Security

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

auth-proxy	Provides information about all authenticated-proxy user events.
system	Performs accounting for all system-level events not associated with users, such as reloads.
network	Runs accounting for all network-related service requests.
exec	Runs accounting for EXEC shell session. This keyword might return user profile information such as what is generated by the **autocommand** command.
connection	Provides information about all outbound connections made from the network access server.
commands *level*	Runs accounting for all commands at the specified privilege level. Valid privilege level entries are integers from 0 through 15.
default	Uses the listed accounting methods that follow this argument as the default list of methods for accounting services.
list-name	Character string used to name the list of at least one of the accounting methods described in
start-stop	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.
stop-only	Sends a "stop" accounting notice at the end of the requested user process.
none	Disables accounting services on this line or interface.
broadcast	(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.
group groupname	At least one of the keywords described in the AAA Accounting Methods table.

Command Default   AAA accounting is disabled.

Command Modes   Global configuration (config)

Command History	**Release**	**Modification**
	Cisco IOS XE Fuji 16.9.2	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 1: AAA Accounting Methods

Keyword	**Description**
group radius	Uses the list of all RADIUS servers for authentication as defined by the **aaa group server radius** command.
group tacacs+	Uses the list of all TACACS+ servers for authentication as defined by the **aaa group server tacacs**+ command.
group *group-name*	Uses a subset of RADIUS or TACACS+ servers for accounting as defined by the server group group-name.

In AAA Accounting Methods table, 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 XE 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.

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> enable
Device# configure terminal
Device(config)# aaa accounting commands 15 default stop-only group TACACS+
Device(config)# exit
```

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> enable
Device# configure terminal
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+
Device(config)# exit
```

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		
name	Name of a server group. This is optional when you enter it after the **broadcast group** and **group** keywords.
default	Specifies the accounting methods that follow as the default list for accounting services.
start-stop	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.
broadcast	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 device uses the list of backup servers to identify the first server.
group	Specifies the server group to be used for accounting services. These are valid server group names: • *name* — Name of a server group. • **radius** — Lists of all RADIUS hosts. • **tacacs+** — Lists of all TACACS+ hosts. The **group** keyword is optional when you enter it after the **broadcast group** and **group** keywords. You can enter more than optional **group** keyword.
radius	(Optional) Enables RADIUS accounting.
tacacs+	(Optional) Enables TACACS+ accounting.

Command Default AAA accounting is disabled.

Command Modes Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# aaa new-model
Device(config)# aaa accounting dot1x default start-stop group radius
Device(config)# exit
```

aaa accounting identity

To enable authentication, authorization, and accounting (AAA) accounting 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	

name	Name of a server group. This is optional when you enter it after the **broadcast group** and **group** keywords.
default	Uses the accounting methods that follow as the default list for accounting services.
start-stop	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.
broadcast	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.
group	Specifies the server group to be used for accounting services. These are valid server group names: • *name* — Name of a server group. • **radius** — Lists of all RADIUS hosts. • **tacacs+** — Lists of all TACACS+ hosts. The **group** keyword is optional when you enter it after the **broadcast group** and **group** keywords. You can enter more than optional **group** keyword.
radius	(Optional) Enables RADIUS authorization.
tacacs+	(Optional) Enables TACACS+ accounting.

Command Default AAA accounting is disabled.

Command Modes Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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
Device(config)# exit
```

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. To disable authentication, use the **no** form of this command.

aaa authentication dot1x {**default**} *method1*
no aaa authentication dot1x {**default**} *method1*

Syntax Description		
default	The default method when a user logs in. Use the listed authentication method that follows this argument.	
method1	Specifies the server authentication. Enter the **group radius** keywords to use the list of all RADIUS servers for authentication.	
	Note	Though other keywords are visible in the command-line help strings, only the **default** and **group radius** keywords are supported.

Command Default No authentication is performed.

Command Modes Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# aaa new-model
Device(config)# aaa authentication dot1x default group radius
Device(config)# exit
```

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)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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.

Examples   The following example initializes AAA:

```
Device> enable
Device# configure terminal
Device(config)# aaa new-model
Device(config)# exit
```

The following example shows a VTY configured and the **aaa new-model** command removed:

```
Device> enable
Device# configure terminal
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
```

!

	Command	Description
Related Commands	**aaa accounting**	Enables AAA accounting of requested services for billing or security purposes.
	aaa authentication arap	Enables an AAA authentication method for ARAP using TACACS+.
	aaa authentication enable default	Enables AAA authentication to determine if a user can access the privileged command level.
	aaa authentication login	Sets AAA authentication at login.
	aaa authentication ppp	Specifies one or more AAA authentication method for use on serial interfaces running PPP.
	aaa authorization	Sets parameters that restrict user access to a network.

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		
multi-auth	Enables multiple-authorization mode (multi-auth mode) on the port.	
multi-domain	Enables multiple-domain mode on the port.	
multi-host	Enables multiple-host mode on the port.	
single-host	Enables single-host mode on the port.	

Command Default Single host mode is enabled.

Command Modes Interface configuration (config-if)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# interface gigabitethernet 2/0/1
Device(config-if)# authentication host-mode multi-auth
Device(config-if)# end
```

This example shows how to enable multi-domain mode on a port:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 2/0/1
Device(config-if)# authentication host-mode multi-domain
Device(config-if)# end
```

This example shows how to enable multi-host mode on a port:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 2/0/1
Device(config-if)# authentication host-mode multi-host
Device(config-if)# end
```

This example shows how to enable single-host mode on a port:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 2/0/1
Device(config-if)# authentication host-mode single-host
Device(config-if)# end
```

You can verify your settings by entering the **show authentication sessions interface** *interface* **details** privileged EXEC command.

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 Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# authentication logging verbose
Device(config)# exit
```

You can verify your settings by entering the **show running-config** privileged EXEC command.

Related Commands

Command	Description
authentication logging verbose	Filters details
dot1x logging verbose	Filters details
mab logging verbose	Filters details

authentication mac-move permit

To enable MAC move on a device, 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 (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines

The command enables authenticated hosts to move between any authentication-enabled ports (MAC authentication bypass [MAB], 802.1x, or Web-auth) on a device. 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:

```
Device> enable
Device# configure terminal
Device(config)# authentication mac-move permit
Device(config)# exit
```

Related Commands

Command	Description
access-session mac-move deny	Disables MAC move on a device.
authentication event	Sets the action for specific authentication events.
authentication fallback	Configures a port to use web authentication as a fall IEEE 802.1x authentication.
authentication host-mode	Sets the authorization manager mode on a port.
authentication open	Enables or disables open access on a port.
authentication order	Sets the order of authentication methods used on a p
authentication periodic	Enable or disables reauthentication on a port.
authentication port-control	Enables manual control of the port authorization sta

Command	Description
authentication priority	Adds an authentication method to the port-priori
authentication timer	Configures the timeout and reauthentication para
authentication violation	Configures the violation modes that occur when device connects to a port with the maximum nur
show authentication	Displays information about authentication mana

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		
dot1x	(Optional) Adds 802.1x to the order of authentication methods.	
mab	(Optional) Adds MAC authentication bypass (MAB) to the order of authenticati methods.	
webauth	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 (config-if)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines Ordering sets the order of methods that the device 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 dot1x webauth
```

This example shows how to set MAB as the first authentication method and web authentication as the second authentication method:

```
Device> enable
Device# configure terminal
```

```
Device(config)# interface gigabitethernet 0/1/2
Device(config-if)# authentication priority mab webauth
Device(config-if)# end
```

Related Commands

Command	Description
authentication control-direction	Configures the port mode as unidirectional or bidirectional.
authentication event fail	Specifies how the Auth Manager handles authentication failures a
authentication event no-response action	Specifies how the Auth Manager handles authentication failures a
authentication event server alive action reinitialize	Reinitializes an authorized Auth Manager session when a previous and accounting server becomes available.
authentication event server dead action authorize	Authorizes Auth Manager sessions when the authentication, autho unreachable.
authentication fallback	Enables a web authentication fallback method.
authentication host-mode	Allows hosts to gain access to a controlled port.
authentication open	Enables open access on a port.
authentication order	Specifies the order in which the Auth Manager attempts to authen
authentication periodic	Enables automatic reauthentication on a port.
authentication port-control	Configures the authorization state of a controlled port.
authentication timer inactivity	Configures the time after which an inactive Auth Manager session
authentication timer reauthenticate	Specifies the period of time between which the Auth Manager atte
authentication timer restart	Specifies the period of time after which the Auth Manager attemp
authentication violation	Specifies the action to be taken when a security violation occurs o
mab	Enables MAC authentication bypass on a port.
show authentication registrations	Displays information about the authentication methods that are reg
show authentication sessions	Displays information about current Auth Manager sessions.
show authentication sessions interface	Displays information about the Auth Manager for a given interfac

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		
protect	Drops unexpected incoming MAC addresses. No syslog errors are generated.
replace	Removes the current session and initiates authentication with the new host.
restrict	Generates a syslog error when a violation error occurs.
shutdown	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 (config-if)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# interface gigabitethernet 2/0/1
Device(config-if)# authentication violation shutdown
Device(config-if)# end
```

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> enable
Device# configure terminal
Device(config)# interface gigabitethernet 2/0/1
Device(config-if)# authentication violation restrict
Device(config-if)# end
```

This example shows how to configure an 802.1x-enabled port to ignore a new device when it connects to the port:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet 2/0/1
Device(config-if)# authentication violation protect
Device(config-if)# end
```

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> enable
Device# configure terminal
Device(config)# interface gigabitethernet 2/0/1
Device(config-if)# authentication violation replace
Device(config-if)# end
```

You can verify your settings by entering the **show running-config interface** *interface-name* command.

automate-tester idle-time

To enable automated testing feature for a RADIUS server, use the **automate-tester** command in RADIUS server configuration mode. To disable automated testing feature, use the **no** form of this command.

automate-tester username *user* [**ignore-auth-port**] [**ignore-acct-port**] [**idle-time** *minutes*] [**vrf** *vrf-name*]

no automate-tester username *user* [**ignore-auth-port**] [**ignore-acct-port**] [**idle-time** *minutes*] [**vrf** *vrf-name*]

username	Specifies the automated test user ID username.
ignore-auth-port	(Optional) Disables testing on the User Datagram Protocol (UDP) port for the RADIUS authentication server.
ignore-acct-port	(Optional) Disables testing on the UDP port for the RADIUS accounting server.
idle-time	(Optional) Specifies the time, in minutes, for which the server remains idle before it is quarantined and test packets are sent out. The timer is periodic. Test packets are sent out after every idle-time period expires.The default value is 60 minutes.
vrf	(Optional) Specifies the non-default interface VRF for automated testing.

Command Default   Automated testing is disabled by default.

Command Modes   RADIUS server configuration (config-radius-server)

Release	Modification
Cisco IOS XE Bengaluru 17.4.1	The command was introduced.

Usage Guidelines   Use the **automate-tester** command to enable automated testing on the RADIUS server accounting and authentication UDP ports for RADIUS server load balancing.

Use the **vrf** keyword to specify the non-default VRF to be used for RADIUS automated testing.

The following example shows how to enable automated testing for a non-default VRF on the RADIUS server:

```
Device(config)#radius server myserver
        Device(config-radius-server)#address ipv4 192.0.2.1 auth-port 1812 acct-port 1813
        Device(config-radius-server)#automate-tester username user1 idle-time 2 vrf VRF1
        Device(config-radius-server)#end
```

automate-tester probe-on

To enable automated testing for a RADIUS server and to verify the status of the server, use the **automate-tester probe-on** command in RADIUS server configuration mode. To disable the automated testing feature, use the **no** form of this command.

automate-tester username *user* [**ignore-auth-port**] [**ignore-acct-port**] [**probe-on**] [**vrf** *vrf-name*]

no automate-tester username *user* [**ignore-auth-port**] [**ignore-acct-port**] [**probe-on**] [**vrf** *vrf-name*]

Syntax Description	

username	Specifies the automated test user ID username.
ignore-auth-port	(Optional) Disables testing on the User Datagram Protocol (UDP) port for the RADIUS authentication server.
ignore-acct-port	(Optional) Disables testing on the UDP port for the RADIUS accounting server.
probe-on	(Optional) Verifies the status of the server by sending a test packet. Test packets are sent only when the server is in the Dead state. Once the server is in the Up state the packets are not sent.
vrf	(Optional) Specifies the non-default interface VRF for automated testing.

Command Default   Automated testing is disabled by default.

Command Modes   RADIUS server configuration (config-radius-server)

Release	Modification
Cisco IOS XE Bengaluru 17.4.1	The command was introduced.

Usage Guidelines   Use the **automate-tester** command to enable automated testing on the RADIUS server accounting and authentication UDP ports for RADIUS server load balancing.

Use the **vrf** keyword to specify the non-default VRF to be used for RADIUS automated testing.

The following example shows how to enable automated testing for a non-default VRF on the RADIUS server:

```
Device(config)#radius server myserver
        Device(config-radius-server)#address ipv4 192.0.2.1 auth-port 1812 acct-port 1813
        Device(config-radius-server)#automate-tester username user1 probe-on vrf VRF1
        Device(config-radius-server)#end
```

cisp enable

To enable Client Information Signaling Protocol (CISP) on a device so that it acts as an authenticator to a supplicant device and a supplicant to an authenticator device, 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 (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines

The link between the authenticator and supplicant device is a trunk. When you enable VTP on both devices, 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 devices, which can be caused by two VTP servers in the same domain.

- Both devices have different configuration revision numbers.

This example shows how to enable CISP:

```
Device> enable
Device# configure terminal
Device(config)# cisp enable
Device(config)# exit
```

Related Commands

Command	Description
dot1x credentials*profile*	Configures a profile on a supplicant device.
dot1x supplicant force-multicast	Forces 802.1X supplicant to send multicast packet
dot1x supplicant controlled transient	Configures controlled access by 802.1X supplicant
show cisp	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*]

Syntax Description	*interface-id*	Specifies an interface.
	vlan list	(Optional) Specifies a list of VLANs to be reenabled. I...

Command Default	No default behavior or values.

Command Modes	Privileged EXEC (#)

Command History	**Release**	**Modification**
	Cisco IOS XE Fuji 16.9.2	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.

Examples 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
```

Related Commands	**Command**	**Description**
	errdisable detect cause	Enables error-disabled detectio...
	errdisable recovery	Configures the recovery mecha...
	show errdisable detect	Displays error-disabled detecti...
	show errdisable recovery	Displays error-disabled recover...
	show interfaces status err-disabled	Displays interface status of a li...

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	**dynamic**	Deletes all dynamic MAC addresses.
	address *mac-addr*	(Optional) Deletes the specified dynamic MAC address
	interface *interface-id*	(Optional) Deletes all dynamic MAC addresses on the s
	vlan *vlan-id*	(Optional) Deletes all dynamic MAC addresses for the s
	move update	Clears the MAC address table move-update counters.
	notification	Clears the notifications in the history table and reset the

Command Default No default behavior or values.

Command Modes Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines You can verify that the information was deleted by entering the **show mac address-table** command.

This example shows how to remove a specific MAC address from the dynamic address table:

```
Device> enable
Device# clear mac address-table dynamic address 0008.0070.0007
```

Related Commands	**Command**	**Description**
	mac address-table notification	Enables the MAC address notification feature.
	mac address-table move update {**receive** | **transmit**}	Configures MAC address-table move update on the device.
	show mac address-table	Displays the MAC address table static and dynamic entries.
	show mac address-table move update	Displays the MAC address-table move update information on the device.

