** global configuration command.

The **BOOT** environment variable can also be reset by using the **no boot system** global configuration command.

The **ENABLE\_BREAK** environment variable can also be reset by using the **no boot enable-break** global configuration command.

The HELPER environment variable can also be reset by using the **no boot helper** global configuration command.

The CONFIG\_FILE environment variable can also be reset by using the **no boot config-file** global configuration command.

### Example

This example shows how to unset the SWITCH\_PRIORITY environment variable:

```
Device: unset SWITCH_PRIORITY
```

# version

To display the boot loader version, use the **version** command in boot loader mode.

## **version**

---

**Syntax Description** This command has no arguments or keywords.

---

**Command Default** No default behavior or values.

---

**Command Modes** Boot loader

---

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---



---

**Examples** This example shows how to display the boot loader version on a :



## Tracing

---

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# Information About Tracing

## Tracing Overview

The tracing functionality logs internal events. Trace files are automatically created and saved to the `tracelogs` subdirectory under `crashinfo`.

The contents of trace files are useful for the following purposes:

- **Troubleshooting**—If a switch has an issue, the trace file output may provide information that can be used for locating and solving the issue.
- **Debugging**—The trace file outputs helps users get a more detailed view of system actions and operations.

To view the most recent trace information for a specific module, use the **show platform software trace message** command.

To modify the trace level to increase or decrease the amount of trace message output, you can set a new trace level using the **set platform software trace** command. Trace levels can be set for each process using the **all-modules** keyword in the **set platform software trace** command, or per module within a process.

## Location of Tracelogs

Each process uses `btrace` infrastructure to log its trace messages. When a process is active, the corresponding in-memory tracelog is found in the directory `/tmp/<FRU>/trace/`, where `<FRU>` refers to the location where the process is running (`rp`, `fp`, or `cc`).

When a tracelog file has reached the maximum file size limit allowed for the process, or if the process ends, it gets rotated into the following directory:

- `/crashinfo/tracelogs`, if the `crashinfo`: partition is available on the switch
- `/harddisk/tracelogs`, if the `crashinfo`: partition is not available on the switch

The tracelog files are compressed before being stored in the directory.

## Tracelog Naming Convention

All the tracelogs that are created using `btrace` have the following naming convention:

`<process_name>_<FRU><SLOT>-<BAY>.<pid>_<counter>.<creation_timestamp>.bin`

Here, `counter` is a free-running 64-bit counter that gets incremented for each new file created for the process. For example, `wcm_R0-0.1362_0.20151006171744.bin`. When compressed, the files will have the `gz` extension appended to their names

### Tracelog size limits and rotation policy

The maximum size limit for a tracelog file is 1MB for each process, and the maximum number of tracelog files that are maintained for a process is 25.



## Rotation and Throttling Policy

Initially, all the tracelog files are moved from the initial `/tmp/<FRU>/trace` directory to the `/tmp/<FRU>/trace/stage` staging directory. The `btrace_rotate` script then moves these tracelogs from the staging directory to the `/crashinfo/tracelogs` directory. When the number of files stored in the `/crashinfo/tracelogs` directory per process reaches the maximum limit, the oldest files for the process are deleted, while the newer files are maintained. This is repeated at every 60 minutes under worst-case situations.

There are two other sets of files that are purged from the `/crashinfo/tracelogs` directory:

- Files that do not have the standard naming convention (other than a few exceptions such as `fed_python.log`)
- Files older than two weeks

The throttling policy has been introduced so that a process with errors does not affect the functioning of the switch. Whenever a process starts logging at a very high rate, for example, if there are more than 16 files in a 4-second interval for the process in the staging directory, the process is throttled. The files do not rotate for the process from `/tmp/<FRU>/trace` into `/tmp/<FRU>/trace/stage`, however the files are deleted when they reach the maximum size. Throttling is re-enabled, when the count goes below 8.

## Tracing Levels

Tracing levels determine how much information should be stored about a module in the trace buffer or file.

The following table shows all of the tracing levels that are available, and provides descriptions of the message that are displayed with each tracing level.

**Table 180: Tracing Levels and Descriptions**

Tracing Level	Description
Emergency	The message is regarding an issue that makes the system unusable.
Error	The message is regarding a system error.
Warning	The message is regarding a system warning.
Notice	The message is regarding a significant issue, but the switch is still working normally.
Informational	The message is useful for informational purposes only.
Debug	The message provides debug-level output.
Verbose	All possible trace messages are sent.
Noise	All possible trace messages for the module are logged.  The noise level is always equal to the highest possible tracing level. Even if a future enhancement to tracing introduces a higher tracing level, the noise level will become equal to the level of that new enhancement.

## set platform software trace

To set the trace level for a specific module within a process, use the **set platform software trace** command in privileged EXEC or user EXEC mode.

**set platform software trace** *process slot module trace-level*

---

### Syntax Description

*process*

Process whose tracing level is being set. Options include:

- **chassis-manager**—The Chassis Manager process.
  - **cli-agent**—The CLI Agent process.
  - **dbm**—The Database Manager process.
  - **emd**—The Environmental Monitoring process.
  - **fed**—The Forwarding Engine Driver process.
  - **forwarding-manager**—The Forwarding Manager process.
  - **host-manager**—The Host Manager process.
  - **iomd**—The Input/Output Module daemon (IOMd) process.
  - **ios**—The IOS process.
  - **license-manager**—The License Manager process.
  - **logger**—The Logging Manager process.
  - **platform-mgr**—The Platform Manager process.
  - **pluggable-services**—The Pluggable Services process.
  - **replication-mgr**—The Replication Manager process.
  - **shell-manager**—The Shell Manager process.
  - **smd**—The Session Manager process.
  - **table-manager**—The Table Manager Server.
  - **wireshark**—The Embedded Packet Capture (EPC) Wireshark process.
-

---

*slot*

Hardware slot where the process for which the trace level is set, is running. Options include:

- *number*—Number of the SIP slot of the hardware module where the trace level is set. For instance, if you want to specify the SIP in SIP slot 2 of the switch, enter 2.
- *SIP-slot / SPA-bay*—Number of the SIP switch slot and the number of the shared port adapter (SPA) bay of that SIP. For instance, if you want to specify the SPA in bay 2 of the SIP in switch slot 3, enter 3/2.
- **F0**—The Embedded-Service-Processor in slot 0.
- **FP active**—The active Embedded-Service-Processor.
- **R0**—The route processor in slot 0.
- **RP active**—The active route processor.
- **switch** *<number>* —The switch with its number specified.
- **switch active**—The active switch.
- **switch standby**—The standby switch.

---

*module*

Module within the process for which the tracing level is set.

---

---

*trace-level*

Trace level. Options include:

- **debug**—Debug level tracing. A debug-level trace message is a non-urgent message providing a large amount of detail about the module.
- **emergency**—Emergency level tracing. An emergency-level trace message is a message indicating that the system is unusable.
- **error**—Error level tracing. An error-level tracing message is a message indicating a system error.
- **info**—Information level tracing. An information-level tracing message is a non-urgent message providing information about the system.
- **noise**—Noise level tracing. The noise level is always equal to the highest tracing level possible and always generates every possible tracing message.  
The noise level is always equal to the highest-level tracing message possible for a module, even if future enhancements to this command introduce options that allow users to set higher tracing levels.
- **notice**—The message is regarding a significant issue, but the switch is still working normally.
- **verbose**—Verbose level tracing. All possible tracing messages are sent when the trace level is set to verbose.
- **warning**—Warning messages.

---

**Command Default** The default tracing level for all modules is **notice**.

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The *module* options vary by process and by *hardware-module*. Use the ? option when entering this command to see which *module* options are available with each keyword sequence.

Use the **show platform software trace message** command to view trace messages.

Trace files are stored in the tracelogs directory in the harddisk: file system. These files can be deleted without doing any harm to your switch operation.

Trace file output is used for debugging. The trace level is a setting that determines how much information should be stored in trace files about a module.

---

**Examples**

This example shows how to set the trace level for all the modules in dbm process:

```
Device# set platform software trace dbm R0 all-modules debug
```

# show platform software trace filter-binary

To display the most recent trace information for a specific module, use the **show platform software trace filter-binary** command in privileged EXEC or user EXEC mode.

**show platform software trace filter-binary***modules* [**context** *mac-address*]

## Syntax Description

**context***mac-address*

Represents the context used to filter. Additionally, you can filter based on module names and trace levels. The context keyword accepts either a MAC address or any other argument based on which a trace is tagged.

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

### Release

### Modification

Cisco IOS XE Everest 16.5.1a This command was introduced.

## Usage Guidelines

This command collates and sorts all the logs present in the `/tmp/. . ./` across all the processes relevant to the module. The trace logs of all the processes relevant to the specified module are printed to the console. This command also generates a file named `collated_log_{system time}` with the same content, in the `/crashinfo/tracelogs` directory.

# show platform software trace message

To display the trace messages for a process, use the **set platform software trace** command in privileged EXEC or user EXEC mode.