Command	Description
show mac address-table notification	Displays the MAC address notification settings for all interfaces or on the specified interface when the **interface** keyword is appended.
snmp trap mac-notification change	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 Fuji 16.9.2	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
mka policy	Configures an MKA policy.
delay-protection	Configures MKA to use delay protection in sending MKPDU.
include-icv-indicator	Includes ICV indicator in MKPDU.
key-server	Configures MKA key-server options.
macsec-cipher-suite	Configures cipher suite for deriving SAK.
sak-rekey	Configures the SAK rekey interval.
send-secure-announcements	Configures MKA to send secure announcements in sending MKPDUs.
ssci-based-on-sci	Computes SSCI based on the SCI.
use-updated-eth-header	Uses the updated Ethernet header for ICV calculation.

crypto pki trustpool import

To manually import (download) a certificate authority (CA) certificate bundle into a public key infrastructure (PKI) trustpool to update or replace an existing CA bundle, use the **crypto pki trustpool import** command in global configuration mode. To remove any of the configured parameters, use the **no** form of this command.

crypto pki trustpool import {**ca-bundle** | **clean** [**terminal** | **url** *url*] | **terminal** | **url** *url*}

no crypto pki trustpool import {**ca-bundle** | **clean** [**terminal** | **url** *url*] | **terminal** | **url** *url*}

Syntax Description	

ca-bundle	Imports a CA certificate bundle configured in the trustpool policy.
clean	Removes all the downloaded PKI trustpool certificates before the new certificates are downloaded. Use the optional **terminal** keyword to remove the existing CA certificate bundle terminal setting, or the **url** keyword and *url* argument to remove the URL file system setting.
terminal	Import a CA certificate bundle through the terminal (cut-and-paste) in privacy-enhanced mail (PEM) format.
url *url*	Imports a CA certificate bundle through the specified URL.

Command Default The PKI trustpool feature is enabled. The device uses the built-in CA certificate bundle in the PKI trustpool, which is updated automatically.

Command Modes Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Usage Guidelines PKI trustpool certificates are automatically updated. When the PKI trustpool certificates are not current, use the **crypto pki trustpool import** command to update them from another location.

Note Security threats, as well as the cryptographic technologies that help protect against them, are constantly changing. For more information about the latest Cisco cryptographic recommendations, see the Next Generation Cryptography white paper.

The *url* argument specifies or changes the URL file system of the CA. The following table lists the available URL file systems.

Table 2: URL File Systems

File System	Description
archive:	Imports from the archive file system.
cns:	Imports from the Cluster Namespace (CNS) file system.
disk0:	Imports from the disc0 file system.

File System	Description
disk1:	Imports from the disc1 file system.
ftp:	Imports from the FTP file system.
http:	Imports from the HTTP file system. The URL must be in the following formats: • http://*CAname*:80, where *CAname* is the Domain Name System (DNS) • http://*ipv4-address*:80, for example: http://10.10.10.1:80. • http://*[ipv6-address]*:80, for example: http://[2001:DB8:1:1::1]:80. The IPv6 address is a hexadecimal notation, and must be enclosed within brackets in the URL.
https:	Imports from the HTTPS file system. The URL must use the same format as the HTTP: file system format.
null:	Imports from the null file system.
nvram:	Imports from the NVRAM file system.
pram:	Imports from the Parameter Random-access Memory (PRAM) file system.
rcp:	Imports from the remote copy protocol (RCP) file system.
scp:	Imports from the secure copy protocol (SCP) file system.
snmp:	Imports from the Simple Network Management Protocol (SNMP).
system:	Imports from the system file.
tar:	Imports from the UNIX TAR file system.
tftp:	Imports from the TFTP file system. **Note** The URL must be in the form: tftp://*CAname/filespecification*.
tmpsys:	Imports from the Cisco IOS tmpsys file system.
unix:	Imports from the UNIX file system.
xmodem:	Imports from the xmodem simple file transfer protocol system.
ymodem:	Imports from the ymodem simple file transfer protocol system.

Examples

The following example shows how to remove all the downloaded PKI trustpool CA certificates and subsequently update the CA certificates in the PKI trustpool by downloading a new CA certification bundle:

```
Device> enable
Device# configure terminal
Device(config)# crypto pki trustpool import clean
```

The following example shows how to update all the CA certificates in the PKI trustpool by downloading a new CA certification bundle without removing all the downloaded PKI trustpool CA certificates:

```
Device(config)# crypto pki trustpool import url http://www.cisco.com/security/pki/trs/ios.p7b
```

Related Commands	Command	Description
	crypto pki trustpool policy	Configures PKI trustpool policy parameters.
	show crypto pki trustpool	Displays the PKI trustpool certificates of the device, and optionally shows the PKI trustpool policy.

debug aaa dead-criteria transaction

To display authentication, authorization, and accounting (AAA) dead-criteria transaction values, use the **debugaaadead-criteriatransaction**command in privileged EXEC mode. To disable dead-criteria debugging, use the **no** form of this command.

debug aaa dead-criteria transaction
no debug aaa dead-criteria transaction

Syntax Description   This command has no arguments or keywords.

Command Default   If the command is not configured, debugging is not turned on.

Command Modes   Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   Dead-criteria transaction values may change with every AAA transaction. Some of the values that can be displayed are estimated outstanding transaction, retransmit tries, and dead-detect intervals. These values are explained in the table below.

Examples   The following example shows dead-criteria transaction information for a particular server group:

```
Device> enable
Device# debug aaa dead-criteria transaction

AAA Transaction debugs debugging is on
*Nov 14 23:44:17.403: AAA/SG/TRANSAC: Computed Retransmit Tries: 10, Current Tries: 3,
Current Max Tries: 10
*Nov 14 23:44:17.403: AAA/SG/TRANSAC: Computed Dead Detect Interval: 10s, Elapsed Time:
317s, Current Max Interval: 10s
*Nov 14 23:44:17.403: AAA/SG/TRANSAC: Estimated Outstanding Transaction: 6, Current Max
Transaction: 6
```

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

Table 3: debug aaa dead-criteria transaction Field Descriptions

Field	Description
AAA/SG/TRANSAC	AAA server-group transaction.
Computed Retransmit Tries	Currently computed number of retransmissions before the server is marked as dead.
Current Tries	Number of successive failures since the last valid response.
Current Max Tries	Maximum number of tries since the last successful transaction.

Field	Description
Computed Dead Detect Interval	Period of inactivity (the number of seconds since the last successful transaction) that can elapse before the server is marked as dead. The period of inactivity starts when a transaction is sent to a server that is considered live. The dead-detect interval is the period that the device waits for responses from the server before the device marks the server as dead.
Elapsed Time	Amount of time that has elapsed since the last valid response.
Current Max Interval	Maximum period of inactivity since the last successful transaction.
Estimated Outstanding Transaction	Estimated number of transaction that are associated with the server.
Current Max Transaction	Maximum transaction since the last successful transaction.

Related Commands

Command	Description
radius-server dead-criteria	Forces one or both of the criteria, used to mark a RADIUS server as dead, to be the indicated constant.
show aaa dead-criteria	Displays dead-criteria detection information for an AAA server.

debug umbrella

To enable debugging of the Cisco Umbrella Integration feature, use the **debug umbrella** command in privileged EXEC mode. To disable debugging, use the **no** form of this command.

debug umbrella {**config** | **device-registration** | **dnscrypt** | **redundancy**}
no debug umbrella {**config** | **device-registration** | **dnscrypt** | **redundancy**}

Syntax Description		
	config	Enables configuration debugging.
	device-registration	Enables device registration debugging.
	dnscrypt	Enables DNSCrypt debugging.
	redundancy	Enables redundancy debugging.

Command Default   Debugging is disabled.

Command Modes   Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Examples

The following example shows how to enable Cisco Umbrella configuration debugging:

```
Device> enable
Device# debug umbrella config

Umbrella config debugging is on

Device# configure terminal
Device(config)# interface gigabitethernet 1/0/12
Device(config-if)# umbrella in test

*Nov 27 08:34:41.088: UMBRELLA-CONFIG:Umbrella token configured, so set mode as TOKEN
*Nov 27 08:34:41.088: UMBRELLA-CONFIG:check user configured resolver count
*Nov 27 08:34:41.088: UMBRELLA-CONFIG:Umbrella interface with no direct cloud access
*Nov 27 08:34:41.088: UMBRELLA-CONFIG:Umbrella mandatory parameter 'token' or
'api-key/secret/orgid' configured
*Nov 27 08:34:41.088: UMBRELLA-CONFIG:Processing is umbrella enabled check
*Nov 27 08:34:41.088: UMBRELLA-CONFIG:Is umbrella enabled check failed:sw idb info not found
*Nov 27 08:34:41.088: UMBRELLA-CONFIG:Send the interface info to device registration proces
*Nov 27 08:34:41.089: UMBRELLA-CONFIG:Add interface GigabitEthernet1/0/12 request sent to
DP
*Nov 27 08:34:41.089: UMBRELLA-CONFIG:Configured 'umbrella in test' on interface
GigabitEthernet1/0/12
*Nov 27 08:34:41.089: UMBRELLA-CONFIG:Cannot add domain patterns to DSA: Nothing to add
```

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 Fuji 16.9.2	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
mka policy	Configures an MKA policy.
confidentiality-offset	Sets the confidentiality offset for MACsec operations.
include-icv-indicator	Includes ICV indicator in MKPDU.
key-server	Configures MKA key-server options.
macsec-cipher-suite	Configures cipher suite for deriving SAK.
sak-rekey	Configures the SAK rekey interval.
send-secure-announcements	Configures MKA to send secure announcements in sending MKPDUs.
ssci-based-on-sci	Computes SSCI based on the SCI.
use-updated-eth-header	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** command in MAC access-list extended configuration mode. 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** | **lavc-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** | **lavc-sca** | **lsap** *lsap mask* | **mop-console** | **mop-dump** | **msdos** | **mumps** | **netbios** | **vines-echo** | **vines-ip** | **xns-idp**] [**cos** *cos*]

Syntax Description

any	Denies any source or destination MAC address.
host *src-MAC-addr*	*src-MAC-addr mask*	Defines a host MAC address and optional subnet matches the defined address, non-IP traffic from
host *dst-MAC-addr*	*dst-MAC-addr mask*	Defines a destination MAC address and optional a packet matches the defined address, non-IP traf
type mask	(Optional) Specifies the EtherType number of a pac 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 t
aarp	(Optional) Specifies EtherType AppleTalk Addres address to a network address.
amber	(Optional) Specifies EtherType DEC-Amber.
appletalk	(Optional) Specifies EtherType AppleTalk/EtherT
dec-spanning	(Optional) Specifies EtherType Digital Equipmen
decnet-iv	(Optional) Specifies EtherType DECnet Phase IV
diagnostic	(Optional) Specifies EtherType DEC-Diagnostic.
dsm	(Optional) Specifies EtherType DEC-DSM.
etype-6000	(Optional) Specifies EtherType 0x6000.
etype-8042	(Optional) Specifies EtherType 0x8042.
lat	(Optional) Specifies EtherType DEC-LAT.
lavc-sca	(Optional) Specifies EtherType DEC-LAVC-SCA

lsap *lsap-number mask*	(Optional) Specifies the LSAP number (0 to 6 identify the protocol of the packet. *mask* is a mask of don't care bits applied to th
mop-console	(Optional) Specifies EtherType DEC-MOP R
mop-dump	(Optional) Specifies EtherType DEC-MOP D
msdos	(Optional) Specifies EtherType DEC-MSDOS
mumps	(Optional) Specifies EtherType DEC-MUMP:
netbios	(Optional) Specifies EtherType DEC- Networ
vines-echo	(Optional) Specifies EtherType Virtual Integr Banyan Systems.
vines-ip	(Optional) Specifies EtherType VINES IP.
xns-idp	(Optional) Specifies EtherType Xerox Networ an arbitrary EtherType in decimal, hexadecim
cos *cos*	(Optional) Specifies a class of service (CoS) i CoS can be performed only in hardware. A war 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 extended configuration (config-ext-macl)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   You enter MAC-access list extended 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 XE terminology are listed in the table.

Table 4: IPX Filtering Criteria

IPX Encapsulation Type		Filter Criterion
Cisco IOS XE 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> enable
Device# configure terminal
Device(config)# mac access-list extended mac_layer
Device(config-ext-macl)# deny any host 00c0.00a0.03fa netbios.
Device(config-ext-macl)# end
```

This example shows how to remove the deny condition from the named MAC extended access list:

```
Device> enable
Device# configure terminal
Device(config)# mac access-list extended mac_layer
Device(config-ext-macl)# no deny any 00c0.00a0.03fa 0000.0000.0000 netbios.
Device(config-ext-macl)# end
```

The following example shows how to deny all packets with EtherType 0x4321:

```
Device> enable
Device# configure terminal
Device(config)# mac access-list extended mac_layer
Device(config-ext-macl)# deny any any 0x4321 0
Device(config-ext-macl)# end
```

You can verify your settings by entering the **show access-lists** privileged EXEC command.

Related Commands

Command	Description
mac access-list extended	Creates an access list based on MAC addresses for
permit	Permits from the MAC access-list configuration.
	Permits non-IP traffic to be forwarded if conditions
show access-lists	Displays access control lists configured on a device

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. To remove the specification, use the **no** form of this command.

device-role {**node** | **switch**}
no device-role {**node** | **switch**}

Syntax Description	**node**	Sets the role of the attached device to node.
	switch	Sets the role of the attached device to device.

Command Default The device role is node.

Command Modes IPv6 snooping configuration (config-ipv6-snooping)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# device-role node
Device(config-ipv6-snooping)# end
```

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		
host	Sets the role of the attached device to host.	
switch	Sets the role of the attached device to switch.	

Command Default   The device role is host.

Command Modes   ND inspection policy configuration (config-nd-inspection)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)#  ipv6 nd inspection policy policy1
Device(config-nd-inspection)# device-role host
Device(config-nd-inspection)# end
```

dnscrypt (Parameter Map)

To enable Domain Name System (DNS) packet encryption for authenticating communications between a Cisco device and the Cisco Umbrella Integration feature, use the **dnscrypt** command in parameter-map type inspect configuration mode. To disable DNS packet encryption, use the **no** form of this command.

dnscrypt
no dnscrypt

Syntax Description   This command has no arguments or keywords.

Command Default   DNS packet encyrption for umbrella mode is not configured.

Command Modes   Parameter-map type inspect configuration (config-profile)

Command History

Release	Modification
Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Usage Guidelines   When DNSCrypt is used, the DNS request packets' size is more than 512 bytes. Ensure that these packets are allowed through the intermediary devices; otherwise, the response may not reach the intended recipients.

Examples   The following example shows how to enable DNS packet encryption:

```
Device> enable
Device# configure terminal
Device(config)# parameter-map type umbrella global
Device(config-profile)# dnscrypt
```

Related Commands

Command	Description
parameter-map type umbrella global	Configures a parameter map type in umbrella mode.

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

Syntax Description	eapol	Specifies that the switch send an EAPOL-Success message when the device successfully authenticates the critical port.

Command Default **eapol** is disabled

Command Modes Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

This example shows how to specify that the device sends an EAPOL-Success message when the device successfully authenticates the critical port:

```
Device> enable
Device# configure terminal
Device(config)# dot1x critical eapol
Device(config)# exit
```

dot1x logging verbose

To filter detailed information from 802.1x system messages, use the **dot1x logging verbose** command in global configuration mode on a device stack or on a standalone device.

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 Fuji 16.9.2	This command was introduced.

Usage Guidelines This command filters details, such as anticipated success, from 802.1x system messages. Failure messages are not filtered.

The following example shows how to filter verbose 802.1x system messages:

```
Device> enable
Device# configure terminal
Device(config)# dot1x logging verbose
Device(config)# exit
```

Related Commands	**Command**	**Description**
	authentication logging verbose	Filters details from authentication
	dot1x logging verbose	Filters details from 802.1x system
	mab logging verbose	Filters details from MAC authentic

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		
supplicant	The interface acts only as a supplicant and will not respond to messages that are meant for an authenticator.
authenticator	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 (config-if)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

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 device 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> enable
Device# configure terminal
Device(config)# interface gigabitethernet 1/0/3
Device(config-if)# dot1x pae supplicant
Device(config-if)# end
```

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 (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   In the default state, when you connect a supplicant device 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. You can control traffic exiting the supplicant port during the authentication period. Entering the **dot1x supplicant controlled transient** 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** command opens the supplicant port during the authentication period. This is the default behavior.

We recommend using the **dot1x supplicant controlled transient** command on a supplicant device 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 device during authentication:

```
Device> enable
Device# configure terminal
Device(config)# dot1x supplicant controlled transient
Device(config)# exit
```

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

Syntax Description	This command has no arguments or keywords.
Command Default	The supplicant device sends unicast EAPOL packets when it receives unicast EAPOL packets. Similarly, it sends multicast EAPOL packets when it receives multicast EAPOL packets.
Command Modes	Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines

Enable this command on the supplicant device for Network Edge Access Topology (NEAT) to work in all host modes.

This example shows how force a supplicant device to send multicast EAPOL packets to the authenticator device:

```
Device> enable
Device# configure terminal
Device(config)# dot1x supplicant force-multicast
Device(config)# end
```

Related Commands

Command	Description
cisp enable	Enables CISP on a device so that it act
dot1x credentials	Configures the 802.1x supplicant crede
dot1x pae supplicant	Configures an interface to act only as a

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.

dot1x test eapol-capable [**interface** *interface-id*]

Syntax Description	**interface** *interface-id*	(Optional) Port to be queried.

Command Default   There is no default setting.

Command Modes   Privileged EXEC (#)

Command History	**Release**	**Modification**
	Cisco IOS XE Fuji 16.9.2	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> enable
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
```

Related Commands	**Command**	**Description**
	dot1x test timeout *timeout*	Configures the timeout used t 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.

dot1x test timeout *timeout*

Syntax Description	*timeout*	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 (config)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	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> enable
Device# dot1x test timeout 27
```

You can verify the timeout configuration status by entering the **show running-config** command.

Related Commands	Command	Description
	dot1x test eapol-capable [**interface** *interface-id*]	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		
	auth-period *seconds*	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.
	held-period *seconds*	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
	quiet-period *seconds*	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
	ratelimit-period *seconds*	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 device processing power).
		• The authenticator ignores EAPOL-Start packets from clients that have successfully authenticated for the rate-limit period duration.
		• The range is from 1 to 65535. By default, rate limiting is disabled.
	server-timeout *seconds*	Configures the interval, in seconds, between two successive EAPOL-Start frames when they are being retransmitted.
		• The range is from 1 to 65535. The default is 30.
		If the server does not send a response to an 802.1X packet within the specified period, the packet is sent again.
	start-period *seconds*	Configures the interval, in seconds, between two successive EAPOL-Start frames when they are being retransmitted.
		The range is from 1 to 65535. The default is 30.

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 Global configuration (config)

Interface configuration (config-if)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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 device only if you have enabled periodic re-authentication by using the **dot1x reauthentication** interface configuration command.

During the quiet period, the device 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 device 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> enable
Device(config)# configure terminal
Device(config)# interface gigabitethernet 1/0/3
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
Device(config-if)# end
```

dtls

To configure Datagram Transport Layer Security (DTLS) parameters, use the **dtls** command in radius server configuration mode. To return to the default setting, use the **no** form of this command.

dtls [**connectiontimeout** *connection-timeout-value* | **idletimeout** *idle-timeout-value* | [**ip** | **ipv6**] { **radius source-interface** *interface-name* | **vrf forwarding** *forwarding-table-name* } | **match-server-identity** { **email-address** *email-address* | **hostname** *hostname* | **ip-address** *ip-address* } | **port** *port-number* | **retries** *number-of-connection-retries* | **trustpoint** { **client** *trustpoint name* | **server** *trustpoint name* }]

no dtls

Syntax Description

connectiontimeout *connection-timeout-value*	(Optional) Configures the DTLS connection timeout value.
idletimeout *idle-timeout-value*	(Optional) Configures the DTLS idle timeout value.
[**ip** | **ipv6**] {**radius source-interface** *interface-name* | **vrf forwarding** *forwarding-table-name*}	(Optional) Configures IP or IPv6 source parameters.
match-server-identity {**email-address** *email-address* | **hostname** *host-name* | **ip-address** *ip-address*}	Configures RadSec certification validation parameters.
port *port-number*	(Optional) Configures the DTLS port number.
retries *number-of-connection-retries*	(Optional) Configures the number of DTLS connection retries.
trustpoint {**client** *trustpoint name* | **server** *trustpoint name*}	(Optional) Configures the DTLS trustpoint for the client and the server.

Command Default

- The default value of DTLS connection timeout is 5 seconds.
- The default value of DTLS idle timeout is 60 seconds.
- The default DTLS port number is 2083.
- The default value of DTLS connection retries is 5.

Command Modes

Radius server configuration (config-radius-server)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.
Cisco IOS XE Gibraltar 16.10.1	The **match-server-identity** keyword was introduced.
Cisco IOS XE Amsterdam 17.1.1	The **ipv6** keyword was introduced.

Usage Guidelines   We recommend that you use the same server type, either only Transport Layer Security (TLS) or only DTLS, under an Authentication, Authorization, and Accounting (AAA) server group.

Examples   The following example shows how to configure the DTLS connection timeout value to 10 seconds:

```
Device> enable
Device# configure terminal
Device(config)# radius server R1
Device(config-radius-server)# dtls connectiontimeout 10
Device(config-radius-server)# end
```

Related Commands

Command	Description
show aaa servers	Displays information related to the DTLS server.
clear aaa counters servers radius	Clears the RADIUS DTLS-specific statistics.
debug radius dtls	Enables RADIUS DTLS-specific debugs.

enable password

To set a local password to control access to various privilege levels, use the **enable password** command in global configuration mode. To remove control access of the local password, use the **no** form of this command.

enable password [**level** *level*]   {[**0**] *unencrypted-password* | [*encryption-type*] *encrypted-password*}
no enable password [**level** *level*]

Syntax Description		
level *level*	(Optional) Specifies the level for which the password is applicable. You can sp_____ levels, using numbers 0 through 15. Level 1 is normal user EXEC mode user p_____ specified in the command or in the **no** form of the command, the privilege leve_____
0	(Optional) Specifies an unencrypted cleartext password. The password is conve_____ Algorithm (SHA) 256 secret and is stored in the device.
unencrypted-password	Specifies the password to enter enable mode.
encryption-type	(Optional) Cisco-proprietary algorithm used to encrypt the password. If you spe_____ next argument that you supply must be an encrypted password (a password alrea_____ device). You can specify type 7, which indicates that a hidden password follow_____
encrypted-password	Encrypted password copied from another device configuration.

Command Default   No password is defined.

Command Modes   Global configuration (config)

Command History

Release	Modif_____
Cisco IOS XE Fuji 16.9.2	This c_____

Usage Guidelines   If neither the **enable password** command nor the **enable secret** command is configured, and if a line password is configured for the console, the console line password serves as the enable password for all VTY (Telnet and Secure Shell [SSH]) sessions.

Use **enable password** command with the **level** option to define a password for a specific privilege level. After you specify the level and the password, share the password with users who need to access this level. Use the **privilege level** configuration command to specify the commands that are accessible at various levels.

Typically, you enter an encryption type only if you copy and paste a password that has already been encrypted by a Cisco device, into this command.

⚠

Caution   If you specify an encryption type and then enter a cleartext password, you will not be able to re-enter enable mode. You cannot recover a lost password that has been encrypted earlier.

If the **service password-encryption** command is set, the encrypted form of the password you create with the **enable password** command is displayed when the **more nvram:startup-config** command is run.

You can enable or disable password encryption with the **service password-encryption** command.

An enable password is defined as follows:

- Must contain a combination of numerals from 1 to 25, and uppercase and lowercase alphanumeric characters.

- Can have leading spaces, but they are ignored. However, intermediate and trailing spaces are recognized.

- Can contain the question mark (?) character if you precede the question mark with the key combination Crtl-V when you create the password, for example, to create the password *abc?123,* do the following:

  1. Enter **abc**.

  2. Press **Crtl-v**.

  3. Enter **?123**.

> **Note** When the system prompt you to enter the **enable password** command, you need not precede the question mark with Ctrl-V; you can enter abc?123 at the password prompt.

Examples

The following example shows how to enables the password pswd2 for privilege level 2:

```
Device> enable
Device# configure terminal
Device(config)# enable password level 2 pswd2
```

The following example shows how to set the encrypted password 1i5Rkls3LoyxzS8t9, which has been copied from a device configuration file, for privilege level 2 using encryption type 7:

```
Device> enable
Device# configure terminal
Device(config)# enable password level 2 5 $1$i5Rkls3LoyxzS8t9
```

Related Commands

Command	Description
enable secret	Specifies an additional layer of security over the **enable pass**
service password-encryption	Encrypts a password.
more nvram:startup-config	Displays the startup configuration file contained in NVRAM CONFIG_FILE environment variable.
privilege level	Sets the privilege level for the user.

enable secret

To specify an additional layer of security over the **enable password** command, use the **enable secret** command in global configuration mode. To turn off the enable secret function, use the **no** form of this command.

enable secret [**level** *level*]   {[**0**] *unencrypted-password* | *encryption-type encrypted-password*}
no enable secret [**level** *level*] [*encryption-type encrypted-password*]

Syntax Description		
level *level*	(Optional) Specifies the level for which the password is applicable. You can spec levels, using numerals 1 through 15. Level 1 is normal user EXEC mode privileges in the command or in the **no** form of the command, the privilege level defaults t
0	(Optional) Specifies an unencrypted cleartext password. The password is conver Algorithm (SHA) 256 secret and is stored in the device.
unencrypted-password	Specifies the password for users to enter enable mode. This password should be dif created with the **enable password** command.
encryption-type	Cisco-proprietary algorithm used to hash the password: • **5**: Specifies a message digest algorithm 5-encrypted (MD5-encrypted) secre • **8**: Specifies a Password-Based Key Derivation Function 2 (PBKDF2) with S • **9**: Specifies a scrypt-hashed secret.
encrypted-password	Hashed password that is copied from another device configuration.

Command Default No password is defined.

Command Modes Global configuration (config)

Command History	Release	Modif
	Cisco IOS XE Fuji 16.9.2	This c

Usage Guidelines If neither the **enable password** command or the **enable secret** command is configured, and if a line password is configured for the console, the console line password serves as the enable password for all vty (Telnet and Secure Shell [SSH]) sessions.

Use the **enable secret** command to provide an additional layer of security over the **enable password** password. The **enable secret** command provides better security by storing the password using a nonreversible cryptographic function. The additional layer of security encryption is useful in environments where the password is sent to the network or is stored on a TFTP server.

Typically, you enter an encryption type only when you paste an encrypted password that you copied from a device configuration file, into this command.

⚠️

Caution If you specify an encryption type and then enter a cleartext password, you will not be able to reenter enable mode. You cannot recover a lost password that has been encrypted earlier.

If you use the same password for the **enable password** and **enable secret** commands, you receive an error message warning that this practice is not recommended, but the password will be accepted. By using the same password, however, you undermine the additional security the **enable secret** command provides.

✎

Note After you set a password using the **enable secret** command, a password set using the **enable password** command works only if the **enable secret** is disabled. Additionally, you cannot recover a lost password that has been encrypted by any method.

If the **service password-encryption** command is set, the encrypted form of the password you create is displayed when the **more nvram:startup-config** command is run.

You can enable or disable password encryption with the **service password-encryption** command.

An enable password is defined as follows:

- Must contain a combination of numerals from 1 to 25, and uppercase and lowercase alphanumeric characters.

- Can have leading spaces, but they are ignored. However, intermediate and trailing spaces are recognized.

- Can contain the question mark (?) character if you precede the question mark with the key combination Crtl-v when you create the password; for example, to create the password *abc?123,* do the following:

  1. Enter **abc**.

  2. Press **Crtl-v**.

  3. Enter **?123**.

✎

Note When the system prompts you to enter the **enable password** command, you need not precede the question mark with Ctrl-v; you can enter **abc?123** at the password prompt.

Examples The following example shows how to specify a password with the **enable secret** command:

```
Device> enable
Device# configure terminal
Device(config)# enable secret password
```

After specifying a password with the **enable secret** command, users must enter this password to gain access. Otherwise, passwords set using the **enable password** command will no longer work.

```
Password: password
```

The following example shows how to enable the encrypted password 1FaD0$Xyti5Rkls3LoyxzS8, which has been copied from a device configuration file, for privilege level 2, using the encryption type 4:

```
Device> enable
Device# configure terminal
Device(config)# enable password level 2 4 $1$FaD0$Xyti5Rkls3LoyxzS8
```

The following example shows the warning message that is displayed when a user enters the **enable secret 4** *encrypted-password* command:

```
Device> enable
Device# configure terminal
Device(config)# enable secret 4 tnhtc92DXBhelxjYk8LWJrPV36S2i4ntXrpb4RFmfqY

WARNING: Command has been added to the configuration but Type 4 passwords have been
deprecated.
Migrate to a supported password type

Device(config)# end
Device# show running-config | inc secret

enable secret 4 tnhtc92DXBhelxjYk8LWJrPV36S2i4ntXrpb4RFmfqY
```

Related Commands

Command	Description
enable password	Sets a local password to control access to various privil
more nvram:startup-config	Displays the startup configuration file contained in NVR CONFIG_FILE environment variable.
service password-encryption	Encrypt passwords.

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 (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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** command.

This example shows how to configure an open directive.