**show platform software trace message** *process slot*

---

**Syntax Description**

*process*

Tracing level that is being set. Options include:

- **chassis-manager**—The Chassis Manager process.
  - **cli-agent**—The CLI Agent process.
  - **cmm**—The CMM process.
  - **dbm**—The Database Manager process.
  - **emd**—The Environmental Monitoring process.
  - **fed**—The Forwarding Engine Driver process.
  - **forwarding-manager**—The Forwarding Manager process.
  - **geo**—The Geo Manager process.
  - **host-manager**—The Host Manager process.
  - **interface-manager**—The Interface Manager process.
  - **iomd**—The Input/Output Module daemon (IOMd) process.
  - **ios**—The IOS process.
  - **license-manager**—The License Manager process.
  - **logger**—The Logging Manager process.
  - **platform-mgr**—The Platform Manager process.
  - **pluggable-services**—The Pluggable Services process.
  - **replication-mgr**—The Replication Manager process.
  - **shell-manager**—The Shell Manager process.
  - **sif**—The Stack Interface (SIF) Manager process.
  - **smd**—The Session Manager process.
  - **stack-mgr**—The Stack Manager process.
  - **table-manager**—The Table Manager Server.
  - **thread-test**—The Multithread Manager process.
  - **virt-manager**—The Virtualization Manager process.
-

---

*slot*

Hardware slot where the process for which the trace level is set, is running. Options include:

- *number*—Number of the SIP slot of the hardware module where the trace level is set. For instance, if you want to specify the SIP in SIP slot 2 of the switch, enter 2.
- *SIP-slot / SPA-bay*—Number of the SIP switch slot and the number of the shared port adapter (SPA) bay of that SIP. For instance, if you want to specify the SPA in bay 2 of the SIP in switch slot 3, enter 3/2.
- **F0**—The Embedded Service Processor slot 0.
- **FP active**—The active Embedded Service Processor.
- **R0**—The route processor in slot 0.
- **RP active**—The active route processor.
- **switch <number>** —The switch, with its number specified.
- **switch active**—The active switch.
- **switch standby**—The standby switch.
  - *number*—Number of the SIP slot of the hardware module where the trace level is set. For instance, if you want to specify the SIP in SIP slot 2 of the switch, enter 2.
  - *SIP-slot / SPA-bay*—Number of the SIP switch slot and the number of the shared port adapter (SPA) bay of that SIP. For instance, if you want to specify the SPA in bay 2 of the SIP in switch slot 3, enter 3/2.
  - **F0**—The Embedded Service Processor in slot 0.
  - **FP active**—The active Embedded Service Processor.
  - **R0**—The route processor in slot 0.
  - **RP active**—The active route processor.

---

#### Command Modes

User EXEC (>)

Privileged EXEC (#)

---

#### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.



## Examples

This example shows how to display the trace messages for the Stack Manager and the Forwarding Engine Driver processes:

```
Device# show platform software trace message stack_mgr switch active R0
10/30 09:42:48.767 [btrace] [8974]: (note): Successfully registered module [97] [uiutil]
10/30 09:42:48.762 [btrace] [8974]: (note): Successfully registered module [98]
[tdl_cdlcore_message]
10/29 13:28:19.023 [stack_mgr] [8974]: (note): Examining peer state
10/29 13:28:19.023 [stack_mgr] [8974]: (note): no switch eligible for standby election
presently
10/29 13:28:19.022 [stack_mgr] [8974]: (note): Posting event
stack_fsm_event_wait_standby_elect_timer_expired, curstate stack_fsm_state_active_ready
10/29 13:28:19.022 [stack_mgr] [8974]: (note): Timer HDL - STACK_WAIT_STANDBY_ELECT_TIMER
expired
10/29 13:26:46.584 [btrace] [8974]: (note): Successfully registered module [99]
[tdl_ui_message]
10/29 13:26:46.582 [bipc] [8974]: (note): Pending connection to server 10.129.1.0
10/29 13:26:36.582 [evutil] [8974]: (ERR): Connection attempt for sman-ui-serv (uipeer
uplink to slot 1) failed, invoking disconnect
10/29 13:26:36.582 [evutil] [8974]: (ERR): Asynchronous connect failed for [uipeer uplink
to slot 1] (fd == -1)
10/29 13:26:36.581 [bipc] [8974]: (note): Pending connection to server 10.129.1.0
10/29 13:26:26.581 [evutil] [8974]: (ERR): Connection attempt for sman-ui-serv (uipeer
uplink to slot 1) failed, invoking disconnect

Device# show platform software trace message fed switch active
11/02 10:55:01.832 [btrace]: [11310]: UUID: 0, ra: 0 (note): Successfully registered module
[86] [uiutil]
11/02 10:55:01.848 [btrace]: [11310]: UUID: 0, ra: 0 (note): Single message size is greater
than 1024
11/02 10:55:01.822 [btrace]: [11310]: UUID: 0, ra: 0 (note): Successfully registered module
[87] [tdl_cdlcore_message]
11/01 09:54:41.474 [btrace]: [12312]: UUID: 0, ra: 0 (note): Successfully registered module
[88] [tdl_ngwc_gold_message]
11/01 09:54:11.228 [btrace]: [12312]: UUID: 0, ra: 0 (note): Successfully registered module
[89] [tdl_doppler_iosd_matm_type]
11/01 09:53:37.454 [btrace]: [11310]: UUID: 0, ra: 0 (note): Successfully registered module
[90] [tdl_ui_message]
11/01 09:53:37.382 [bipc]: [11310]: UUID: 0, ra: 0 (note): Pending connection to server
10.129.1.0
11/01 09:53:34.227 [xcvr]: [18846]: UUID: 0, ra: 0 (ERR): FRU hardware authentication Fail,
result = 1.
11/01 09:53:33.775 [ng3k_scc]: [18846]: UUID: 0, ra: 0 (ERR): SMART COOKIE: SCC I2C receive
failed: rc=10
11/01 09:53:33.775 [ng3k_scc]: [18846]: UUID: 0, ra: 0 (ERR):
SMART COOKIE receive failed, try again
11/01 09:53:33.585 [ng3k_scc]: [18846]: UUID: 0, ra: 0 (ERR):
```

# show platform software trace level

To view the trace levels for all the modules under a specific process, use the **show platform software trace level** command in privileged EXEC or user EXEC mode.

**show platform software trace level** *process slot*

---

## Syntax Description

*process*

Process whose tracing level is being set. Options include:

- **chassis-manager**—The Chassis Manager process.
  - **cli-agent**—The CLI Agent process.
  - **cmm**—The CMM process.
  - **dbm**—The Database Manager process.
  - **emd**—The Environmental Monitoring process.
  - **fed**—The Forwarding Engine Driver process.
  - **forwarding-manager**—The Forwarding Manager process.
  - **geo**—The Geo Manager process.
  - **host-manager**—The Host Manager process.
  - **interface-manager**—The Interface Manager process.
  - **iomd**—The Input/Output Module daemon (IOMd) process.
  - **ios**—The IOS process.
  - **license-manager**—The License Manager process.
  - **logger**—The Logging Manager process.
  - **platform-mgr**—The Platform Manager process.
  - **pluggable-services**—The Pluggable Services process.
  - **replication-mgr**—The Replication Manager process.
  - **shell-manager**—The Shell Manager process.
  - **sif**—The Stack Interface (SIF) Manager process.
  - **smd**—The Session Manager process.
  - **stack-mgr**—The Stack Manager process.
  - **table-manager**—The Table Manager Server.
  - **thread-test**—The Multithread Manager process.
  - **virt-manager**—The Virtualization Manager process.
-

<i>slot</i>	<p>Hardware slot where the process for which the trace level is set, is running. Options include:</p> <ul style="list-style-type: none"> <li>• <i>number</i>—Number of the SIP slot of the hardware module where the trace level is set. For instance, if you want to specify the SIP in SIP slot 2 of the switch, enter 2.</li> <li>• <i>SIP-slot / SPA-bay</i>—Number of the SIP switch slot and the number of the shared port adapter (SPA) bay of that SIP. For instance, if you want to specify the SPA in bay 2 of the SIP in switch slot 3, enter 3/2.</li> <li>• <b>F0</b>—The Embedded Service Processor in slot 0.</li> <li>• <b>F1</b>—The Embedded Service Processor in slot 1.</li> <li>• <b>FP active</b>—The active Embedded Service Processor.</li> <li>• <b>R0</b>—The route processor in slot 0.</li> <li>• <b>RP active</b>—The active route processor.</li> <li>• <b>switch &lt;number&gt;</b> —The switch, with its number specified.</li> <li>• <b>switch active</b>—The active switch.</li> <li>• <b>switch standby</b>—The standby switch. <ul style="list-style-type: none"> <li>• <i>number</i>—Number of the SIP slot of the hardware module where the trace level is set. For instance, if you want to specify the SIP in SIP slot 2 of the switch, enter 2.</li> <li>• <i>SIP-slot / SPA-bay</i>—Number of the SIP switch slot and the number of the shared port adapter (SPA) bay of that SIP. For instance, if you want to specify the SPA in bay 2 of the SIP in switch slot 3, enter 3/2.</li> <li>• <b>F0</b>—The Embedded Service Processor in slot 0.</li> <li>• <b>FP active</b>—The active Embedded Service Processor.</li> <li>• <b>R0</b>—The route processor in slot 0.</li> <li>• <b>RP active</b>—The active route processor.</li> </ul> </li> </ul>
-------------	---

**Command Modes** User EXEC (>)  
Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Examples** This example shows how to view the trace level:

```
Device# show platform software trace level dbm switch active R0
```

## show platform software trace level

Module Name	Trace Level
-----	-----
binos	Notice
binos/brand	Notice
bipc	Notice
btrace	Notice
bump_ptr_alloc	Notice
cdllib	Notice
chasfs	Notice
dbal	Informational
dbm	Debug
evlib	Notice
evutil	Notice
file_alloc	Notice
green-be	Notice
ios-avl	Notice
klib	Debug
services	Notice
sw_wdog	Notice
syshw	Notice
tcl_cdlcore_message	Notice
tcl_dbal_root_message	Notice
tcl_dbal_root_type	Notice

# request platform software trace archive

To archive all the trace logs relevant to all the processes running on a system since the last reload on the switch and to save this in the specified location, use the **request platform software trace archive** command in privileged EXEC or user EXEC mode.