```
Device> enable
Device# configure terminal
Device(config)# epm access-control open
Device(config)# exit
```

Related Commands

Command	Description
show running-config	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 Fuji 16.9.2	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
mka policy	Configures an MKA policy.
confidentiality-offset	Sets the confidentiality offset for MACsec operations.
delay-protection	Configures MKA to use delay protection in sending MKPDU.
key-server	Configures MKA key-server options.
macsec-cipher-suite	Configures cipher suite for deriving SAK.
sak-rekey	Configures the SAK rekey interval.
send-secure-announcements	Configures MKA to send secure announcements in sending MKPDUs.
ssci-based-on-sci	Computes SSCI based on the SCI.
use-updated-eth-header	Uses the updated Ethernet header for ICV calculation.

ip access-list

To define an IP access list or object-group access control list (ACL) by name or number or to enable filtering for packets with IP helper-address destinations, use the **ip access-list** command in global configuration mode. To remove the IP access list or object-group ACL or to disable filtering for packets with IP helper-address destinations, use the **no** form of this command.

ip access-list { {**extended** | **resequence** | **standard**} {*access-list-numberaccess-list-name*} | **helper egress check** | **log-update threshold** *threshold-number* | **logging** {**hash-generation** | **interval** *time*} | **persistent** | **role-based** *access-list-name* | **fqdn** *access-list-name* }
no ip access-list { {**extended** | **resequence** | **standard**} { *access-list-number access-list-name* } | **helper egress check** | **log-update threshold** | **logging** { **hash-generation** | **interval** } | **persistent** | **role-based** *access-list-name* | **fqdn** *access-list-name* }

Syntax Description		
standard	Specifies a standard IP access list.
resequence	Specifies a resequenced IP access list.
extended	Specifies an extended IP access list. Required for object-group ACLs.
access-list-name	Name of the IP access list or object-group ACL. Names cannot contain a space or quotation mark, and must begin with an alphabetic character to prevent ambiguity with numbered access lists.
access-list-number	Number of the access list. • A standard IP access list is in the ranges 1-99 or 1300-1999. • An extended IP access list is in the ranges 100-199 or 2000-2699.
helper egress check	Enables permit or deny matching capability for an outbound access list that is applied to an interface, for traffic that is relayed via the IP helper feature to a destination server address.
log-update	Controls the access list log updates.
threshold *threshold-number*	Sets the access list logging threshold. The range is 0 to 2147483647.
logging	Controls the access list logging.
hash-generation	Enables syslog hash code generation.
interval *time*	Sets the access list logging interval in milliseconds. The range is 0 to 2147483647.
persistent	Access control entry (ACE) sequence numbers are persistent across reloads. **Note** This is enabled by default and cannot be disabled.
role-based	Specifies a role-based IP access list.

fqdn	Specifies a FQDN IP access list.
	Note The name must start with an alphabet.

Command Default

No IP access list or object-group ACL is defined, and outbound ACLs do not match and filter IP helper relayed traffic.

Command Modes

Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.
Cisco IOS XE Bengaluru 17.4.1	The **fqdn** keyword was introduced.

Usage Guidelines

Use this command to configure a named or numbered IP access list or an object-group ACL. This command places the device in access-list configuration mode, where you must define the denied or permitted access conditions by using the **deny** and **permit** commands.

Specifying the **standard** or **extended** or **fqdn** keyword with the **ip access-list** command determines the prompt that appears when you enter access-list configuration mode. You must use the **extended** keyword when defining object-group ACLs.

You can create object groups and IP access lists or object-group ACLs independently, which means that you can use object-group names that do not yet exist.

Use the **ip access-group** command to apply the access list to an interface.

The **ip access-list helper egress check** command enables outbound ACL matching for permit or deny capability on packets with IP helper-address destinations. When you use an outbound extended ACL with this command, you can permit or deny IP helper relayed traffic based on source or destination User Datagram Protocol (UDP) ports. The **ip access-list helper egress check** command is disabled by default; outbound ACLs will not match and filter IP helper relayed traffic.

Examples

The following example defines a standard access list named Internetfilter:

```
Device> enable
Device# configure terminal
Device(config)# ip access-list standard Internetfilter
Device(config-std-nacl)# permit 192.168.255.0 0.0.0.255
Device(config-std-nacl)# permit 10.88.0.0 0.0.255.255
Device(config-std-nacl)# permit 10.0.0.0 0.255.255.255
```

The following example shows how to set the FQDN TTL timeout factor and create an FQDN ACL named facl.

```
Device> enable
Device# configure terminal
Device(config)# fqdn ttl-timeout-factor 100
Device(config)# ip access-list fqdn facl
Device(config-fqdn-acl)# 100 permit ip any any
Device(config-fqdn-acl)# 10 permit ip host 192.0.2.121 host dynamic www.google.com
Device(config-fqdn-acl)# end
```

The following example shows how to create an object-group ACL that permits packets from the users in my_network_object_group if the protocol ports match the ports specified in my_service_object_group:

```
Device> enable
Device# configure terminal
Device(config)# ip access-list extended my_ogacl_policy
Device(config-ext-nacl)# permit tcp object-group my_network_object_group portgroup
 my_service_object_group any
Device(config-ext-nacl)# deny tcp any any
```

The following example shows how to enable outbound ACL filtering on packets with helper-address destinations:

```
Device> enable
Device# configure terminal
Device(config)# ip access-list helper egress check
```

Related Commands	Command	Description
	deny	Sets conditions in a named IP access list or in an object-group ACL that will deny packets.
	ip access-group	Applies an ACL or an object-group ACL to an interface or a service policy map.
	object-group network	Defines network object groups for use in object-group ACLs.
	object-group service	Defines service object groups for use in object-group ACLs.
	permit	Sets conditions in a named IP access list or in an object-group ACL that will permit packets.
	show ip access-list	Displays the contents of IP access lists or object-group ACLs.
	show object-group	Displays information about object groups that are configured.

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*

Syntax Description	*access-list-name* Name of the security group access control list (SGACL).

Command Default   Role-based ACLs are not configured.

Command Modes   Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   For SGACL logging, you must configure the **permit ip log** 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:

```
Device> enable
Device# configure terminal
Device(config)# ip access-list role-based rbacl1
Device(config-rb-acl)# permit ip log
Device(config-rb-acl)# end
```

Related Commands

Command	Description
permit ip log	Permits logging that matches the configured entry.
show ip access-list	Displays contents of all current IP access lists.

ip admission

To enable web authentication, use the **ip admission** command in interface configuration mode or 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 (config-if)

Fallback-profile configuration (config-fallback-profile)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines The **ip admission** command applies a web authentication rule to a switch port.

This example shows how to apply a web authentication rule to a switchport:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ip admission rule1
Device(config-if)# end
```

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> enable
Device# configure terminal
Device(config)# fallback profile profile1
Device(config-fallback-profile)# ip admission rule1
Device(config-fallback-profile)# end
```

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		
name	Name of network admission control rule.
consent	Associates an authentication proxy consent web page with the IP admission rule specified using the *admission-name* argument.
proxy http	Configures web authentication custom page.
absolute-timer *minutes*	(Optional) Elapsed time, in minutes, before the external server times out.
inactivity-time *minutes*	(Optional) Elapsed time, in minutes, before the external file server is deemed unreachable.
list	(Optional) Associates the named rule with an access control list (ACL).
acl	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.
acl-name	Applies a named access list to a named admission control rule.
service-policy type tag	(Optional) A control plane service policy is to be configured.
service-policy-name	Control plane tag service policy that is configured using the **policy-map type control tag***policyname* 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 (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
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> enable
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
dot1x fallback	Configures a port to use web authentication as a fallback method for clients that do not support IEEE 802.1x authentication.
fallback profile	Creates a web authentication fallback profile.
ip admission	Enables web authentication on a port.
show authentication sessions interface *interface* **detail**	Displays information about the web authentication session status.
show ip admission	Displays information about NAC cached entries or the NAC configuration.

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**]
abor

Syntax Description		
crashinfo:*url*		Specifies the database URL for storing entries using crashinfo.
flash:*url*		Specifies the database URL for storing entries using flash.
ftp:*url*		Specifies the database URL for storing entries using FTP.
http:*url*		Specifies the database URL for storing entries using HTTP.
https:*url*		Specifies the database URL for storing entries using secure HTTP (https).
rcp:*url*		Specifies the database URL for storing entries using remote copy (rcp).
scp:*url*		Specifies the database URL for storing entries using Secure Copy (SCP).
tftp:*url*		Specifies the database URL for storing entries using TFTP.
timeout *seconds*		Specifies the cancel timeout interval; valid values are from 0 to 86400 seconds.
usbflash0:*url*		Specifies the database URL for storing entries using USB flash.

write-delay *seconds*	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 (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)#  ip dhcp snooping database tftp://10.90.90.90/snooping-rp2
Device(config)# exit
```

This example shows how to specify the amount of time before writing DHCP snooping entries to an external server:

```
evice> enable
Device# configure terminal
Device(config)#  ip dhcp snooping database write-delay 15
Device(config)# exit
```

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 device 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		
	hostname	Specify the device hostname as the remote ID.
	string *string*	Specify a remote ID, using from 1 to 63 ASCII characters (no spaces).

Command Default   The device MAC address is the remote ID.

Command Modes   Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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 device MAC address. This command allows you to configure either the device 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> enable
Device# configure terminal
Device(config)# ip dhcp snooping information option format remote-id hostname
Device(config)# exit
```

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 (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# no ip dhcp snooping verify no-relay-agent-address
Device(config)# exit
```

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.

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

access-list-number	Standard IP access list number in the range 0 to 99, as configured by the **access-list** global configuration command.
ipv4	Specifies the IPv4 access list to restrict access to the secure HTTP server.
access-list-name	Name of a standard IPv4 access list, as configured by the **ip access-list** command.
ipv6	Specifies the IPv6 access list to restrict access to the secure HTTP server.

Command Default   No access list is applied to the HTTP server.

Command Modes

Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
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
Device(config-std-nacl)# exit
```

The following example shows how to define an IPv4 named access list as and assign it to the HTTP server.

```
Device> enable
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
Device(config)# exit
```

Related Commands

Command	Description
ip access-list	Assigns an ID to an access list and enters access list configuration mode.
ip http server	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

interface-name	Name of the interface that RADIUS uses for all of its outgoing packets.
vrf *vrf-name*	(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 Fuji 16.9.2	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 disjoined 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 vrf1
```

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*

Syntax Description		
	mac-address	Binding MAC address.
	vlan *vlan-id*	Specifies the Layer 2 VLAN identification; valid values are from 1 to 4094.
	ip-address	Binding IP address.
	interface *interface-id*	ID of the physical interface.

Command Default   No IP source bindings are configured.

Command Modes   Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config) ip source binding 0100.0230.0002 vlan 11 10.0.0.4 interface
gigabitethernet1/0/1
Device(config)# exit
```

ip ssh source-interface

To specify the IP address of an interface as the source address for a Secure Shell (SSH) client device, use the **ip ssh source-interface** command in global configuration mode. To remove the IP address as the source address, use the **no** form of this command.

ip ssh source-interface *interface*
no ip ssh source-interface *interface*

Syntax Description

interface	The interface whose address is used as the source address for the SSH client.

Command Default   The address of the closest interface to the destination is used as the source address (the closest interface is the output interface through which the SSH packet is sent).

Command Modes   Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Gibraltar 16.10.1	This command was introduced.
Cisco IOS XE Gibraltar 16.11.1	

Usage Guidelines   By specifying this command, you can force the SSH client to use the IP address of the source interface as the source address.

Examples   In the following example, the IP address assigned to GigabitEthernet interface 1/0/1 is used as the source address for the SSH client:

```
Device> enable
Device# configure terminal
Device(config)# ip ssh source-interface GigabitEthernet 1/0/1
Device(config)# exit
```

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

mac-check	(Optional) Enables IP source guard with MAC address verification.
tracking	(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 (config-if)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ip verify source
Device(config-if)# end
```

This example shows how to enable IP source guard with MAC address verification:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# ip verify source mac-check
Device(config-if)# end
```

You can verify your settings by entering the **show ip verify source** 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	**ipv6** *access-list-name*	Creates a named IPv6 ACL (up to 64 characters in length) and enters IPv6 ACL configuration mode.
		access-list-name: Name of the IPv6 access list. Names cannot contain a space or quotation mark, or begin with a numeric.
	match-local-traffic	Enables matching for locally-generated traffic.
	log-update threshold *threshold-in-msgs*	Determines how syslog messages are generated after the initial packet match.
		threshold-in-msgs- Number of packets generated.
	role-based *list-name*	Creates a role-based IPv6 ACL.

Command Default No IPv6 access list is defined.

Command Modes

Global configuration (config)

Command History	**Release**	**Modification**
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

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. 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> enable
Device# configure terminal
Device(config)# ipv6 access-list list1
Device(config-ipv6-acl)# end
```

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 from GigabitEthernet interface 0/1/2. 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> enable
Device# configure terminal
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 gigabitethernet 0/1/2
Device(config-if)# ipv6 traffic-filter list2 out
Device(config-if)# end
```

ipv6 snooping 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*

Syntax Description

snooping-policy	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 Default   An IPv6 snooping policy is not configured.

Command Modes   Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# end
```

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**
no key chain *name* [**macsec**]

Syntax Description	*name* Name of a key chain to be used to get keys.

Command Default   Key chain macsec is disabled.

Command Modes   Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

This example shows how to configure MACsec key chain to fetch a 128-bit Pre Shared Key (PSK):

```
Device> enable
Device# configure terminal
Device(config)# key chain kc1 macsec
Device(config-keychain-macsec)# key 1000
Device(config-keychain-macsec)# cryptographic-algorithm aes-128-cmac
Device(config-keychain-macsec-key)# key-string fb63e0269e2768c49bab8ee9a5c2258f
Device(config-keychain-macsec-key)# end
Device#
```

This example shows how to configure MACsec key chain to fetch a 256-bit Pre Shared Key (PSK):

```
Device> enable
Device# configure terminal
Device(config)# key chain kc1 macsec
Device(config-keychain-macsec)# key 2000
Device(config-keychain-macsec)# cryptographic-algorithm aes-256-cmac
Device(config-keychain-macsec-key)# key-string c865632acb269022447c417504a1b
f5db1c296449b52627ba01f2ba2574c2878
Device(config-keychain-macsec-key)# end
Device#
```

key config-key password-encrypt

To store a type 6 encryption key in private NVRAM, use the **key config-key password-encrypt** command in global configuration mode. To disable the encryption, use the **no** form of this command.

key config-key password-encrypt [*text*]
no key config-key password-encrypt [*text*]

Syntax Description	*text*	(Optional) **Password** or **master** key.
	Note	We recommended that you do not use the *text* argument, and instead use interactive mode (using the **Enter** key after you enter the **key config-key password-encrypt** command) so that the preshared key is not printed anywhere and, therefore, cannot be seen.

Command Default Type 6 password encryption key is not stored in private NVRAM.

Command Modes Global configuration (config)

Command History

Release	Modifica
Cisco IOS XE Fuji 16.9.2	This com introduce

Usage Guidelines You can securely store plain text passwords in type 6 format in NVRAM using a CLI. Type 6 passwords are encrypted. Although the encrypted passwords can be seen or retrieved, it is difficult to decrypt them to find out the actual password. Use the **key config-key password-encrypt** command along with the **password encryption aes** command to configure and enable the password (symmetric cipher Advanced Encryption Standard [AES] is used to encrypt the keys). The password (key) configured using the **key config-key password-encrypt** command is the master encryption key that is used to encrypt all other keys in the device.

If you configure the **password encryption aes** command without configuring the **key config-key password-encrypt** command, the following message is displayed at startup or during a nonvolatile generation (NVGEN) process, such as when the **show running-config** or **copy running-config startup-config** commands are configured:

```
"Can not encrypt password. Please configure a configuration-key with 'key config-key'"
```

Changing a Password

If the password (master key) is changed or reencrypted, use the **key config-key password-encrypt** command) for the list registry to pass the old key and the new key to the application modules that are using type 6 encryption.

Deleting a Password

If the master key that was configured using the **key config-key password-encrypt** command is deleted from the system, a warning is displayed (and a confirm prompt is issued) stating that all type 6 passwords will become useless. As a security measure, after the passwords are encrypted, they will never be decrypted in the Cisco IOS software. However, passwords can be re-encrypted, as explained in the previous paragraph.

⚠️

Caution   If the password that is configured using the **key config-key password-encrypt** command is lost, it cannot be recovered. We, therefore, recommend that you store the password in a safe location.

Unconfiguring Password Encryption

If you unconfigure password encryption using the **no password encryption aes** command, all the existing type 6 passwords are left unchanged, and as long as the password (master key) that was configured using the **key config-key password-encrypt** command exists, the type 6 passwords will be decrypted as and when required by the application.