**request platform software trace archive** [**last** *number-of-days* [**days** [**target** *location*]] | **target** *location*]

Syntax Description		
<b>last</b> <i>number-of-days</i>		Specifies the number of days for which the trace files have to be archived.
<b>target</b> <i>location</i>		Specifies the location and name of the archive file.

Command Modes	
	User EXEC (>)
	Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** This archive file can be copied from the system, using the tftp or scp commands.

## Examples

This example shows how to archive all the trace logs of the processes running on the switch since the last 5 days:

```
Device# request platform software trace archive last 5 days target flash:test_archive
```

# request platform software trace rotate all

To rotate all the current in-memory trace logs into the crashinfo partition and start a new in-memory trace log for each process, use the **request platform software trace rotate all** command in privileged EXEC or user EXEC mode.

**request platform software trace rotate all**

## Command Modes

User EXEC (>)

Privileged EXEC (#)

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The trace log files are for read-only purpose. Do not edit the contents of the file. If there is a requirement to delete the contents of the file to view certain set of logs, use this command to start a new trace log file.

## Examples

This example shows how to rotate all the in-memory trace logs of the processes running on the switch since the last one day:

```
Device# request platform software trace slot switch active R0 archive last 1 days target
flash:test
```

# request platform software trace filter-binary

To collate and sort all the archived logs present in the tracelogs subdirectory, use the **request platform software trace filter-binary** command in privileged EXEC or user EXEC mode.

**request platform software trace filter-binary** *modules* [**context** *mac-address*]

<b>Syntax Description</b>	<b>context</b> <i>mac-address</i>	Represents the context used to filter. Additionally, you can filter based on module names and trace levels. The context keyword accepts either a MAC address or any other argument based on which a trace is tagged.
<b>Command Modes</b>	User EXEC (>) Privileged EXEC (#)	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.
<b>Usage Guidelines</b>	This command collates and sorts all the archived logs present in the tracelogs subdirectory, across all the processes relevant to the module. This command also generates a file named <code>collated_log_{system time}</code> with the same content, in the <code>/crashinfo/tracelogs</code> directory.	







# PART **XIII**

## **VLAN**

- [VLAN Commands, on page 1395](#)





## VLAN Commands

---

- [clear vtp counters](#), on page 1396
- [debug platform vlan](#), on page 1397
- [debug sw-vlan](#), on page 1398
- [debug sw-vlan ifs](#), on page 1399
- [debug sw-vlan notification](#), on page 1400
- [debug sw-vlan vtp](#), on page 1401
- [interface vlan](#), on page 1402
- [show platform vlan](#), on page 1403
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- [switchport priority extend](#), on page 1413
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- [vtp \(global configuration\)](#), on page 1423
- [vtp \(interface configuration\)](#), on page 1428
- [vtp primary](#), on page 1429

# clear vtp counters

To clear the VLAN Trunking Protocol (VTP) and pruning counters, use the **clear vtp counters** command in privileged EXEC mode.

**clear vtp counters**

**Syntax Description** This command has no arguments or keywords.

**Command Default** None

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

This example shows how to clear the VTP counters:

```
Device# clear vtp counters
```

You can verify that information was deleted by entering the **show vtp counters** privileged EXEC command.

# debug platform vlan

To enable debugging of the VLAN manager software, use the **debug platform vlan** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

---

**Command Default** Debugging is disabled.

---

**Command Modes** Privileged EXEC

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

**Usage Guidelines** The **undebg platform vlan** command is the same as the **no debug platform vlan** command.

This example shows how to display VLAN error debug messages:

```
Device# debug platform vlan error
```

## debug sw-vlan

To enable debugging of VLAN manager activities, use the **debug sw-vlan** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

**debug sw-vlan badpmcookies | cfg-vlan bootup | cli | events | ifs | mapping | notification | packets | redundancy | registries | vtp**  
**no debug sw-vlan badpmcookies | cfg-vlan bootup | cli | events | ifs | mapping | notification | packets | redundancy | registries | vtp**

### Syntax Description

<b>badpmcookies</b>	Displays debug messages for VLAN manager incidents of bad port manager cookies.
<b>cfg-vlan</b>	Displays VLAN configuration debug messages.
<b>bootup</b>	Displays messages when the switch is booting up.
<b>cli</b>	Displays messages when the command-line interface (CLI) is in VLAN configuration mode.
<b>events</b>	Displays debug messages for VLAN manager events.
<b>ifs</b>	Displays debug messages for the VLAN manager IOS file system (IFS). See <a href="#">debug sw-vlan ifs, on page 1399</a> for more information.
<b>mapping</b>	Displays debug messages for VLAN mapping.
<b>notification</b>	Displays debug messages for VLAN manager notifications. See <a href="#">debug sw-vlan notification, on page 1400</a> for more information.
<b>packets</b>	Displays debug messages for packet handling and encapsulation processes.
<b>redundancy</b>	Displays debug messages for VTP VLAN redundancy.
<b>registries</b>	Displays debug messages for VLAN manager registries.
<b>vtp</b>	Displays debug messages for the VLAN Trunking Protocol (VTP) code. See <a href="#">debug sw-vlan vtp, on page 1401</a> for more information.

### Command Default

Debugging is disabled.

### Command Modes

Privileged EXEC

### Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

### Usage Guidelines

The **undebug sw-vlan** command is the same as the **no debug sw-vlan** command.

This example shows how to display debug messages for VLAN manager events:

```
Device# debug sw-vlan events
```

## debug sw-vlan ifs

To enable debugging of the VLAN manager IOS file system (IFS) error tests, use the **debug sw-vlan ifs** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

**debug sw-vlan ifs open read | write | read 1 | 2 | 3 | 4 | write**  
**no debug sw-vlan ifs open read | write | read 1 | 2 | 3 | 4 | write**

Syntax Description	open read	Displays VLAN manager IFS file-read operation debug messages.
	open write	Displays VLAN manager IFS file-write operation debug messages.
	read	Displays file-read operation debug messages for the specified error test ( <b>1</b> , <b>2</b> , <b>3</b> , or <b>4</b> ).
	write	Displays file-write operation debug messages.

**Command Default** Debugging is disabled.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **undebug sw-vlan ifs** command is the same as the **no debug sw-vlan ifs** command.

When selecting the file read operation, Operation **1** reads the file header, which contains the header verification word and the file version number. Operation **2** reads the main body of the file, which contains most of the domain and VLAN information. Operation **3** reads type length version (TLV) descriptor structures. Operation **4** reads TLV data.

This example shows how to display file-write operation debug messages:

```
Device# debug sw-vlan ifs write
```

# debug sw-vlan notification

To enable debugging of VLAN manager notifications, use the **debug sw-vlan notification** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

**debug sw-vlan notification** **accfwdchange** | **allowedvlanfgchange** | **fwdchange** | **linkchange** | **modechange** | **pruningcfgchange** | **statechange**  
**no debug sw-vlan notification** **accfwdchange** | **allowedvlanfgchange** | **fwdchange** | **linkchange** | **modechange** | **pruningcfgchange** | **statechange**

## Syntax Description

<b>accfwdchange</b>	Displays debug messages for VLAN manager notification of aggregated access interface spanning-tree forward changes.
<b>allowedvlanfgchange</b>	Displays debug messages for VLAN manager notification of changes to the allowed VLAN configuration.
<b>fwdchange</b>	Displays debug messages for VLAN manager notification of spanning-tree forwarding changes.
<b>linkchange</b>	Displays debug messages for VLAN manager notification of interface link-state changes.
<b>modechange</b>	Displays debug messages for VLAN manager notification of interface mode changes.
<b>pruningcfgchange</b>	Displays debug messages for VLAN manager notification of changes to the pruning configuration.
<b>statechange</b>	Displays debug messages for VLAN manager notification of interface state changes.

## Command Default

Debugging is disabled.

## Command Modes

Privileged EXEC

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The **undebug sw-vlan notification** command is the same as the **no debug sw-vlan notification** command.

This example shows how to display debug messages for VLAN manager notification of interface mode changes:

```
Device# debug sw-vlan notification
```



## debug sw-vlan vtp

To enable debugging of the VLAN Trunking Protocol (VTP) code, use the **debug sw-vlan vtp** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

**debug sw-vlan vtp** **events** | **packets** | **pruning** [**packets** | **xmit**] | **redundancy** | **xmit**  
**no debug sw-vlan vtp** **events** | **packets** | **pruning** | **redundancy** | **xmit**

Syntax Description		
	<b>events</b>	Displays debug messages for general-purpose logic flow and detailed VTP messages generated by the VTP_LOG_RUNTIME macro in the VTP code.
	<b>packets</b>	Displays debug messages for the contents of all incoming VTP packets that have been passed into the VTP code from the Cisco IOS VTP platform-dependent layer, except for pruning packets.
	<b>pruning</b>	Displays debug messages generated by the pruning segment of the VTP code.
	<b>packets</b>	(Optional) Displays debug messages for the contents of all incoming VTP pruning packets that have been passed into the VTP code from the Cisco IOS VTP platform-dependent layer.
	<b>xmit</b>	(Optional) Displays debug messages for the contents of all outgoing VTP packets that the VTP code requests the Cisco IOS VTP platform-dependent layer to send.
	<b>redundancy</b>	Displays debug messages for VTP redundancy.
	<b>xmit</b>	Displays debug messages for the contents of all outgoing VTP packets that the VTP code requests the Cisco IOS VTP platform-dependent layer to send, except for pruning packets.