Storing Passwords

Because no one can *read* the password (configured using the **key config-key password-encrypt** command), there is no way that the password can be retrieved from the device. Existing management stations cannot *know* what it is unless the stations are enhanced to include this key somewhere, in which case, the password needs to be stored securely within the management system. If configurations are stored using TFTP, the configurations are not standalone, meaning that they cannot be loaded onto a device. Before or after the configurations are loaded onto a device, the password must be manually added (using the **key config-key password-encrypt** command). The password can be manually added to the stored configuration. However we do not recommend this because adding the password manually allows anyone to decrypt all the passwords in that configuration.

Configuring New or Unknown Passwords

If you enter or cut and paste ciphertext that does not match the master key, or if there is no master key, the ciphertext is accepted or saved, but an alert message is displayed:

```
"ciphertext>[for username bar>] is incompatible with the configured master key."
```

If a new master key is configured, all plain keys are encrypted and made type 6 keys. The existing type 6 keys are not encrypted. The existing type 6 keys are left as is.

If the old master key is lost or is unknown, you have the option of deleting the master key using the **no key config-key password-encrypt** command. Deleting the master key causes the existing encrypted passwords to remain encrypted in the device configuration. The passwords cannot be decrypted.

Examples   The following example shows how a type 6 encryption key is stored in NVRAM:

```
Device> enable
Device# configure terminal
Device (config)# key config-key password-encrypt
```

Related Commands

Command	Description
password encryption aes	Enables a type 6 encrypted p

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

Syntax Description

priority *value*	Specifies the priority value of the MKA key-server.

Command Default   MKA key-server is disabled.

Command Modes   MKA-policy configuration (config-mka-policy)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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
```

Related Commands

Command	Description
mka policy	Configures an MKA policy.
confidentiality-offset	Sets the confidentiality offset for MACsec operations.
delay-protection	Configures MKA to use delay protection in sending MKPDU.
include-icv-indicator	Includes ICV indicator in MKPDU.
macsec-cipher-suite	Configures cipher suite for deriving SAK)
sak-rekey	Configures the SAK rekey interval.
send-secure-announcements	Configures MKA to send secure announcements in sending MKPDUs.
ssci-based-on-sci	Computes SSCI based on the SCI.
use-updated-eth-header	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

Syntax Description	*maximum*	The number of addresses allowed on the port. The range is from 1 to 10000.

Command Default

The default is no limit.

Command Modes

IPv6 snooping configuration (config-ipv6-snooping)

ND inspection policy configuration (config-nd-inspection)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines

The **limit address-count** 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, and limit the number of IPv6 addresses allowed on the port to 25:

```
Device> enable
Device# configure terminal
Device(config)# ipv6 nd inspection policy policy1
Device(config-nd-inspection)# limit address-count 25
Device(config-nd-inspection)# end
```

This example shows how to define an IPv6 snooping policy name as policy1, and limit the number of IPv6 addresses allowed on the port to 25:

```
Device> enable
Device# configure terminal
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# limit address-count 25
Device(config-ipv6-snooping)# end
```

local-domain (Parameter Map)

To configure a local domain for the Cisco Umbrella Integration feature, use the **local-domain** command in parameter-map type inspect configuration mode. To remove a local domain, use the **no** form of this command.

local-domain *regex_param_map_name*
no local-domain *regex_param_map_name*

Syntax Description		
	regex_param_map_name	Name of the regular expression parameter map.

Command Default

No local domain is created for the parameter map.

Command Modes

Parameter-map type inspect configuration (config-profile)

Command History

Release	Modification
Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Usage Guidelines

A maximum of 64 local domains can be configured, and the allowed domain name length is 100 characters.

Examples

The following example shows how to configure a local domain:

```
Device> enable
Device# configure terminal
Device(config)# parameter-map type umbrella global
Device(config-profile)# local-domain dns_bypass
```

Related Commands

Command	Description
parameter-map type umbrella global	Configures a parameter-map type in umbrella mode.

mab logging verbose

To filter detailed information from MAC authentication bypass (MAB) system messages, use the **mab logging verbose** command in global configuration mode. Use the no form of this command to disable logging MAB system messages.

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 Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# mab logging verbose
Device(config)# exit
```

You can verify your settings by entering the **show running-config** command.

Related Commands

Command	Description
authentication logging verbose	Filters details from authentication system messages.
dot1x logging verbose	Filters details from 802.1x system messages.
mab logging verbose	Filters details from MAC authentication bypass (MAB) system me

mab request format attribute 32

To enable VLAN ID-based MAC authentication on a device, 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 (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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 device:

```
Device> enable
Device# configure terminal
Device(config)# mab request format attribute 32 vlan access-vlan
Device(config)# exit
```

Related Commands

Command	Description
authentication event	Sets the action for specific authentication events.
authentication fallback	Configures a port to use web authentication as a fallback method that do not support IEEE 802.1x authentication.
authentication host-mode	Sets the authorization manager mode on a port.
authentication open	Enables or disables open access on a port.
authentication order	Sets the order of authentication methods used on a port.
authentication periodic	Enables or disables reauthentication on a port.
authentication port-control	Enables manual control of the port authorization state.
authentication priority	Adds an authentication method to the port-priority list.
authentication timer	Configures the timeout and reauthentication parameters for an 802.1x-enabled port.

Command	Description
authentication violation	Configures the violation modes that occur when a new device a port or when a new device connects to a port with the maxi of devices already connected to that port.
mab	Enables MAC-based authentication on a port.
mab eap	Configures a port to use the Extensible Authentication Proto
show authentication	Displays information about authentication manager events o

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
no macsec-cipher-suite gcm-aes-128

Syntax Description

gcm-aes-128	Configures cipher suite for deriving SAK with 128-bit encryption.

Command Default GCM-AES-128 encryption is enabled.

Command Modes MKA-policy configuration (config-mka-policy)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Examples

The following example shows how to configure MACsec cipher suite for deriving SAK with 128-bit encryption:

```
Device> enable
Device# configure terminal
Device(config)# mka policy 2
Device(config-mka-policy)# macsec-cipher-suite gcm-aes-128
```

Related Commands

Command	Description
mka policy	Configures an MKA policy.
confidentiality-offset	Sets the confidentiality offset for MACsec operations.
delay-protection	Configures MKA to use delay protection in sending MKPDU.
include-icv-indicator	Includes ICV indicator in MKPDU.
key-server	Configures MKA key-server options.
sak-rekey	Configures the SAK rekey interval.
send-secure-announcements	Configures MKA to send secure announcements in sending MKPDUs.
ssci-based-on-sci	Computes SSCI based on the SCI.
use-updated-eth-header	Uses the updated Ethernet header for ICV calculation.

macsec network-link

To enable MACsec Key Agreement protocol (MKA) configuration on the uplink interfaces, use the **macsec network-link** command in interface configuration mode. To disable it, use the **no** form of this command.

macsec network-link

no macsec network-link

Syntax Description	**macsec network-link**	Enables MKA MACsec configuration on device interfaces using EAP-TLS authentication protocol.

Command Default MACsec network-link is disabled.

Command Modes Interface configuration (config-if)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

This example shows how to configure MACsec MKA on an interface using the EAP-TLS authentication protocol:

```
Device> enable
Device# configure terminal
Device(config)# interface GigabitEthernet 1/0/20
Device(config-if)# macsec network-link
Device(config-if)# end
Device#
```

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. 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		
ip address	Sets the access map to match packets against an IP address access list.
ipv6 address	Sets the access map to match packets against an IPv6 address access list.
mac address	Sets the access map to match packets against a MAC address access list.
name	Name of the access list to match packets against.
number	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 (config-access-map)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	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.

Examples 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> enable
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
Device(config)# exit
```

You can verify your settings by entering the **show vlan access-map** command.

mka pre-shared-key

To configure MACsec Key Agreement (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 interface configuration mode. To disable it, use the **no** form of this command.

mka pre-shared-key key-chain *key-chain-name*
no mka pre-shared-key key-chain *key-chain-name*

Syntax Description	**mka pre-shared-key key-chain**	Enables MACsec MKA configuration on device interfaces using a PSK.

Command Default   MKA pre-shared-key is disabled.

Command Modes   Interface configuration (config-if)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

This example shows how to configure MKA MACsec on an interface using a PSK:

```
Device> enable
Device# configure terminal
Device(config)# interface Gigabitethernet 1/0/20
Device(config-if)# mka pre-shared-key key-chain kc1
Device(config-if)# end
Device#
```

mka suppress syslogs sak-rekey

To suppress MACsec Key Agreement (MKA) secure association key (SAK) rekey messages during logging, use the **mka suppress syslogs sak-rekey** command in global configuration mode. To enable MKA SAK rekey message logging, use the **no** form of this command.

mka suppres syslogs sak-rekey
no mka suppres syslogs sak-rekey

This command has no arguments or keywords.

Command Default   All MKA SAK syslog messages are displayed on the console.

Command Modes   Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Gibraltar 16.9.1	This command was introduced.

Usage Guidelines   MKA SAK syslogs are continuously generated at every rekey interval, and when MKA is configured on multiple interfaces, the amount of syslog generated is too high. Use this command to suppress the MKA SAK syslogs.

Example

The following example shows show to suppress MKA SAK syslog logging:

```
Device> enable
Device# configure terminal
Device(config)# mka suppress syslogs sak-rekey
```

parameter-map type regex

To configure a parameter-map type with a regular expression to match a specific traffic pattern, use the **parameter-map type regex** command in global configuration mode. To delete a parameter-map type with a regular expression, use the **no** form of this command.

parameter-map type regex *parameter-map-name*
no parameter-map type regex

Syntax Description

parameter-map-name	Name of the parameter map. The name can have a maximum of 228 alphanumeric characters.
	Note We do not recommend the use of blank spaces. The system interprets the first blank space as the end of the parameter-map name unless the string is delimited by quotation marks.

Command Default   A regex parameter map is not configured.

Command Modes   Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Usage Guidelines   You can enter a regular expression to match text strings either as an exact string or by using metacharacters to match multiple variants of a text string. You can use a regular expression to match the content of certain application traffic. For example, you can match a uniform resource identifier (URI) string inside an HTTP packet using the **match request regex** command under an HTTP inspection class map.

Press **Ctrl-V** to ignore all of the special characters in the CLI, such as a question mark (?) or a tab. For example, press **d**[**Ctrl-V**]**g** to enter **d?g** in the configuration.

The following table lists the metacharacters that have special meanings.

Table 5: regex Metacharacters

Character	Description	Notes
.	Dot	Matches any single character. For example, **d.g** matches dog, dag, dtg, and any word that contains those characters.
(*xxx*)	Subexpression	Segregates characters from surrounding characters so that you can use other metacharacters on the subexpression. For example, **d(o|a)g** matches dog and dag, but **do|ag** matches do and ag. A subexpression can also be used with repeat quantifiers to differentiate the characters meant for repetition. For example, **ab(xy){3}z** matches abxyxyxyz.
|	Alternation	Matches either of the expressions that it separates. For example, **dog|cat** matches dog or cat.

Character	Description	Notes
?	Question mark	Indicates that there are 0 or 1 occurrence of the previous expression. For example, **lo?se** matches lse or lose. **Note** You must enter **Ctrl-V** and then a question mark. Otherwise, the Help function is invoked.
*	Asterisk	Indicates that there are 0, 1, or any number of occurrences of the previous expression. For example, **lo*se** matches lse, lose, loose, and so on.
+	Plus	Indicates that there is at least one occurrence of the previous expression. For example, **lo+se** matches lose and loose, but not lse.
{ *x* }	Repeat quantifier	Repeats exactly *x* times. For example, **ab(xy){3}z** matches abxyxyxyz.
{ *x* ,}	Minimum repeat quantifier	Repeats at least *x* times. For example, **ab(xy){2,}z** matches abxyxyz, abxyxyxyz, and so on.
[*abc*]	Character class	Matches any character in the bracket. For example, **[abc]** matches a, b, or c.
[^ *abc*]	Negated character class	Matches a single character that is not contained within brackets. For example, **[^abc]** matches any character other than a, b, or c, and **[^A-Z]** matches any single character that is not an uppercase letter.
[*a* - *c*]	Character range class	Matches any character in the specified range. **[a-z]** matches any lowercase letter. You can mix characters and ranges. For example, **[abcq-z]** matches a, b, c, q, r, s, t, u, v, w, x, y, z, and so does **[a-cq-z]**. **Note** The dash (-) character is literal only if it is the last or first character within brackets, for example, **[abc-]** or **[-abc]**.
" "	Quotation marks	Preserves trailing or leading spaces in the string. For example, **"test"** preserves the leading space when it looks for a match.
^	Caret	Specifies the beginning of a line.
\	Escape character	When preceding a literal character, matches the literal character. For example, **\[** matches the left square bracket.
char	Character	When the character is not a metacharacter, matches the literal character.
\r	Carriage return	Matches the carriage return 0x0d.
\n	New line	Matches the new line 0x0a.
\t	Tab	Matches the tab 0x09.
\f	Formfeed	Matches the form feed 0x0c.

Character	Description	Notes
\x *nn*	Escaped hexadecimal number	Matches an ASCII character using hexadecimal numbers (exactly two digits).
\ *nnn*	Escaped octal number	Matches an ASCII character as an octal number (exactly three digits). For example, the character **040** represents a space.

Examples

The following example shows how to configure and apply a regex parameter map to an HTTP application firewall parameter-map type whose URI matches any of the following regular expressions:

- ".*cmd.exe"

- ".*money"

- ".*shopping"

```
Device> enable
Device# configure terminal
Device(config)# parameter-map type regex uri-regex-cm
Device(config-profile)# pattern ".*cmd.exe"
Device(config-profile)# pattern ".*money"
Device(config-profile)# pattern ".*shopping"
Device(config-profile)# exit
Device(config)# class-map type inspect http uri-check-cm
Device(config-cmap)# match request uri regex uri-regex-cm
Device(config-cmap)# exit
Device(config)# policy-map type inspect http uri-check-pm
Device(config-pmap)# class type inspect http uri-check-cm
Device(config-pmap-c)# reset
```

The following example shows how to configure a regex parameter map whose case-insensitive pattern matches multiple variants of the string hello:

```
Device# configure terminal
Device(config)# parameter-map type regex body_regex
Device(config-profile)# pattern ".*[Hh][Ee][Ll][Ll][Oo]"
Device(config-profile)# end
```

Related Commands

Command	Description
class-map type inspect	Creates a Layer 3 and Layer 4 or a Layer 7 (application-specific) inspect-type class map.
class type inspect	Specifies the traffic (class) on which an action is to be performed.
match request regex	Configures an HTTP firewall policy to permit or deny HTTP traffic on the basis of request messages whose URI or arguments (parameters) match a defined regular expression.
parameter-map type	Creates or modifies a parameter map.
policy-map type inspect	Creates a Layer 3 and Layer 4 or a Layer 7 (application-specific) inspect-type policy map.

parameter-map type umbrella global

To configure a parameter-map type in umbrella mode, use the **parameter-map type umbrella global** command in global configuration mode. To delete a parameter-map type in umbrella mode, use the **no** form of this command.

parameter-map type umbrella global
no parameter-map type umbrella

Syntax Description   This command has no arguments or keywords.

Command Default   Umbrella mode parameter-map is not configured.

Command Modes   Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Examples   The following example shows how to set the parameter-map type to umbrella mode:

```
Device> enable
Device# configure terminal
Device(config)# parameter-map type umbrella global
Device(config-profile)#
```

Related Commands

Command	Description
parameter-map type	Creates or modifies a parameter map.

password encryption aes

To enable a type 6 encrypted preshared key, use the **password encryption aes** command in global configuration mode. To disable password encryption, use the **no** form of this command.

password encryption aes
no password encryption aes

Syntax Description	This command has no arguments or keywords.
Command Default	Preshared keys are not encrypted.
Command Modes	Global configuration (config)

Command History

Release	Modifica
Cisco IOS XE Fuji 16.9.2	This com introduce

Usage Guidelines You can securely store plain text passwords in type 6 format in NVRAM using a CLI. Type 6 passwords are encrypted. Although the encrypted passwords can be seen or retrieved, it is difficult to decrypt them to find out the actual password. Use the **key config-key password-encrypt** command along with the **password encryption aes** command to configure and enable the password (symmetric cipher Advanced Encryption Standard [AES] is used to encrypt the keys). The password (key) that is configured using the **key config-key password-encrypt** command is the master encryption key that is used to encrypt all other keys in the router.

If you configure the **password encryption aes** command without configuring the **key config-key password-encrypt** command, the following message is displayed at startup or during a nonvolatile generation (NVGEN) process, such as when the **show running-config** or **copy running-config startup-config** commands are run:

```
"Can not encrypt password. Please configure a configuration-key with 'key config-key'"
```

Changing a Password

If the password (master key) is changed or re-encrypted using the **key config-key password-encrypt** command), the list registry passes the old key and the new key to the application modules that are using type 6 encryption.

Deleting a Password

If the master key that was configured using the **key config-key password-encrypt** command is deleted from the system, a warning is displayed (and a confirm prompt is issued) that states that all type 6 passwords will no longer be applicable. As a security measure, after the passwords are encrypted, they will never be decrypted in the Cisco IOS software. However, passwords can be re-encrypted as explained in the previous paragraph.

⚠️ **Caution** If a password that is configured using the **key config-key password-encrypt** command is lost, it cannot be recovered. Therefore, the password should be stored in a safe location.

Unconfiguring Password Encryption

If you unconfigure password encryption using the **no password encryption aes** command, all the existing type 6 passwords are left unchanged. As long as the password (master key) that was configured using the **key config-key password-encrypt** command exists, the type 6 passwords are decrypted as and when required by the application.

Storing Passwords

Because no one can *read* the password (configured using the **key config-key password-encrypt** command), there is no way that the password can be retrieved from the router. Existing management stations cannot *know* what it is unless the stations are enhanced to include this key somewhere. Therefore, the password needs to be stored securely within the management system. If configurations are stored using TFTP, the configurations are not standalone, meaning that they cannot be loaded onto a router. Before or after the configurations are loaded onto a router, the password must be manually added (using the **key config-key password-encrypt** command). The password can be manually added to the stored configuration, but we do not recommend this because adding the password manually allows anyone to decrypt all the passwords in that configuration.

Configuring New or Unknown Passwords

If you enter or cut and paste ciphertext that does not match the master key, or if there is no master key, the ciphertext is accepted or saved, but the following alert message is displayed:

"ciphertext>[for username bar>] is incompatible with the configured master key."

If a new master key is configured, all the plain keys are encrypted and converted to type 6 keys. The existing type 6 keys are not encrypted. The existing type 6 keys are left as is.

If the old master key is lost or unknown, you have the option of deleting the master key using the **no key config-key password-encrypt** command. This causes the existing encrypted passwords to remain encrypted in the router configuration. The passwords will not be decrypted.

Examples

The following example shows how a type 6 encrypted preshared key is enabled:

```
Device> enable
Device# configure terminal
Device (config)# password encryption aes
```

Related Commands

Command	Description
key config-key password-encrypt	Stores a type 6 encryption key

pattern (Parameter Map)

To configure a matching pattern that specifies a list of domains, URL keywords, or URL metacharacters that must be allowed or blocked by the local URL filtering, use the **pattern** command in parameter-map type inspect configuration mode. To remove the matching pattern, use the **no** form of this command.

pattern *expression*
no **pattern** *expression*

Syntax Description

expression	Matching pattern argument that refers to a domain name, URL keyword, URL metacharacter entry, or a URL keyword, and URL-metacharacter combination.

Command Default

No pattern is created for the parameter map.

Command Modes

Parameter-map type inspect configuration (config-profile)

Command History

Release	Modification
Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Usage Guidelines

A matching pattern expression is configured for a parameter map created by the **parameter-map type regex** command.

In a pattern expression, the characters /, {, and } are not allowed. The question mark (?) character is not allowed because it is reserved for the CLI Help function. The asterisk (*) character is not allowed at the beginning of a pattern.

For URL pattern matching, the period (.) character is interpreted as a dot, and not as a wildcard entry that represents a single character, as is the case with regular expression pattern matching. Any character in the host or domain name can be allowed or blocked through URL filtering.

A URL keyword is a complete word that comes after the domain name and is between the forward slash (/) path delimiters. For example, in the URL http://www.example.com/hack/123.html, only **hack** is treated as a keyword. The entire keyword in the URL must match a pattern. For example, if you have configured a pattern named **hack**, the URL www.example.com/hacksite/123.html will not match the pattern. To match the URL, your pattern must have **hacksite**.

URL metacharacters allow pattern matching of single characters or ranges of characters to URLs, similar to the way a UNIX glob expression works. URL metacharacters are described in the following table.

Table 6: URL Metacharacters for URL Pattern Matching

Character	Description
*	Asterisk: Matches any sequence of 0 or more characters.
[*abc*]	Character class: Matches any character within brackets. Character matching is case sensitive. For example, **[abc]** matches a, b, or c.

Character	Description
[*a-c*]	Character range class: Matches any character in a specified range. Character matching is case sensitive. For example, **[a-z]** matches any lowercase letter. You can also mix characters and ranges. For example, **[abcq-z]** matches a, b, c, q, r, s, t, u, v, w, x, y, z, and so does **[a-cq-z]**.
	Note The dash (-) character is matched only if it is the last or the first character within brackets, for example, **[abc-]** or **[-abc]**.
[0-9]	Numerical range class: Matches any number within brackets. For example, **[0-9]** matches 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9.

URL metacharacters are combined with domain names and URL keywords for pattern matching. For example, the pattern www.example[0-9][0-9].com can be used to block www.example01.com, www.example33.com, www.example99.com, and so on. You can combine a keyword and a metacharacter and create a matching pattern to block a URL. For example, you can use pattern hack* to block www.example.com/hacksite/123.html.

When you configure the **parameter-map type regex** command and then the **pattern** command, patterns that are specified in the **pattern** command are used as filters in General Packet Radio Service (GPRS) Tunneling Protocol (GTP) classes.

Examples

The following example shows how to configure a matching pattern for a specified URL:

```
Device(config)# parameter-map type regex dns_bypass
Device(config-profile)# pattern www.example.com
```

The following example shows how to specify a case-insensitive pattern that matches multiple variants of the string hello:

```
Device> enable
Device# configure terminal
Device(config)# parameter-map type regex body-regex
Device(config-profile)# pattern ".*[Hh][Ee][Ll][Ll][Oo]"
```

The following example shows an error message that appears on the console when an asterisk (*) character is specified at the beginning of a pattern:

```
Device(config)# parameter-map type regex gtp-map
Device(config-profile)# pattern *.gprs.com
%Invalid first char + or * in regex pattern
```

Related Commands

Command	Description
parameter-map type regex	Configures a regex parameter map that matches a specific regular expression pattern and enters parameter-map type inspect configuration mode.

permit (MAC access-list configuration)

To allow non-IP traffic to be forwarded if the conditions are matched, use the **permit** command in MAC access-list configuration mode. To remove a permit condition from the extended MAC access list, use the **no** form of this command.

{**permit** {**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** | **lavc-sca** | **lsap***lsap mask* | **mop-console** | **mop-dump** | **msdos** | **mumps** | **netbios** | **vines-echo** | **vines-ip** | **xns-idp**] [**cos***cos*]
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** | **lavc-sca** | **lsap** *lsap mask* | **mop-console** | **mop-dump** | **msdos** | **mumps** | **netbios** | **vines-echo** | **vines-ip** | **xns-idp**] [**cos***cos*]

Syntax Description

any	Denies any source or destination MAC address.
host *src-MAC-addr* | *src-MAC-addr mask*	Specifies a host MAC address and optional subnet mask. defined address, non-IP traffic from that address is denie
host *dst-MAC-addr* | *dst-MAC-addr mask*	Specifies a destination MAC address and optional subnet matches the defined address, non-IP traffic to that addres
type mask	(Optional) Specifies the EtherType number of a packet w identify the protocol of the packet. • *type* is 0 to 65535, specified in hexadecimal. • *mask* is a mask of don't care bits applied to the Ethe
aarp	(Optional) Specifies EtherType AppleTalk Address Reso to a network address.
amber	(Optional) Specifies EtherType DEC-Amber.
appletalk	(Optional) Specifies EtherType AppleTalk/EtherTalk.
dec-spanning	(Optional) Specifies EtherType Digital Equipment Corpo
decnet-iv	(Optional) Specifies EtherType DECnet Phase IV protoco
diagnostic	(Optional) Specifies EtherType DEC-Diagnostic.
dsm	(Optional) Specifies EtherType DEC-DSM.
etype-6000	(Optional) Specifies EtherType 0x6000.
etype-8042	(Optional) Specifies EtherType 0x8042.
lat	(Optional) Specifies EtherType DEC-LAT.
lavc-sca	(Optional) Specifies EtherType DEC-LAVC-SCA.

Security

permit (MAC access-list configuration)

lsap *lsap-number mask*	(Optional) Specifies the LSAP number (0 to 65535) c the protocol of the packet.
	The *mask* is a mask of don't care bits applied to the L
mop-console	(Optional) Specifies EtherType DEC-MOP Remote C
mop-dump	(Optional) Specifies EtherType DEC-MOP Dump.
msdos	(Optional) Specifies EtherType DEC-MSDOS.
mumps	(Optional) Specifies EtherType DEC-MUMPS.
netbios	(Optional) Specifies EtherType DEC- Network Basic
vines-echo	(Optional) Specifies EtherType Virtual Integrated Netw
vines-ip	(Optional) Specifies EtherType VINES IP.
xns-idp	(Optional) Specifies EtherType Xerox Network Syste
cos *cos*	(Optional) Specifies an arbitrary class of service (CoS CoS can be performed only in hardware. A warning r

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 Fuji 16.9.2	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 XE terminology are listed in the following table.

Table 7: IPX Filtering Criteria

IPX Encapsulation Type		Filter Criterion
Cisco IOS Name	**Novell Name**	
arpa	Ethernet II	EtherType 0x8137

Security

IPX Encapsulation Type		Filter Criterion
Cisco IOS Name	**Novell Name**	
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> enable
Device# configure terminal
Device(config)# mac access-list extended
Device(config-ext-macl)# permit any host 00c0.00a0.03fa netbios
Device(config-ext-macl)# end
```

This example shows how to remove the permit condition from the MAC-named extended access list:

```
Device> enable
Device# configure terminal
Device(config)# mac access-list extended
Device(config-ext-macl)# no permit any 00c0.00a0.03fa 0000.0000.0000 netbios
Device(config-ext-macl)# end
```

This example permits all packets with EtherType 0x4321:

```
Device> enable
Device# configure terminal
Device(config)# mac access-list extended
Device(config-ext-macl)# permit any any 0x4321 0
Device(config-ext-macl)# end
```

You can verify your settings by entering the **show access-lists** command.

Related Commands	**Command**	**Description**
	deny	Denies from the MAC non-IP traffic to be f
	mac access-list extended	Creates an access list traffic.
	show access-lists	Displays access contr

protocol (IPv6 snooping)

s

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 in IPv6 snooping configuration mode. To disable address gleaning with DHCP or NDP, use the **no** form of the command.

protocol {**dhcp** | **ndp**}
no protocol {**dhcp** | **ndp**}

Syntax Description		
dhcp	Specifies that addresses should be gleaned in Dynamic Host Configuration Protocol (DHCP) packets.	
ndp	Specifies that addresses should be gleaned in Neighbor Discovery Protocol (NDP) packets.	

Command Default   Snooping and recovery are attempted using both DHCP and NDP.

Command Modes   IPv6 snooping configuration mode (config-ipv6-snooping)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   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.

- Using the **no protocol** {**dhcp** | **ndp**} command indicates that a protocol will not be used for snooping or gleaning.

- If the **no protocol dhcp** command is used, DHCP can still be used for binding table recovery.

- Data glean can recover with DHCP and NDP, though destination guard will only recovery through DHCP.

This example shows how to define an IPv6 snooping policy name as policy1, and configure the port to use DHCP to glean addresses:

```
Device> enable
Device# configure terminal
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# protocol dhcp
Device(config-ipv6-snooping)# end
```

radius server

To configure the RADIUS server parameters, including the RADIUS accounting and authentication, use the **radius server** command in global configuration mode. 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	address {ipv4	ipv6} *ip{address	hostname}*	Specifies the IP address of the RADIUS server.
	auth-port *udp-port*	(Optional) Specifies the UDP port for the RADIUS authentication server. The range is from 0 to 65536.
	acct-port *udp-port*	(Optional) Specifies the UDP port for the RADIUS accounting server. The range is from 0 to 65536.
	key *string*	(Optional) Specifies the authentication and encryption key for all RADIUS communication between the device and the RADIUS daemon.
		Note 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.
	automate tester *name*	(Optional) Enables automatic server testing of the RADIUS server status, and specify the username to be used.
	retransmit *value*	(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.
	timeout *seconds*	(Optional) Specifies the time interval that the device 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** command.

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	Global configuration (config)

Command History	**Release**	**Modification**
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

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* command in RADIUS server configuration mode. 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> enable
Device# configure terminal
Device(config)# radius server ISE
Device(config-radius-server)# address ipv4 10.1.1 auth-port 1645 acct-port 1646
Device(config-radius-server)# key cisco123
Device(config-radius-server)# end
```

radius-server dead-criteria

To force one or both of the criteria, used to mark a RADIUS server as dead, to be the indicated constant, use the **radius-server dead-criteria** command in global configuration mode. To disable the criteria that were set, use the **no** form of this command.

radius-server dead-criteria [**time** *seconds*] [**tries** *number-of-tries*]
no radius-server dead-criteria [**time** *seconds* | **tries** *number-of-tries*]

Syntax Description

time *seconds*	(Optional) Minimum amount of time, in seconds, that must elapse from the time that the device last received a valid packet from the RADIUS server to the time the server is marked as dead. If a packet has not been received since the device booted, and there is a timeout, the time criterion will be treated as though it has been met. You can configure the time to be from 1 through 120 seconds. • If the *seconds* argument is not configured, the number of seconds will range from 10 to 60 seconds, depending on the transaction rate of the server. **Note** Both the time criterion and the tries criterion must be met for the server to be marked as dead.
tries *number-of-tries*	(Optional) Number of consecutive timeouts that must occur on the device before the RADIUS server is marked as dead. If the server performs both authentication and accounting, both types of packets will be included in the number. Improperly constructed packets will be counted as though they were timeouts. All transmissions, including the initial transmit and all retransmits, will be counted. You can configure the number of timeouts to be from 1 through 100. • If the *number-of-tries* argument is not configured, the number of consecutive timeouts will range from 10 to 100, depending on the transaction rate of the server and the number of configured retransmissions. **Note** Both the time criterion and the tries criterion must be met for the server to be marked as dead.

Command Default

The number of seconds and number of consecutive timeouts that occur before the RADIUS server is marked as dead will vary, depending on the transaction rate of the server and the number of configured retransmissions.

Command Modes

Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines

> **Note**   Both the time criterion and the tries criterion must be met for the server to be marked as dead.

The **no** form of this command has the following cases:

- If neither the *seconds* nor the *number-of-tries* argument is specified with the **no radius-server dead-criteria** command, both time and tries will be reset to their defaults.

- If the *seconds* argument is specified using the originally set value, the time will be reset to the default value range (10 to 60).

- If the *number-of-tries* argument is specified using the originally set value, the number of tries will be reset to the default value range (10 to 100).

Examples

The following example shows how to configure the device so that it will be considered dead after 5 seconds and 4 tries:

```
Device> enable
Device# configure terminal
Device(config)# radius-server dead-criteria time 5 tries 4
```

The following example shows how to disable the time and number-of-tries criteria that were set for the **radius-server dead-criteria** command.