**Command Default** Debugging is disabled.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** The **undebg sw-vlan vtp** command is the same as the **no debug sw-vlan vtp** command. If no additional parameters are entered after the **pruning** keyword, VTP pruning debugging messages appear. They are generated by the VTP\_PRUNING\_LOG\_NOTICE, VTP\_PRUNING\_LOG\_INFO, VTP\_PRUNING\_LOG\_DEBUG, VTP\_PRUNING\_LOG\_ALERT, and VTP\_PRUNING\_LOG\_WARNING macros in the VTP pruning code.

This example shows how to display debug messages for VTP redundancy:

```
Device# debug sw-vlan vtp redundancy
```

# interface vlan

To create or access a dynamic switch virtual interface (SVI) and to enter interface configuration mode, use the **interface vlan** command in global configuration mode. To delete an SVI, use the **no** form of this command.

**interface vlan** *vlan-id*  
**no interface vlan** *vlan-id*

## Syntax Description

*vlan-id* VLAN number. The range is 1 to 4094.

## Command Default

The default VLAN interface is VLAN 1.

## Command Modes

Global configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

SVIs are created the first time you enter the **interface vlan** *vlan-id* command for a particular VLAN. The *vlan-id* corresponds to the VLAN-tag associated with data frames on an IEEE 802.1Q encapsulated trunk or the VLAN ID configured for an access port.



### Note

When you create an SVI, it does not become active until it is associated with a physical port.

If you delete an SVI using the **no interface vlan** *vlan-id* command, it is no longer visible in the output from the **show interfaces** privileged EXEC command.



### Note

You cannot delete the VLAN 1 interface.

You can reinstate a deleted SVI by entering the **interface vlan** *vlan-id* command for the deleted interface. The interface comes back up, but the previous configuration is gone.

The interrelationship between the number of SVIs configured on a switch or a switch stack and the number of other features being configured might have an impact on CPU utilization due to hardware limitations. You can use the **sdm prefer** global configuration command to reallocate system hardware resources based on templates and feature tables.

You can verify your setting by entering the **show interfaces** and **show interfaces vlan** *vlan-id* privileged EXEC commands.

This example shows how to create a new SVI with VLAN ID 23 and enter interface configuration mode:

```
Device(config)# interface vlan 23
Device(config-if)#
```

# show platform vlan

To display platform-dependent VLAN information, use the **show platform vlan** privileged EXEC command.

---

**Command Default** None

---

**Command Modes** Privileged EXEC

---

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

---

---

**Usage Guidelines** Use this command only when you are working directly with your technical support representative while troubleshooting a problem. Do not use this command unless your technical support representative asks you to do so.

# show vlan

To display the parameters for all configured VLANs or one VLAN (if the VLAN ID or name is specified) on the switch, use the **show vlan** command in user EXEC mode.

**show vlan** [**brief** | **group** | **id** *vlan-id* | **mtu** | **name** *vlan-name* | **remote-span** | **summary**]

Syntax Description		
<b>brief</b>		(Optional) Displays one line for each VLAN with the VLAN name, status, and its ports.
<b>group</b>		(Optional) Displays information about VLAN groups.
<b>id</b> <i>vlan-id</i>		(Optional) Displays information about a single VLAN identified by the VLAN ID number. For <i>vlan-id</i> , the range is 1 to 4094.
<b>mtu</b>		(Optional) Displays a list of VLANs and the minimum and maximum transmission unit (MTU) sizes configured on ports in the VLAN.
<b>name</b> <i>vlan-name</i>		(Optional) Displays information about a single VLAN identified by the VLAN name. The VLAN name is an ASCII string from 1 to 32 characters.
<b>remote-span</b>		(Optional) Displays information about Remote SPAN (RSPAN) VLANs.
<b>summary</b>		(Optional) Displays VLAN summary information.



**Note** The **ifindex** keyword is not supported, even though it is visible in the command-line help string.

**Command Default** None

**Command Modes** User EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** In the **show vlan mtu** command output, the MTU\_Mismatch column shows whether all the ports in the VLAN have the same MTU. When yes appears in the column, it means that the VLAN has ports with different MTUs, and packets that are switched from a port with a larger MTU to a port with a smaller MTU might be dropped. If the VLAN does not have an SVI, the hyphen (-) symbol appears in the SVI\_MTU column. If the MTU-Mismatch column displays yes, the names of the ports with the MinMTU and the MaxMTU appear.

This is an example of output from the **show vlan** command. See the table that follows for descriptions of the fields in the display.

```

Device> show vlan
VLAN Name                Status      Ports
-----
1    default                active      Gi1/0/2, Gi1/0/3, Gi1/0/4
                                           Gi1/0/5, Gi1/0/6, Gi1/0/7
                                           Gi1/0/8, Gi1/0/9, Gi1/0/10
                                           Gi1/0/11, Gi1/0/12, Gi1/0/13
                                           Gi1/0/14, Gi1/0/15, Gi1/0/16
                                           Gi1/0/17, Gi1/0/18, Gi1/0/19
                                           Gi1/0/20, Gi1/0/21, Gi1/0/22
                                           Gi1/0/23, Gi1/0/24, Gi1/0/25
                                           Gi1/0/26, Gi1/0/27, Gi1/0/28
                                           Gi1/0/29, Gi1/0/30, Gi1/0/31
                                           Gi1/0/32, Gi1/0/33, Gi1/0/34
                                           Gi1/0/35, Gi1/0/36, Gi1/0/37
                                           Gi1/0/38, Gi1/0/39, Gi1/0/40
                                           Gi1/0/41, Gi1/0/42, Gi1/0/43
                                           Gi1/0/44, Gi1/0/45, Gi1/0/46
                                           Gi1/0/47, Gi1/0/48

2    VLAN0002                active
40   vlan-40                  active
300  VLAN0300                 active
1002 fddi-default             act/unsup
1003 token-ring-default     act/unsup
1004 fddinet-default        act/unsup
1005 trnet-default          act/unsup

VLAN Type  SAID      MTU   Parent  RingNo  BridgeNo  Stp   BrdgMode  Trans1  Trans2
-----
1    enet     100001    1500  -       -       -       -       -         0       0
2    enet     100002    1500  -       -       -       -       -         0       0
40   enet     100040    1500  -       -       -       -       -         0       0
300  enet     100300    1500  -       -       -       -       -         0       0
1002 fddi     101002    1500  -       -       -       -       -         0       0
1003 tr      101003    1500  -       -       -       -       -         0       0
1004 fdnet  101004    1500  -       -       -       ieee  -         0       0
1005 trnet  101005    1500  -       -       -       ibm   -         0       0
2000 enet     102000    1500  -       -       -       -       -         0       0
3000 enet     103000    1500  -       -       -       -       -         0       0

Remote SPAN VLANs
-----
2000,3000

Primary Secondary Type          Ports
-----

```

**Table 181: show vlan Command Output Fields**

Field	Description
VLAN	VLAN number.
Name	Name, if configured, of the VLAN.
Status	Status of the VLAN (active or suspend).
Ports	Ports that belong to the VLAN.
Type	Media type of the VLAN.

Field	Description
SAID	Security association ID value for the VLAN.
MTU	Maximum transmission unit size for the VLAN.
Parent	Parent VLAN, if one exists.
RingNo	Ring number for the VLAN, if applicable.
BrdgNo	Bridge number for the VLAN, if applicable.
Stp	Spanning Tree Protocol type used on the VLAN.
BrdgMode	Bridging mode for this VLAN—possible values are source-route bridging (SRB) and source-route transparent (SRT); the default is SRB.
Trans1	Translation bridge 1.
Trans2	Translation bridge 2.
Remote SPAN VLANs	Identifies any RSPAN VLANs that have been configured.

This is an example of output from the **show vlan summary** command:

```
Device> show vlan summary
Number of existing VLANs           : 45
Number of existing VTP VLANs      : 45
Number of existing extended VLANs : 0
```

This is an example of output from the **show vlan id** command:

```
Device# show vlan id 2
VLAN Name                Status      Ports
-----
2    VLAN0200              active     Gi1/0/7, Gi1/0/8
2    VLAN0200              active     Gi2/0/1, Gi2/0/2

VLAN Type  SAID      MTU   Parent RingNo BridgeNo  Stp  BrdgMode  Trans1  Trans2
-----
2    enet  100002   1500  -     -     -     -     -     0     0

Remote SPAN VLANs
-----
Disabled
```

# show vtp

To display general information about the VLAN Trunking Protocol (VTP) management domain, status, and counters, use the **show vtp** command in EXEC mode.

**show vtp counters** | **devices** [**conflicts**] | **interface** [*interface-id*] | **password** | **status**

Syntax Description		
<b>counters</b>		Displays the VTP statistics for the .
<b>devices</b>		Displays information about all VTP version 3 devices in the domain. This keyword applies only if the is not running VTP version 3.
<b>conflicts</b>		(Optional) Displays information about VTP version 3 devices that have conflicting primary servers. This command is ignored when the is in VTP transparent or VTP off mode.
<b>interface</b>		Displays VTP status and configuration for all interfaces or the specified interface.
<i>interface-id</i>		(Optional) Interface for which to display VTP status and configuration. This can be a physical interface or a port channel.
<b>password</b>		Displays the configured VTP password (available in privileged EXEC mode only).
<b>status</b>		Displays general information about the VTP management domain status.

**Command Default** None

**Command Modes** User EXEC  
Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** When you enter the **show vtp password** command when the is running VTP version 3, the display follows these rules:

- If the **password** *password* global configuration command did not specify the **hidden** keyword and encryption is not enabled on the , the password appears in clear text.
- If the **password** *password* command did not specify the **hidden** keyword and encryption is enabled on the , the encrypted password appears.
- If the **password** *password* command is included the **hidden** keyword, the hexadecimal secret key is displayed.

This is an example of output from the **show vtp devices** command. A **Yes** in the **Conflict** column indicates that the responding server is in conflict with the local server for the feature; that is, when two in the same domain do not have the same primary server for a database.

```
Device# show vtp devices
Retrieving information from the VTP domain. Waiting for 5 seconds.
VTP Database Conf ID Primary Server Revision System Name
                lict
-----
VLAN          Yes  00b0.8e50.d000 000c.0412.6300 12354      main.cisco.com
MST           No   00b0.8e50.d000 0004.AB45.6000 24         main.cisco.com
VLAN          Yes  000c.0412.6300=000c.0412.6300 67         qwerty.cisco.com
```

This is an example of output from the **show vtp counters** command. The table that follows describes each field in the display.

```
Device> show vtp counters
VTP statistics:
Summary advertisements received : 0
Subset advertisements received : 0
Request advertisements received : 0
Summary advertisements transmitted : 0
Subset advertisements transmitted : 0
Request advertisements transmitted : 0
Number of config revision errors : 0
Number of config digest errors : 0
Number of V1 summary errors : 0

VTP pruning statistics:

Trunk          Join Transmitted Join Received Summary advts received from
                ----- non-pruning-capable device
-----
Gi1/0/47       0                0                0
Gi1/0/48       0                0                0
Gi2/0/1        0                0                0
Gi3/0/2        0                0                0
```

**Table 182: show vtp counters Field Descriptions**

Field	Description
Summary advertisements received	Number of summary advertisements received by this on its trunk ports. Summary advertisements contain the management domain name, the configuration revision number, the update timestamp and identity, the authentication checksum, and the number of subset advertisements to follow.
Subset advertisements received	Number of subset advertisements received by this on its trunk ports. Subset advertisements contain all the information for one or more VLANs.
Request advertisements received	Number of advertisement requests received by this on its trunk ports. Advertisement requests normally request information on all VLANs. They can also request information on a subset of VLANs.



Field	Description
Summary advertisements transmitted	Number of summary advertisements sent by this on its trunk ports. Summary advertisements contain the management domain name, the configuration revision number, the update timestamp and identity, the authentication checksum, and the number of subset advertisements to follow.
Subset advertisements transmitted	Number of subset advertisements sent by this on its trunk ports. Subset advertisements contain all the information for one or more VLANs.
Request advertisements transmitted	Number of advertisement requests sent by this on its trunk ports. Advertisement requests normally request information on all VLANs. They can also request information on a subset of VLANs.
Number of configuration revision errors	<p>Number of revision errors.</p> <p>Whenever you define a new VLAN, delete an existing one, suspend or resume an existing VLAN, or modify the parameters on an existing VLAN, the configuration revision number of the increments.</p> <p>Revision errors increment whenever the receives an advertisement whose revision number matches the revision number of the , but the MD5 digest values do not match. This error means that the VTP password in the two is different or that the have different configurations.</p> <p>These errors indicate that the is filtering incoming advertisements, which causes the VTP database to become unsynchronized across the network.</p>
Number of configuration digest errors	<p>Number of MD5 digest errors.</p> <p>Digest errors increment whenever the MD5 digest in the summary packet and the MD5 digest of the received advertisement calculated by the do not match. This error usually means that the VTP password in the two is different. To solve this problem, make sure the VTP password on all is the same.</p> <p>These errors indicate that the is filtering incoming advertisements, which causes the VTP database to become unsynchronized across the network.</p>

Field	Description
Number of V1 summary errors	Number of Version 1 errors.  Version 1 summary errors increment whenever a in VTP V2 mode receives a VTP Version 1 frame. These errors indicate that at least one neighboring is either running VTP Version 1 or VTP Version 2 with V2-mode disabled. To solve this problem, change the configuration of the in VTP V2-mode to disabled.
Join Transmitted	Number of VTP pruning messages sent on the trunk.
Join Received	Number of VTP pruning messages received on the trunk.
Summary Advts Received from non-pruning-capable device	Number of VTP summary messages received on the trunk from devices that do not support pruning.

This is an example of output from the **show vtp status** command. The table that follows describes each field in the display.

```
Device> show vtp status
VTP Version capable          : 1 to 3
VTP version running         : 1
VTP Domain Name             :
VTP Pruning Mode            : Disabled
VTP Traps Generation        : Disabled
Device ID                   : 2037.06ce.3580
Configuration last modified by 192.168.1.1 at 10-10-12 04:34:02
Local updater ID is 192.168.1.1 on interface LIIN0 (first layer3 interface found
)

Feature VLAN:
-----
VTP Operating Mode          : Server
Maximum VLANs supported locally : 1005
Number of existing VLANs    : 7
Configuration Revision      : 2
MD5 digest                  : 0xA0 0xA1 0xFE 0x4E 0x7E 0x5D 0x97 0x41
                           : 0x89 0xB9 0x9B 0x70 0x03 0x61 0xE9 0x27
```

**Table 183: show vtp status Field Descriptions**

Field	Description
VTP Version capable	Displays the VTP versions that are capable of operating on the .
VTP Version running	Displays the VTP version operating on the . By default, the implements Version 1 but can be set to Version 2.
VTP Domain Name	Name that identifies the administrative domain for the .

Field	Description
VTP Pruning Mode	Displays whether pruning is enabled or disabled. Enabling pruning on a VTP server enables pruning for the entire management domain. Pruning restricts flooded traffic to those trunk links that the traffic must use to access the appropriate network devices.
VTP Traps Generation	Displays whether VTP traps are sent to a network management station.
Device ID	Displays the MAC address of the local device.
Configuration last modified	Displays the date and time of the last configuration modification. Displays the IP address of the that caused the configuration change to the database.
VTP Operating Mode	<p>Displays the VTP operating mode, which can be server, client, or transparent.</p> <p><b>Server</b>—A in VTP server mode is enabled for VTP and sends advertisements. You can configure VLANs on it. The guarantees that it can recover all the VLAN information in the current VTP database from NVRAM after reboot. By default, every is a VTP server.</p> <p><b>Note</b> The automatically changes from VTP server mode to VTP client mode if it detects a failure while writing the configuration to NVRAM and cannot return to server mode until the NVRAM is functioning.</p> <p><b>Client</b>—A in VTP client mode is enabled for VTP, can send advertisements, but does not have enough nonvolatile storage to store VLAN configurations. You cannot configure VLANs on it. When a VTP client starts up, it does not send VTP advertisements until it receives advertisements to initialize its VLAN database.</p> <p><b>Transparent</b>—A in VTP transparent mode is disabled for VTP, does not send or learn from advertisements sent by other devices, and cannot affect VLAN configurations on other devices in the network. The receives VTP advertisements and forwards them on all trunk ports except the one on which the advertisement was received.</p>
Maximum VLANs Supported Locally	Maximum number of VLANs supported locally.
Number of Existing VLANs	Number of existing VLANs.

Field	Description
Configuration Revision	Current configuration revision number on this .
MD5 Digest	A 16-byte checksum of the VTP configuration.

This is an example of output from the **show vtp status** command for a running VTP version 3:

# switchport priority extend

To set a port priority for the incoming untagged frames or the priority of frames received by the IP phone connected to the specified port, use the **switchport priority extend** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

**switchport priority extend cos value | trust**  
**no switchport priority extend**

Syntax Description	cos value	trust
	Sets the IP phone port to override the IEEE 802.1p priority received from the PC or the attached device with the specified class of service (CoS) value. The range is 0 to 7. Seven is the highest priority. The default is 0.	Sets the IP phone port to trust the IEEE 802.1p priority received from the PC or the attached device.

**Command Default** The default port priority is set to a CoS value of 0 for untagged frames received on the port.

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** When voice VLAN is enabled, you can configure the to send the Cisco Discovery Protocol (CDP) packets to instruct the IP phone how to send data packets from the device attached to the access port on the Cisco IP Phone. You must enable CDP on the port connected to the Cisco IP Phone to send the configuration to the Cisco IP Phone. (CDP is enabled by default globally and on all interfaces.)

You should configure voice VLAN on access ports.

This example shows how to configure the IP phone connected to the specified port to trust the received IEEE 802.1p priority:

```
Device(config)# interface gigabitethernet1/0/2
Device(config-if)# switchport priority extend trust
```

You can verify your settings by entering the **show interfaces interface-id switchport** privileged EXEC command.

# switchport trunk

To set the trunk characteristics when the interface is in trunking mode, use the **switchport trunk** command in interface configuration mode. To reset a trunking characteristic to the default, use the **no** form of this command.

**switchport trunk allowed vlan** *vlan-list* | **native vlan** *vlan-id* | **pruning vlan** *vlan-list*  
**no switchport trunk allowed vlan** | **native vlan** | **pruning vlan**

## Syntax Description

<b>allowed vlan</b> <i>vlan-list</i>	Sets the list of allowed VLANs that can receive and send traffic on this interface in tagged format when in trunking mode. See the Usage Guidelines for the <i>vlan-list</i> choices.
<b>native vlan</b> <i>vlan-id</i>	Sets the native VLAN for sending and receiving untagged traffic when the interface is in IEEE 802.1Q trunking mode. The range is 1 to 4094.
<b>pruning vlan</b> <i>vlan-list</i>	Sets the list of VLANs that are eligible for VTP pruning when in trunking mode. See the Usage Guidelines for the <i>vlan-list</i> choices.

## Command Default

VLAN 1 is the default native VLAN ID on the port.  
 The default for all VLAN lists is to include all VLANs.