```
Device(config)# no radius-server dead-criteria
```

The following example shows how to disable the time criterion that was set for the **radius-server dead-criteria** command.

```
Device(config)# no radius-server dead-criteria time 5
```

The following example shows how to disable the number-of-tries criterion that was set for the **radius-server dead-criteria** command.

```
Device(config)# no radius-server dead-criteria tries 4
```

Related Commands

Command	Description
debug aaa dead-criteria transactions	Displays AAA dead-criteria transaction values.
show aaa dead-criteria	Displays dead-criteria information for a AAA server.
show aaa server-private	Displays the status of all private RADIUS servers.
show aaa servers	Displays information about the number of packets sent to and received from AAA servers.

radius-server deadtime

To improve RADIUS response time when some servers might be unavailable and to skip unavailable servers immediately, use the **radius-server deadtime** command in global configuration mode. To set deadtime to 0, use the **no** form of this command.

radius-server deadtime *minutes*
no radius-server deadtime

Syntax Description

minutes	Length of time, in minutes (up to a maximum of 1440 minutes or 24 hours), for which a RADIUS server is skipped over by transaction requests.

Command Default   Dead time is set to 0.

Command Modes   Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   Use this command to enable the Cisco IOS software to mark as *dead* any RADIUS servers that fail to respond to authentication requests, thus avoiding the wait for the request to time out before trying the next configured server. A RADIUS server marked as *dead* is skipped by additional requests for the specified duration (in minutes) or unless there are no servers not marked as *dead*.

Note   If a RADIUS server that is marked as *dead* receives a directed-request, the directed- request is not omitted by the RADIUS server. The RADIUS server continues to process the directed-request because the request is directly sent to the RADIUS server.

The RADIUS server will be marked as dead if both of the following conditions are met:

1. A valid response has not been received from the RADIUS server for any outstanding transaction for at least the timeout period that is used to determine whether to retransmit to that server, and

2. At at least the requisite number of retransmits plus one (for the initial transmission) have been sent consecutively across all transactions being sent to the RADIUS server without receiving a valid response from the server within the requisite timeout.

Examples   The following example specifies five minutes of deadtime for RADIUS servers that fail to respond to authentication requests:

```
Device> enable
Device# configure terminal
Device(config)# aaa new-model
Device(config)# radius-server deadtime 5
```

	Command	Description
Related Commands	**deadtime (server-group configuration)**	Configures deadtime within the context of RADIUS server groups.
	radius-server host	Specifies a RADIUS server host.
	radius-server retransmit	Specifies the number of times that the Cisco IOS software searches the list of RADIUS server hosts before giving up.
	radius-server timeout	Sets the interval for which a device waits for a server host to reply.

radius-server directed-request

To allow users to log in to a Cisco network access server (NAS) and select a RADIUS server for authentication, use the **radius-server directed-request** command in global configuration mode. To disable the directed-request function, use the **no** form of this command.

radius-server   directed-request   [restricted]
no   radius-server   directed-request   [restricted]

Syntax Description	**restricted** (Optional) Prevents the user from being sent to a secondary server if the specified server is not available.

Command Default   The User cannot log in to a Cisco NAS and select a RADIUS server for authentication.

Command Modes

Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   The **radius-server directed-request** command sends only the portion of the username before the "@" symbol to the host specified after the "@" symbol. In other words, with this command enabled, you can direct a request to any of the configured servers, and only the username is sent to the specified server.

> **Note**   If a private RADIUS server is used as the group server by configuring the **server-private** (RADIUS) command, then the **radius-server directed-request** command cannot be configured.

The following is the sequence of events to send a message to RADIUS servers:

- If the **radius-server directed-request** command is configured:

  - A request is sent to the directed server. If there are more servers with the same IP address, the request is sent only to the first server with same IP address.

  - If a response is not received, requests will be sent to all servers listed in the first method list.

  - If no response is received with the first method, the request is sent to all servers listed in the second method list until the end of the method list is reached.

> **Note**   To select the directed server, search the first server group in the method list for a server with the IP address provided in a directed request. If it is not available, the first server group with the same IP address from the global pool is considered.

- If the **radius-server directed-request restricted** command is configured for every server group in the method list, until the response is received from the directed server or the end of method list is reached, the following actions occur:

  - The first server with an IP address of the directed server will be used to send the request.

  - If a server with the same IP address is not found in the server group, then the first server in the global pool with the IP address of the directed-server will be used.

If the **radius-server directed-request** command is disabled using the **no radius-server directed-request** command, the entire string, both before and after the "@" symbol, is sent to the default RADIUS server. The router queries the list of servers, starting with the first one in the list. It sends the whole string, and accepts the first response from the server.

Use the **radius-server directed-request restricted** command to limit the user to the RADIUS server identified as part of the username.

If the user request has a server IP address, then the directed server forwards it to a specific server before forwarding it to the group. For example, if a user request such as user@10.0.0.1 is sent to the directed server, and if the IP address specified in this user request is the IP address of a server, the directed server forwards the user request to the specific server.

If a directed server is configured both on the server group and on the host server, and if the user request with the configured server name is sent to the directed server, the directed server forwards the user request to the host server before forwarding it to the server group. For example, if a user request of user@10.0.0.1 is sent to the directed server and 10.0.0.1 is the host server address, then the directed server forwards the user request to the host server before forwarding the request to the server group.

Note When the **no radius-server directed-request restricted** command is entered, only the restricted flag is removed, and the directed-request flag is retained. To disable the directed-request function, you must also enter the **no radius-server directed-request** command.

Examples

The following example shows how to configure the directed-request function:

```
Device> enable
Device# configure terminal
Device(config)# radius server rad-1
Device(config-radius-server)# address ipv4 10.1.1.2
Device(config-radius-server)# key dummy123
Device(config-radius-server)# exit
Device(config)# radius-server directed-request
```

Related Commands

Command	Description
aaa group server	Groups different server hosts into distinct lists and distinct methods.
aaa new-model	Enables the AAA access control model.
server-private (**RADIUS**)	Configures the IP address of the private RADIUS server for the group server.

radius-server domain-stripping

To configure a network access server (NAS) to strip suffixes, or to strip both suffixes and prefixes from the username before forwarding the username to the remote RADIUS server, use the **radius-server domain-stripping** command in global configuration mode. To disable a stripping configuration, use the **no** form of this command.

✎

| Note | The **ip vrf default** command must be configured in global configuration mode before the **radius-server domain-stripping** command is configured to ensure that the default VRF name is a NULL value until the defaulf vrf name is configured. |

radius-server **domain-stripping** [[**right-to-left**] [**prefix-delimiter** *character* [*character2* . . . *character7*]] [**delimiter** *character* [*character2* . . . *character7*]] | **strip-suffix** *suffix*] [**vrf** *vrf-name*]
no **radius-server** **domain-stripping** [[**right-to-left**] [**prefix-delimiter** *character* [*character2* . . . *character7*]] [**delimiter** *character* [*character2* . . . *character7*]] | **strip-suffix** *suffix*] [**vrf** *vrf-name*]

Syntax Description

right-to-left	(Optional) Specifies that the NAS will apply the stripping configuration at the first delimiter found when parsing the full username from right to left. The default is for the NAS to apply the stripping configuration at the first delimiter found when parsing the full username from left to right.
prefix-delimiter *character* [*character2...character7*]	(Optional) Enables prefix stripping and specifies the character or characters that will be recognized as a prefix delimiter. Valid values for the *character* argument are @, /, $, %, \, #, and -. Multiple characters can be entered without intervening spaces. Up to seven characters can be defined as prefix delimiters, which is the maximum number of valid characters. If a \ is entered as the final or only value for the *character* argument, it must be entered as \\. No prefix delimiter is defined by default.
delimiter *character* [*character2...character7*]	(Optional) Specifies the character or characters that will be recognized as a suffix delimiter. Valid values for the *character* argument are @, /, $, %, \, #, and -. Multiple characters can be entered without intervening spaces. Up to seven characters can be defined as suffix delimiters, which is the maximum number of valid characters. If a \ is entered as the final or only value for the *character* argument, it must be entered as \\. The default suffix delimiter is the @ character.
strip-suffix *suffix*	(Optional) Specifies a suffix to strip from the username.
vrf *vrf-name*	(Optional) Restricts the domain stripping configuration to a Virtual Private Network (VPN) routing and forwarding (VRF) instance. The *vrf-name* argument specifies the name of a VRF.

Command Default Stripping is disabled. The full username is sent to the RADIUS server.

Command Modes

Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines

Use the **radius-server domain-stripping** command to configure the NAS to strip the domain from a username before forwarding the username to the RADIUS server. If the full username is user1@cisco.com, enabling the **radius-server domain-stripping** command results in the username "user1" being forwarded to the RADIUS server.

Use the **right-to-left** keyword to specify that the username should be parsed for a delimiter from right to left, rather than from left to right. This allows strings with two instances of a delimiter to strip the username at either delimiter. For example, if the username is user@cisco.com@cisco.net, the suffix could be stripped in two ways. The default direction (left to right) would result in the username "user" being forwarded to the RADIUS server. Configuring the **right-to-left** keyword would result in the username "user@cisco.com" being forwarded to the RADIUS server.

Use the **prefix-delimiter** keyword to enable prefix stripping and to specify the character or characters that will be recognized as a prefix delimiter. The first configured character that is parsed will be used as the prefix delimiter, and any characters before that delimiter will be stripped.

Use the **delimiter** keyword to specify the character or characters that will be recognized as a suffix delimiter. The first configured character that is parsed will be used as the suffix delimiter, and any characters after that delimiter will be stripped.

Use **strip-suffix** *suffix* to specify a particular suffix to strip from usernames. For example, configuring the **radius-server domain-stripping strip-suffix cisco.net** command would result in the username user@cisco.net being stripped, while the username user@cisco.com will not be stripped. You may configure multiple suffixes for stripping by issuing multiple instances of the **radius-server domain-stripping** command. The default suffix delimiter is the @ character.

✎

Note Issuing the **radius-server domain-stripping s trip-suffix** *suffix* command disables the capacity to strip suffixes from all domains. Both the suffix delimiter and the suffix must match for the suffix to be stripped from the full username. The default suffix delimiter of @ will be used if you do not specify a different suffix delimiter or set of suffix delimiters using the **delimiter**keyword.

To apply a domain-stripping configuration only to a specified VRF, use the **vrf** *vrf-name* option.

The interactions between the different types of domain stripping configurations are as follows:

- You may configure only one instance of the **radius-server domain-stripping**[**right-to-left**] [**prefix-delimiter** *character* [*character2...character7*]] [**delimiter** *character* [*character2...character7*]] command.

- You may configure multiple instances of the **radius-server domain-stripping**[**right-to-left**] [**prefix-delimiter** *character* [*character2...character7*]] [**delimiter** *character* [*character2...character7*]] [**vrf** *vrf-name*] command with unique values for **vrf** *vrf-name*.

- You may configure multiple instances of the **radius-server domain-stripping strip-suffix** *suffix*[**vrf** *per-vrf*] command to specify multiple suffixes to be stripped as part of a global or per-VRF ruleset.

- Issuing any version of the **radius-server domain-stripping** command automatically enables suffix stripping using the default delimiter character @ for that ruleset, unless a different delimiter or set of delimiters is specified.

- Configuring a per-suffix stripping rule disables generic suffix stripping for that ruleset. Only suffixes that match the configured suffix or suffixes will be stripped from usernames.

Examples

The following example configures the router to parse the username from right to left and sets the valid suffix delimiter characters as @, \, and $. If the full username is cisco/user@cisco.com$cisco.net, the username "cisco/user@cisco.com" will be forwarded to the RADIUS server because the $ character is the first valid delimiter encountered by the NAS when parsing the username from right to left.

```
radius-server domain-stripping right-to-left delimiter @\$
```

The following example configures the router to strip the domain name from usernames only for users associated with the VRF instance named abc. The default suffix delimiter @ will be used for generic suffix stripping.

```
radius-server domain-stripping vrf abc
```

The following example enables prefix stripping using the character / as the prefix delimiter. The default suffix delimiter character @ will be used for generic suffix stripping. If the full username is cisco/user@cisco.com, the username "user" will be forwarded to the RADIUS server.

```
radius-server domain-stripping prefix-delimiter /
```

The following example enables prefix stripping, specifies the character / as the prefix delimiter, and specifies the character # as the suffix delimiter. If the full username is cisco/user@cisco.com#cisco.net, the username "user@cisco.com" will be forwarded to the RADIUS server.

```
radius-server domain-stripping prefix-delimiter / delimiter #
```

The following example enables prefix stripping, configures the character / as the prefix delimiter, configures the characters $, @, and # as suffix delimiters, and configures per-suffix stripping of the suffix cisco.com. If the full username is cisco/user@cisco.com, the username "user" will be forwarded to the RADIUS server. If the full username is cisco/user@cisco.com#cisco.com, the username "user@cisco.com" will be forwarded.

```
radius-server domain-stripping prefix-delimiter / delimiter $@#
radius-server domain-stripping strip-suffix cisco.com
```

The following example configures the router to parse the username from right to left and enables suffix stripping for usernames with the suffix cisco.com. If the full username is cisco/user@cisco.net@cisco.com, the username "cisco/user@cisco.net" will be forwarded to the RADIUS server. If the full username is cisco/user@cisco.com@cisco.net, the full username will be forwarded.