## Command Modes

Interface configuration

## Command History

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

## Usage Guidelines

The *vlan-list* format is **all** | **none** | [**add** | **remove** | **except**] *vlan-atom* [,*vlan-atom*...]:

- **all** specifies all VLANs from 1 to 4094. This is the default. This keyword is not allowed on commands that do not permit all VLANs in the list to be set at the same time.
- **none** specifies an empty list. This keyword is not allowed on commands that require certain VLANs to be set or at least one VLAN to be set.
- **add** adds the defined list of VLANs to those currently set instead of replacing the list. Valid IDs are from 1 to 1005; extended-range VLANs (VLAN IDs greater than 1005) are valid in some cases.



**Note** You can add extended-range VLANs to the allowed VLAN list, but not to the pruning-eligible VLAN list.

Separate nonconsecutive VLAN IDs with a comma; use a hyphen to designate a range of IDs.

- **remove** removes the defined list of VLANs from those currently set instead of replacing the list. Valid IDs are from 1 to 1005; extended-range VLAN IDs are valid in some cases.



---

**Note** You can remove extended-range VLANs from the allowed VLAN list, but you cannot remove them from the pruning-eligible list.

---

- **except** lists the VLANs that should be calculated by inverting the defined list of VLANs. (VLANs are added except the ones specified.) Valid IDs are from 1 to 1005. Separate nonconsecutive VLAN IDs with a comma; use a hyphen to designate a range of IDs.
- *vlan-atom* is either a single VLAN number from 1 to 4094 or a continuous range of VLANs described by two VLAN numbers, the lesser one first, separated by a hyphen.

#### Native VLANs:

- All untagged traffic received on an IEEE 802.1Q trunk port is forwarded with the native VLAN configured for the port.
- If a packet has a VLAN ID that is the same as the sending-port native VLAN ID, the packet is sent without a tag; otherwise, the switch sends the packet with a tag.
- The **no** form of the **native vlan** command resets the native mode VLAN to the appropriate default VLAN for the device.

#### Allowed VLAN:

- To reduce the risk of spanning-tree loops or storms, you can disable VLAN 1 on any individual VLAN trunk port by removing VLAN 1 from the allowed list. When you remove VLAN 1 from a trunk port, the interface continues to send and receive management traffic, for example, Cisco Discovery Protocol (CDP), Port Aggregation Protocol (PAgP), Link Aggregation Control Protocol (LACP), Dynamic Trunking Protocol (DTP), and VLAN Trunking Protocol (VTP) in VLAN 1.
- The **no** form of the **allowed vlan** command resets the list to the default list, which allows all VLANs.

#### Trunk pruning:

- The pruning-eligible list applies only to trunk ports.
- Each trunk port has its own eligibility list.
- If you do not want a VLAN to be pruned, remove it from the pruning-eligible list. VLANs that are pruning-ineligible receive flooded traffic.
- VLAN 1, VLANs 1002 to 1005, and extended-range VLANs (VLANs 1006 to 4094) cannot be pruned.

This example shows how to configure VLAN 3 as the default for the port to send all untagged traffic:

```
Device(config)# interface gigabitethernet1/0/2
Device(config-if)# switchport trunk native vlan 3
```

This example shows how to add VLANs 1, 2, 5, and 6 to the allowed list:

```
Device(config)# interface gigabitethernet1/0/2
Device(config-if)# switchport trunk allowed vlan add 1,2,5,6
```

This example shows how to remove VLANs 3 and 10 to 15 from the pruning-eligible list:

```
Device(config)# interface gigabitethernet1/0/2  
Device(config-if)# switchport trunk pruning vlan remove 3,10-15
```

You can verify your settings by entering the **show interfaces** *interface-id* **switchport** privileged EXEC command.



# vlan

To add a VLAN and to enter the VLAN configuration mode, use the **vlan** command in global configuration mode. To delete the VLAN, use the **no** form of this command.

```
vlan vlan-id
no vlan vlan-id
```

<b>Syntax Description</b>	<i>vlan-id</i> ID of the VLAN to be added and configured. The range is 1 to 4094. You can enter a single VLAN ID, a series of VLAN IDs separated by commas, or a range of VLAN IDs separated by hyphens.				
<b>Command Default</b>	None				
<b>Command Modes</b>	Global configuration				
<b>Command History</b>	<table border="1"> <thead> <tr> <th>Release</th> <th>Modification</th> </tr> </thead> <tbody> <tr> <td>Cisco IOS XE Everest 16.5.1a</td> <td>This command was introduced.</td> </tr> </tbody> </table>	Release	Modification	Cisco IOS XE Everest 16.5.1a	This command was introduced.
Release	Modification				
Cisco IOS XE Everest 16.5.1a	This command was introduced.				

**Usage Guidelines** You can use the **vlan** *vlan-id* global configuration command to add normal-range VLANs (VLAN IDs 1 to 1005) or extended-range VLANs (VLAN IDs 1006 to 4094). Configuration information for normal-range VLANs is always saved in the VLAN database, and you can display this information by entering the **show vlan** privileged EXEC command. If the VTP mode is transparent, VLAN configuration information for normal-range VLANs is also saved in the running configuration file. VLAN IDs in the extended range are not saved in the VLAN database, but they are stored in the switch running configuration file, and you can save the configuration in the startup configuration file.

VTP version 3 supports propagation of extended-range VLANs. VTP versions 1 and 2 propagate only VLANs 1 to 1005.

When you save the VLAN and VTP configurations in the startup configuration file and reboot the , the configuration is selected as follows:

- If the VTP mode is transparent in the startup configuration and the VLAN database and the VTP domain name from the VLAN database matches that in the startup configuration file, the VLAN database is ignored (cleared), and the VTP and VLAN configurations in the startup configuration file are used. The VLAN database revision number remains unchanged in the VLAN database.
- If the VTP mode or domain name in the startup configuration do not match the VLAN database, the domain name and VTP mode and configuration for VLAN IDs 1 to 1005 use the VLAN database information.

If you enter an invalid VLAN ID, you receive an error message and do not enter VLAN configuration mode.

Entering the **vlan** command with a VLAN ID enables VLAN configuration mode. When you enter the VLAN ID of an existing VLAN, you do not create a new VLAN, but you can modify VLAN parameters for that VLAN. The specified VLANs are added or modified when you exit the VLAN configuration mode. Only the **shutdown** command (for VLANs 1 to 1005) takes effect immediately.



**Note** Although all commands are visible, the only VLAN configuration command that is supported on extended-range VLANs is **remote-span**. For extended-range VLANs, all other characteristics must remain at the default state.

These configuration commands are available in VLAN configuration mode. The **no** form of each command returns the characteristic to its default state:

- **are** *are-number*—Defines the maximum number of all-routes explorer (ARE) hops for this VLAN. This keyword applies only to TrCRF VLANs. The range is 0 to 13. The default is 7. If no value is entered, 0 is assumed to be the maximum.
- **backupcrf**—Specifies the backup CRF mode. This keyword applies only to TrCRF VLANs.
  - **enable**—Backup CRF mode for this VLAN.
  - **disable**—Backup CRF mode for this VLAN (the default).
- **bridge** {*bridge-number* | **type**}—Specifies the logical distributed source-routing bridge, the bridge that interconnects all logical rings that have this VLAN as a parent VLAN in FDDI-NET, Token Ring-NET, and TrBRF VLANs. The range is 0 to 15. The default bridge number is 0 (no source-routing bridge) for FDDI-NET, TrBRF, and Token Ring-NET VLANs. The **type** keyword applies only to TrCRF VLANs and is one of these:
  - **srb**—Source-route bridging
  - **srt**—Source-route transparent) bridging VLAN
- **exit**—Applies changes, increments the VLAN database revision number (VLANs 1 to 1005 only), and exits VLAN configuration mode.
- **media**—Defines the VLAN media type and is one of these:



**Note** The **media** command supports only Ethernet ports. You configure only FDDI and Token Ring media-specific characteristics for VLAN Trunking Protocol (VTP) global advertisements to other switches. These VLANs are locally suspended.

- **ethernet**—Ethernet media type (the default).
- **fd-net**—FDDI network entity title (NET) media type.
- **fdi**—FDDI media type.
- **tokenring**—Token Ring media type if the VTP v2 mode is disabled, or TrCRF if the VTP Version 2 (v) mode is enabled.
- **tr-net**—Token Ring network entity title (NET) media type if the VTP v2 mode is disabled or TrBRF media type if the VTP v2 mode is enabled.

See the table that follows for valid commands and syntax for different media types.

- **name** *vlan-name*—Names the VLAN with an ASCII string from 1 to 32 characters that must be unique within the administrative domain. The default is VLANxxxx where xxxx represents four numeric digits (including leading zeros) equal to the VLAN ID number.
- **no**—Negates a command or returns it to the default setting.
- **parent** *parent-vlan-id*—Specifies the parent VLAN of an existing FDDI, Token Ring, or TrCRF VLAN. This parameter identifies the TrBRF to which a TrCRF belongs and is required when defining a TrCRF. The range is 0 to 1005. The default parent VLAN ID is 0 (no parent VLAN) for FDDI and Token Ring VLANs. For both Token Ring and TrCRF VLANs, the parent VLAN ID must already exist in the database and be associated with a Token Ring-NET or TrBRF VLAN.
- **remote-span**—Configures the VLAN as a Remote SPAN (RSPAN) VLAN. When the RSPAN feature is added to an existing VLAN, the VLAN is first deleted and is then recreated with the RSPAN feature. Any access ports are deactivated until the RSPAN feature is removed. If VTP is enabled, the new RSPAN VLAN is propagated by VTP for VLAN IDs that are lower than 1024. Learning is disabled on the VLAN.
- **ring** *ring-number*—Defines the logical ring for an FDDI, Token Ring, or TrCRF VLAN. The range is 1 to 4095. The default for Token Ring VLANs is 0. For FDDI VLANs, there is no default.
- **said** *said-value*—Specifies the security association identifier (SAID) as documented in IEEE 802.10. The range is 1 to 4294967294, and the number must be unique within the administrative domain. The default value is 100000 plus the VLAN ID number.
- **shutdown**—Shuts down VLAN switching on the VLAN. This command takes effect immediately. Other commands take effect when you exit VLAN configuration mode.
- **state**—Specifies the VLAN state:
  - **active** means the VLAN is operational (the default).
  - **suspend** means the VLAN is suspended. Suspended VLANs do not pass packets.
- **ste** *ste-number*—Defines the maximum number of spanning-tree explorer (STE) hops. This keyword applies only to TrCRF VLANs. The range is 0 to 13. The default is 7.
- **stp type**—Defines the spanning-tree type for FDDI-NET, Token Ring-NET, or TrBRF VLANs. For FDDI-NET VLANs, the default STP type is *ieee*. For Token Ring-NET VLANs, the default STP type is *ibm*. For FDDI and Token Ring VLANs, the default is no type specified.
  - **ieee**—IEEE Ethernet STP running source-route transparent (SRT) bridging.
  - **ibm**—IBM STP running source-route bridging (SRB).
  - **auto**—STP running a combination of source-route transparent bridging (IEEE) and source-route bridging (IBM).
- **tb-vlan1** *tb-vlan1-id* and **tb-vlan2** *tb-vlan2-id*—Specifies the first and second VLAN to which this VLAN is translationally bridged. Translational VLANs translate FDDI or Token Ring to Ethernet, for example. The range is 0 to 1005. If no value is specified, 0 (no transitional bridging) is assumed.

Table 184: Valid Commands and Syntax for Different Media Types

Media Type	Valid Syntax
Ethernet	<b>name</b> <i>vlan-name</i> , <b>media</b> ethernet, <b>state</b> {suspend   active}, <b>said</b> <i>said-value</i> , <b>remote-span</b> , <b>tb-vlan1</b> <i>tb-vlan1-id</i> , <b>tb-vlan2</b> <i>tb-vlan2-id</i>
FDDI	<b>name</b> <i>vlan-name</i> , <b>media</b> fddi, <b>state</b> {suspend   active}, <b>said</b> <i>said-value</i> , <b>ring</b> <i>ring-number</i> , <b>parent</b> <i>parent-vlan-id</i> , <b>tb-vlan1</b> <i>tb-vlan1-id</i> , <b>tb-vlan2</b> <i>tb-vlan2-id</i>
FDDI-NET	<b>name</b> <i>vlan-name</i> , <b>media</b> fd-net, <b>state</b> {suspend   active}, <b>said</b> <i>said-value</i> , <b>bridge</b> <i>bridge-number</i> , <b>stp type</b> {ieec   ibm   auto}, <b>tb-vlan1</b> <i>tb-vlan1-id</i> , <b>tb-vlan2</b> <i>tb-vlan2-id</i>  If VTP v2 mode is disabled, do not set the <b>stp type</b> to <b>auto</b> .
Token Ring	VTP v1 mode is enabled. <b>name</b> <i>vlan-name</i> , <b>media</b> tokenring, <b>state</b> {suspend   active}, <b>said</b> <i>said-value</i> , <b>ring</b> <i>ring-number</i> , <b>parent</b> <i>parent-vlan-id</i> , <b>tb-vlan1</b> <i>tb-vlan1-id</i> , <b>tb-vlan2</b> <i>tb-vlan2-id</i>
Token Ring concentrator relay function (TrCRF)	VTP v2 mode is enabled. <b>name</b> <i>vlan-name</i> , <b>media</b> tokenring, <b>state</b> {suspend   active}, <b>said</b> <i>said-value</i> , <b>ring</b> <i>ring-number</i> , <b>parent</b> <i>parent-vlan-id</i> , <b>bridge type</b> {srb   srt}, <b>are</b> <i>are-number</i> , <b>ste</b> <i>ste-number</i> , <b>backupcrf</b> {enable   disable}, <b>tb-vlan1</b> <i>tb-vlan1-id</i> , <b>tb-vlan2</b> <i>tb-vlan2-id</i>
Token Ring-NET	VTP v1 mode is enabled. <b>name</b> <i>vlan-name</i> , <b>media</b> tr-net, <b>state</b> {suspend   active}, <b>said</b> <i>said-value</i> , <b>bridge</b> <i>bridge-number</i> , <b>stp type</b> {ieec   ibm}, <b>tb-vlan1</b> <i>tb-vlan1-id</i> , <b>tb-vlan2</b> <i>tb-vlan2-id</i>
Token Ring bridge relay function (TrBRF)	VTP v2 mode is enabled. <b>name</b> <i>vlan-name</i> , <b>media</b> tr-net, <b>state</b> {suspend   active}, <b>said</b> <i>said-value</i> , <b>bridge</b> <i>bridge-number</i> , <b>stp type</b> {ieec   ibm   auto}, <b>tb-vlan1</b> <i>tb-vlan1-id</i> , <b>tb-vlan2</b> <i>tb-vlan2-id</i>

The following table describes the rules for configuring VLANs:

Table 185: VLAN Configuration Rules

Configuration	Rule
VTP v2 mode is enabled, and you are configuring a TrCRF VLAN media type.	Specify a parent VLAN ID of a TrBRF that already exists in the database.  Specify a ring number. Do not leave this field blank.  Specify unique ring numbers when TrCRF VLANs have the same parent VLAN ID. Only one backup concentrator relay function (CRF) can be enabled.
VTP v2 mode is enabled, and you are configuring VLANs other than TrCRF media type.	Do not specify a backup CRF.
VTP v2 mode is enabled, and you are configuring a TrBRF VLAN media type.	Specify a bridge number. Do not leave this field blank.
VTP v1 mode is enabled.	No VLAN can have an STP type set to auto.  This rule applies to Ethernet, FDDI, FDDI-NET, Token Ring, and Token Ring-NET VLANs.
Add a VLAN that requires translational bridging (values are not set to zero).	The translational bridging VLAN IDs that are used must already exist in the database.  The translational bridging VLAN IDs that a configuration points to must also contain a pointer to the original VLAN in one of the translational bridging parameters (for example, Ethernet points to FDDI, and FDDI points to Ethernet).  The translational bridging VLAN IDs that a configuration points to must be different media types than the original VLAN (for example, Ethernet can point to Token Ring).  If both translational bridging VLAN IDs are configured, these VLANs must be different media types (for example, Ethernet can point to FDDI and Token Ring).

This example shows how to add an Ethernet VLAN with default media characteristics. The default includes a *vlan-name* of VLAN *xxxx*, where *xxxx* represents four numeric digits (including leading zeros) equal to the VLAN ID number. The default media is ethernet; the state is active. The default said-value is 100000 plus the VLAN ID; the mtu-size variable is 1500; the stp-type is ieee. When you enter the **exit** VLAN configuration command, the VLAN is added if it did not already exist; otherwise, this command does nothing.

This example shows how to create a new VLAN with all default characteristics and enter VLAN configuration mode:

```
Device(config)# vlan 200
Device(config-vlan)# exit
Device(config)#
```

This example shows how to create a new extended-range VLAN with all the default characteristics, to enter VLAN configuration mode, and to save the new VLAN in the startup configuration file:

```
Device(config)# vlan 2000  
Device(config-vlan)# end  
Device# copy running-config startup config
```

You can verify your setting by entering the **show vlan** privileged EXEC command.

## vtp (global configuration)

To set or modify the VLAN Trunking Protocol (VTP) configuration characteristics, use the **vtp** command in global configuration mode. To remove the settings or to return to the default settings, use the **no** form of this command.

**vtp domain** *domain-name* | **file** *filename* | **interface** *interface-name* [**only**] | **mode** **client** | **off** | **server** | **transparent** [**mst** | **unknown** | **vlan**] | **password** *password* [**hidden** | **secret**] | **pruning** | **version** *number*  
**no vtp file** | **interface** | **mode** [**client** | **off** | **server** | **transparent**] [**mst** | **unknown** | **vlan**] | **password** | **pruning** | **version**

Syntax	Description
<b>domain</b> <i>domain-name</i>	Specifies the VTP domain name, an ASCII string from 1 to 32 characters that identifies the VTP administrative domain for the . The domain name is case sensitive.
<b>file</b> <i>filename</i>	Specifies the Cisco IOS file system file where the VTP VLAN configuration is stored.
<b>interface</b> <i>interface-name</i>	Specifies the name of the interface providing the VTP ID updated for this device.
<b>only</b>	(Optional) Uses only the IP address of this interface as the VTP IP updater.
<b>mode</b>	Specifies the VTP device mode as client, server, or transparent.
<b>client</b>	Places the in VTP client mode. A in VTP client mode is enabled for VTP, and can send advertisements, but does not have enough nonvolatile storage to store VLAN configurations. You cannot configure VLANs on a VTP client. VLANs are configured on another in the domain that is in server mode. When a VTP client starts up, it does not send VTP advertisements until it receives advertisements to initialize its VLAN database.
<b>off</b>	Places the in VTP off mode. A in VTP off mode functions the same as a VTP transparent device except that it does not forward VTP advertisements on trunk ports.
<b>server</b>	Places the in VTP server mode. A in VTP server mode is enabled for VTP and sends advertisements. You can configure VLANs on the . The can recover all the VLAN information in the current VTP database from nonvolatile storage after reboot.
<b>transparent</b>	Places the in VTP transparent mode. A in VTP transparent mode is disabled for VTP, does not send advertisements or learn from advertisements sent by other devices, and cannot affect VLAN configurations on other devices in the network. The receives VTP advertisements and forwards them on all trunk ports except the one on which the advertisement was received.  When VTP mode is transparent, the mode and domain name are saved in the running configuration file, and you can save them in the startup configuration file by entering the <b>copy running-config startup config</b> privileged EXEC command.
<b>mst</b>	(Optional) Sets the mode for the multiple spanning tree (MST) VTP database (only VTP Version 3).
<b>unknown</b>	(Optional) Sets the mode for unknown VTP databases (only VTP Version 3).

<b>vlan</b>	(Optional) Sets the mode for VLAN VTP databases. This is the default (only VTP Version 3).
<b>password</b> <i>password</i>	Sets the administrative domain password for the generation of the 16-byte secret value used in MD5 digest calculation to be sent in VTP advertisements and to validate received VTP advertisements. The password can be an ASCII string from 1 to 32 characters. The password is case sensitive.
<b>hidden</b>	(Optional) Specifies that the key generated from the password string is saved in the VLAN database file. When the <b>hidden</b> keyword is not specified, the password string is saved in clear text. When the hidden password is entered, you need to reenter the password to issue a command in the domain. This keyword is supported only in VTP Version 3.
<b>secret</b>	(Optional) Allows the user to directly configure the password secret key (only VTP Version 3).
<b>pruning</b>	Enables VTP pruning on the .
<b>version</b> <i>number</i>	Sets the VTP Version to Version 1, Version 2, or Version 3.

**Command Default**

The default filename is *flash:vlan.dat*.

The default mode is server mode and the default database is VLAN.

In VTP Version 3, for the MST database, the default mode is transparent.

No domain name or password is defined.

No password is configured.

Pruning is disabled.

The default version is Version 1.

**Command Modes**

Global configuration

**Command History**

Release	Modification
Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines**

When you save VTP mode, domain name, and VLAN configurations in the startup configuration file and reboot the , the VTP and VLAN configurations are selected by these conditions:

- If the VTP mode is transparent in the startup configuration and the VLAN database and the VTP domain name from the VLAN database matches that in the startup configuration file, the VLAN database is ignored (cleared), and the VTP and VLAN configurations in the startup configuration file are used. The VLAN database revision number remains unchanged in the VLAN database.
- If the VTP mode or domain name in the startup configuration do not match the VLAN database, the domain name and VTP mode and configuration for VLAN IDs 1 to 1005 use the VLAN database information.

The **vtp file** *filename* cannot be used to load a new database; it renames only the file in which the existing database is stored.



Follow these guidelines when configuring a VTP domain name:

- The switch is in the no-management-domain state until you configure a domain name. While in the no-management-domain state, the switch does not send any VTP advertisements even if changes occur to the local VLAN configuration. The switch leaves the no-management-domain state after it receives the first VTP summary packet on any port that is trunking or after you configure a domain name by using the **vtp domain** command. If the switch receives its domain from a summary packet, it resets its configuration revision number to 0. After the switch leaves the no-management-domain state, it cannot be configured to reenter it until you clear the NVRAM and reload the software.
- Domain names are case-sensitive.
- After you configure a domain name, it cannot be removed. You can only reassign it to a different domain.

Follow these guidelines when setting VTP mode:

- The **no vtp mode** command returns the switch to VTP server mode.
- The **vtp mode server** command is the same as **no vtp mode** except that it does not return an error if the switch is not in client or transparent mode.
- If the receiving switch is in client mode, the client switch changes its configuration to duplicate the configuration of the server. If you have a switch in client mode, be sure to make all VTP or VLAN configuration changes on a switch in server mode, as it has a higher VTP configuration revision number. If the receiving switch is in transparent mode, the switch configuration is not changed.
- A switch in transparent mode does not participate in VTP. If you make VTP or VLAN configuration changes on a switch in transparent mode, the changes are not propagated to other switches in the network.
- If you change the VTP or VLAN configuration on a switch that is in server mode, that change is propagated to all the switches in the same VTP domain.
- The **vtp mode transparent** command disables VTP from the domain but does not remove the domain from the switch.
- In VTP Versions 1 and 2, the VTP mode must be transparent for VTP and VLAN information to be saved in the running configuration file.
- With VTP Versions 1 and 2, you cannot change the VTP mode to client or server if extended-range VLANs are configured on the switch. Changing the VTP mode is allowed with extended VLANs in VTP Version 3.
- The VTP mode must be transparent for you to add extended-range VLANs or for VTP and VLAN information to be saved in the running configuration file.
- VTP can be set to either server or client mode only when dynamic VLAN creation is disabled.
- The **vtp mode off** command sets the device to off. The **no vtp mode off** command resets the device to the VTP server mode.

Follow these guidelines when setting a VTP password:

- Passwords are case sensitive. Passwords should match on all switches in the same domain.
- When you use the **no vtp password** form of the command, the switch returns to the no-password state.
- The **hidden** and **secret** keywords are supported only in VTP Version 3. If you convert from VTP Version 2 to VTP Version 3, you must remove the hidden or secret keyword before the conversion.

Follow these guidelines when setting VTP pruning:

- VTP pruning removes information about each pruning-eligible VLAN from VTP updates if there are no stations belonging to that VLAN.
- If you enable pruning on the VTP server, it is enabled for the entire management domain for VLAN IDs 1 to 1005.
- Only VLANs in the pruning-eligible list can be pruned.
- Pruning is supported with VTP Version 1 and Version 2.

Follow these guidelines when setting the VTP version:

- Toggling the Version 2 (v2) mode state modifies parameters of certain default VLANs.
- Each VTP automatically detects the capabilities of all the other VTP devices. To use Version 2, all VTP in the network must support Version 2; otherwise, you must configure them to operate in VTP Version 1 mode.
- If all in a domain are VTP Version 2-capable, you only need to configure Version 2 on one ; the version number is then propagated to the other Version-2 capable in the VTP domain.
- If you are using VTP in a Token Ring environment, VTP Version 2 must be enabled.
- If you are configuring a Token Ring bridge relay function (TrBRF) or Token Ring concentrator relay function (TrCRF) VLAN media type, you must use Version 2.
- If you are configuring a Token Ring or Token Ring-NET VLAN media type, you must use Version 1.
- In VTP Version 3, all database VTP information is propagated across the VTP domain, not only VLAN database information.
- Two VTP Version 3 regions can only communicate over a VTP Version 1 or VTP Version 2 region in transparent mode.

You cannot save password, pruning, and version configurations in the configuration file.

This example shows how to rename the filename for VTP configuration storage to vtpfilename:

```
Device(config)# vtp file vtpfilename
```

This example shows how to clear the device storage filename:

```
Device(config)# no vtp file vtpconfig
Clearing device storage filename.
```

This example shows how to specify the name of the interface providing the VTP updater ID for this device:

```
Device(config)# vtp interface gigabitethernet
```

This example shows how to set the administrative domain for the :

```
Device(config)# vtp domain OurDomainName
```

This example shows how to place the in VTP transparent mode:

```
Device(config)# vtp mode transparent
```

This example shows how to configure the VTP domain password:

```
Device(config)# vtp password ThisIsOurDomainsPassword
```

This example shows how to enable pruning in the VLAN database:

```
Device(config)# vtp pruning
Pruning switched ON
```

This example shows how to enable Version 2 mode in the VLAN database:

```
Device(config)# vtp version 2
```

You can verify your settings by entering the **show vtp status** privileged EXEC command.

## vtp (interface configuration)

To enable the VLAN Trunking Protocol (VTP) on a per-port basis, use the **vtp** command in interface configuration mode. To disable VTP on the interface, use the **no** form of this command.

**vtp**  
**no vtp**

**Syntax Description** This command has no arguments or keywords.

**Command Default** None

**Command Modes** Interface configuration

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** Enter this command only on interfaces that are in trunking mode.

This example shows how to enable VTP on an interface:

```
Device(config-if)# vtp
```

This example shows how to disable VTP on an interface:

```
Device(config-if)# no vtp
```

## vtp primary

To configure a switch as the VLAN Trunking Protocol (VTP) primary server, use the **vtp primary** command in privileged EXEC mode.

```
vtp primary [mst | vlan] [force]
```

Syntax Description	Parameter	Description
	<b>mst</b>	(Optional) Configures the switch as the primary VTP server for the multiple spanning tree (MST) feature.
	<b>vlan</b>	(Optional) Configures the switch as the primary VTP server for VLANs.
	<b>force</b>	(Optional) Configures the switch to not check for conflicting devices when configuring the primary server.

**Command Default** The switch is a VTP secondary server.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	Cisco IOS XE Everest 16.5.1a	This command was introduced.

**Usage Guidelines** A VTP primary server updates the database information and sends updates that are honored by all devices in the system. A VTP secondary server can only back up the updated VTP configurations received from the primary server to NVRAM.

By default, all devices come up as secondary servers. Primary server status is needed only for database updates when the administrator issues a takeover message in the domain. You can have a working VTP domain without any primary servers.

Primary server status is lost if the device reloads or domain parameters change.



**Note** This command is supported only when the switch is running VTP Version 3.

This example shows how to configure the switch as the primary VTP server for VLANs:

```
Device# vtp primary vlan
Setting device to VTP TRANSPARENT mode.
```

You can verify your settings by entering the **show vtp status** privileged EXEC command.



# Notices

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