```
radius-server domain-stripping right-to-left
radius-server domain-stripping strip-suffix cisco.com
```

The following example configures a set of global stripping rules that will strip the suffix cisco.com using the delimiter @, and a different set of stripping rules for usernames associated with the VRF named myvrf:

```
radius-server domain-stripping strip-suffix cisco.com
!
radius-server domain-stripping prefix-delimiter # vrf myvrf
radius-server domain-stripping strip-suffix cisco.net vrf myvrf
```

Related Commands

Command	Description
aaa new-model	Enables the AAA access control model.
ip vrf	Defines a VRF instance and enters VRF configuration mode.
tacacs-server domain-stripping	Configures a router to strip a prefix or suffix from the username before forwarding the username to the TACACS+ server.

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

interval *time-interval*	SAK rekey interval in seconds.
	The range is from 30 to 65535, and the default is 0.
on-live-peer-loss	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 16.9.2	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
mka policy	Configures an MKA policy.
confidentiality-offset	Sets the confidentiality offset for MACsec operations.
delay-protection	Configures MKA to use delay protection in sending MKPDU.
include-icv-indicator	Includes ICV indicator in MKPDU.
key-server	Configures MKA key-server options.
macsec-cipher-suite	Configures cipher suite for deriving SAK.
send-secure-announcements	Configures MKA to send secure announcements in sending MKPDUs.
ssci-based-on-sci	Computes SSCI based on the SCI.
use-updated-eth-header	Uses the updated Ethernet header for ICV calculation.

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	
glean	Extracts addresses from the messages and installs them into the binding table without performing any verification.
guard	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.
inspect	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 (config-ipv6-snooping)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

This example shows how to define an IPv6 snooping policy name as policy1 and configure the security level as inspect:

```
Device> enable
Device# configure terminal
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# security-level inspect
Device(config-ipv6-snooping)# end
```

send-secure-announcements

To enable MKA to send secure announcements in MACsec Key Agreement Protocol Data Units (MKPDUs), use the **send-secure-announcements** command in MKA-policy configuration mode. To disable sending of secure announcements, use the **no** form of this command.

send-secure-announcements
no send-secure-announcements

Syntax Description	This command has no arguments or keywords.
Command Default	Secure announcements in MKPDUs is disabled.
Command Modes	MKA-policy configuration (config-mka-policy)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   Secure announcements revalidate the MACsec Cipher Suite capabilities which were shared previously through unsecure announcements.

Examples   The following example shows how to enable sending of secure announcements:

```
Device> enable
Device# configure terminal
Device(config)# mka policy 2
Device(config-mka-policy)# send-secure-announcements
```

Related Commands

Command	Description
mka policy	Configures an MKA policy.
confidentiality-offset	Sets the confidentiality offset for MACsec operations.
delay-protection	Configures MKA to use delay protection in sending MKPDU.
include-icv-indicator	Includes ICV indicator in MKPDU.
key-server	Configures MKA key-server options.
macsec-cipher-suite	Configures cipher suite for deriving SAK.
sak-rekey	Configures the SAK rekey interval.
ssci-based-on-sci	Computes SSCI based on the SCI.
use-updated-eth-header	Uses the updated ethernet header for ICV calculation.

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	

ip-address	IP address of the private RADIUS server host.
auth-port *port-number*	(Optional) User Datagram Protocol (UDP) destination port for authentication requests. The default value is 1645.
acct-port *port-number*	Optional) UDP destination port for accounting requests. The default value is 1646.
non-standard	(Optional) RADIUS server is using vendor-proprietary RADIUS attributes.
timeout *seconds*	(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 **radius-server timeout** command. If no timeout value is specified, the global value is used.
retransmit *retries*	(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 **radius-server retransmit** command.
key *string*	(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 **radius-server key** command. If no key string is specified, the global value is used.
	The *string* can be **0** (specifies that an unencrypted key follows), **6** (specifies that an advanced encryption scheme [AES] encrypted key follows), **7** (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 Fuji 16.9.2	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
aaa group server	Groups different server hosts into distinct lists and distinct methods.
aaa new-model	Enables the AAA access control model.
password encryption aes	Enables a type 6 encrypted preshared key.
radius-server host	Specifies a RADIUS server host.
radius-server directed-request	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		
	ip4-address	IPv4 address of the private TACACS+ server host.
	ip6-address	IPv6 address of the private TACACS+ server host.
	fqdn	Fully qualified domain name (fqdn) of the private TACACS+ server host for address resolution from the Domain Name Server (DNS)
	nat	(Optional) Specifies the port Network Address Translation (NAT) address of the remote device. This address is sent to the TACACS+ server.
	single-connection	(Optional) Maintains a single TCP connection between the router and the TACACS+ server.
	timeout *seconds*	(Optional) Specifies a timeout value for the server response. This value overrides the global timeout value set with the **tacacs-server timeout** command for this server only.
	port *port-number*	(Optional) Specifies a server port number. This option overrides the default, which is port 49.
	key [**0**|**7**] *string*	(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 tacacs-server key command for this server only.
		If no number or 0 is entered, the *string* that is entered is considered to be plain text. If 7 is entered, the *string* 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 Fuji 16.9.2	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
aaa group server	Groups different server hosts into distinct lists and distinct methods.
aaa new-model	Enables the AAA access control model.
ip tacacs source-interface	Uses the IP address of a specified interface for all outgoing TACACS+ packets.
ip vrf forwarding (server-group)	Configures the VRF reference of an AAA TACACS+ server group.

show aaa clients

To display authentication, authorization, and accounting (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 (>)

Privileged EXEC (#)

Command History	**Release**	**Modification**
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

This is an example of output from the **show aaa clients** command:

```
Device> enable
Device# show aaa clients

Dropped request packets: 0
```

show aaa command handler

To display authentication, authorization, and accounting (AAA) command handler statistics, use the **show aaa command handler** command.

show aaa command handler

Syntax Description   This command has no aruguments or keywords.

Command Modes   User EXEC (>)

Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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 dead-criteria

To display dead-criteria detection information for an authentication, authorization, and accounting (AAA) server, use the **show aaa dead-criteria** command in privileged EXEC mode.

show aaa dead-criteria {**security-protocol** *ip-address*} [**auth-port** *port-number*] [**acct-port** *port-number*][*server-group-name*]

Syntax Description

security-protocol	Security protocol of the specified AAA server. Currently, the only protocol that is supported is RADIUS.
ip-address	IP address of the specified AAA server.
auth-port	(Optional) Authentication port for the RADIUS server that was specified.
port-number	(Optional) Number of the authentication port. The default is 1645 (for a RADIUS server).
acct-port	(Optional) Accounting port for the RADIUS server that was specified.
port-number	(Optional) Number of the accounting port. The default is 1646 (for a RADIUS server).
server-group-name	(Optional) Server group with which the specified server is associated. The default is *radius* (for a RADIUS server).

Command Default

Currently, the *port-number* argument for the **auth-port** keyword and the *port-number* argument for the **acct-port** keyword default to 1645 and 1646, respectively. The default for the *server-group-name* argument is radius.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines

Multiple RADIUS servers having the same IP address can be configured on a device. The **auth-port** and **acct-port** keywords are used to differentiate the servers. The dead-detect interval of a server that is associated with a specified server group can be obtained by using the **server-group-name** keyword. (The dead-detect interval and retransmit values of a RADIUS server are set on the basis of the server group to which the server belongs. The same server can be part of multiple server groups.)

Examples

The following example shows that dead-criteria-detection information has been requested for a RADIUS server at the IP address 172.19.192.80:

```
Device# show aaa dead-criteria radius 172.19.192.80 radius

RADIUS Server Dead Critieria:
==============================
Server Details:
    Address : 172.19.192.80
```

```
        Auth Port : 1645
        Acct Port : 1646
Server Group : radius
Dead Criteria Details:
        Configured Retransmits : 62
        Configured Timeout : 27
        Estimated Outstanding Transactions: 5
        Dead Detect Time : 25s
        Computed Retransmit Tries: 22
        Statistics Gathered Since Last Successful Transaction
=====================================================
Max Computed Outstanding Transactions: 5
Max Computed Dead Detect Time: 25s
Max Computed Retransmits : 22
```

The **Max Computed Dead Detect Time** is displayed in seconds. The other fields shown in the display are self-explanatory.

Related Commands	Command	Description
	debug aaa dead-criteria transactions	Displays AAA dead-criteria transaction values.
	radius-server dead-criteria	Forces one or both of the criteria, used to mark a RADIUS server as dead, to be the indicated constant.
	show aaa server-private	Displays the status of all private RADIUS servers.
	show aaa servers	Displays information about the number of packets sent to and received from AAA servers.

show aaa local

To display authentication, authorization, and accounting (AAA) local method options, use the **show aaa local** command.

show aaa local {**netuser** {*name* | **all** } | **statistics** | **user lockout**}

Syntax Description		
netuser	Specifies the AAA local network or guest user database.	
name	Network user name.	
all	Specifies the network and guest user information.	
statistics	Displays statistics for local authentication.	
user lockout	Specifies the AAA local locked-out user.	

Command Modes   User EXEC (>)

Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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 display all authentication, authorization, and accounting (AAA) servers as seen by the AAA server MIB, use the **show aaa servers** command.

show aaa servers [private | **public** | [**detailed]]**

Syntax Description		
	detailed	(Optional) Displays private AAA servers as seen by the AAA server MIB.
	public	(Optional) Displays public AAA servers as seen by the AAA server MIB.
	detailed	(Optional) Displays detailed AAA server statistics.

Command Modes

User EXEC (>)

Privileged EXEC (>)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

Examples

The following is a sample output from the **show aaa servers** command:

show aaa sessions

To display authentication, authorization, and accounting (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 (>)

Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

The following is sample 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		
switch-number	Valid values for the *switch-number* variable are from 1 to 9.
R0	Displays information about the Route Processor (RP) slot 0.
active	Specifies the active instance.
standby	Specifies the standby instance.

Command Modes

Privileged EXEC (#)

User EXEC (>)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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           Fg  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 8: 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: • A—Applying policy (multi-line status for details) • D—Awaiting removal • F—Final removal in progress • I—Awaiting IIF ID allocation • P—Pushed session • R—Removing user profile (multi-line status for details) • U—Applying user profile (multi-line status for details) • X—Unknown blocker
Uptime	Indicates the duration since which the session came up

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	**database**	(Optional) Shows only data stored in session database.
	handle *handle-id*	(Optional) Specifies the particular handle for which Auth Manager information is to be displayed.
	details	(Optional) Shows detailed information.
	interface *type number*	(Optional) Specifies a particular interface type and number for which Auth Manager information is to be displayed.
	mac *mac-address*	(Optional) Specifies the particular MAC address for which you want to display information.
	method *method-name*	(Optional) Specifies the particular authentication method for which Auth Manager information is to be displayed. If you specify a method (**dot1x**, **mab**, or **webauth**), you may also specify an interface.
	session-id *session-id*	(Optional) Specifies the particular session for which Auth Manager information is to be displayed.

Command Modes	User EXEC (>)
	Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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 9: 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 10: 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 device:

```
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:  0A3462C8000000000002763C
      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 cisp

To display Client Information Signaling Protocol (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		
	clients	(Optional) Display CISP client details.
	interface *interface-id*	(Optional) Display CISP information about the specified inte channels.
	registrations	Displays CISP registrations.
	summary	(Optional) Displays CISP summary.

Command Modes	Privileged EXEC (#)

Command History	**Release**	**Modification**
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

The following is sample output from the **show cisp interface** command:

```
Device# show cisp interface fastethernet 0/1/1

CISP not enabled on specified interface
```

The following is sample 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
	cisp enable	Enables CISP.
	dot1x credentials *profile*	Configures a profile on a supplicant device.

show device-tracking capture-policy

To display the rules that the system pushes to the hardware (forwarding layer), enter the **show device-tracking capture-policy** command in privileged EXEC mode. These rules determine which packets are punted to SISF for further action. These rules are a translation of the policy that is applied to the interface or VLAN.

show device-tracking capture-policy [**interface** *inteface_type_no* | **vlan** *vlan_id*]

Syntax Description		
interface *inteface_type_no*	Displays message capture policy information for the interface you specify. Enter an interface type and number.	
	Use the question mark (?) online help function to display the types of interfaces on the device.	
vlan *vlan_id*	Displays message capture policy information for the VLAN ID you specify. The valid value range is from 1 to 4095.	

Command Modes   Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   The output of this command is used by the technical support team, for troubleshooting.

Examples

The following is sample output from the **show device-tracking capture-policy** command:

```
Device# show device-tracking capture-policy interface tengigabitethernet1/0/1

   HW Target Te1/0/1 HW policy signature 0001DF9F policies#:1 rules 14 sig 0001DF9F
      SW policy sisf-01 feature Device-tracking - Active

      Rule DHCP4 CLIENT Protocol UDP mask 00000400 action PUNT match1 0 match2 67#feat:1
         feature Device-tracking
      Rule DHCP4 SERVER SOURCE Protocol UDP mask 00001000 action PUNT match1 0 match2
68#feat:1
         feature Device-tracking
      Rule DHCP4 SERVER Protocol UDP mask 00000800 action PUNT match1 67 match2 0#feat:1
         feature Device-tracking
      Rule ARP Protocol IPV4 mask 00004000 action PUNT match1 0 match2 0#feat:1
         feature Device-tracking
      Rule DHCP SERVER SOURCE Protocol UDP mask 00000200 action PUNT match1 0 match2
546#feat:1
         feature Device-tracking
      Rule DHCP CLIENT Protocol UDP mask 00000080 action PUNT match1 0 match2 547#feat:1
         feature Device-tracking
      Rule DHCP SERVER Protocol UDP mask 00000100 action PUNT match1 547 match2 0#feat:1
         feature Device-tracking
      Rule RS Protocol ICMPV6 mask 00000004 action PUNT match1 133 match2 0#feat:1
         feature Device-tracking
      Rule RA Protocol ICMPV6 mask 00000008 action PUNT match1 134 match2 0#feat:1
```

```
     feature Device-tracking
Rule NS Protocol ICMPV6 mask 00000001 action PUNT match1 135 match2 0#feat:1
     feature Device-tracking
Rule NA Protocol ICMPV6 mask 00000002 action PUNT match1 136 match2 0#feat:1
     feature Device-tracking
Rule REDIR Protocol ICMPV6 mask 00000010 action PUNT match1 137 match2 0#feat:1
     feature Device-tracking
Rule DAR Protocol ICMPV6 mask 00008000 action PUNT match1 157 match2 0#feat:1
     feature Device-tracking
Rule DAC Protocol ICMPV6 mask 00010000 action PUNT match1 158 match2 0#feat:1
     feature Device-tracking
```

show device-tracking counters

To display information about the number of broadcast, multicast, bridged, unicast, probe, dropped device-tracking messages and faults received on an interface or VLAN or both, enter the **show device-tracking counters** command in privileged EXEC mode. Where applicable, the messages are categorized by protocol. The list of protocols include Address Resolution Protocol (ARP), Neighbor Discovery Protocol (NDP), DHCPv6, DHCPv4, Address Collision Detection (ACD), and Duplicate Address Detection (DAD).

show device-tracking counters [**all** | **interface** *inteface_type_no* | **vlan** *vlan_id*]

Syntax Description		
all	Displays information for all interfaces and VLANs on the device where a policy is attached.
interface *inteface_type_no*	Displays information for the specified interface. Enter an interface type and number.
	Use the question mark (?) online help function to display the types of interfaces on the device.
vlan *vlan_id*	Displays information for the VLAN ID you specify. The range is from 1 to 4095.

Command Modes   Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   When you enter the **show device-tracking counters** command, you must enter one of the keywords that follow, that is, **all**, or **interface** *inteface_type_no* , or **vlan** *vlan_id* .

If you specify an interface or VLAN where a policy is not attached, the following message is displayed: `% no ipv6 snooping policy attached on <interface number or VLAN ID>`

Examples

The following is sample output from the **show device-tracking counters** command. Information relating to a particular VLAN (VLAN 10) is displayed here:

```
Device# show device-tracking counters vlan 10
Received messages on vlan 10   :
Protocol        Protocol message
NDP             RA[2479] NS[1757] NA[2794]
DHCPv6
ARP             REP[878]
DHCPv4
ACD&DAD         --[3]

Received Broadcast/Multicast messages on vlan 10   :
Protocol        Protocol message
NDP             RA[2479] NS[3] NA[5]
DHCPv6
```

```
ARP             REP[1]
DHCPv4

Bridged messages from vlan 10   :
Protocol        Protocol message
NDP             RA[1238] NS[1915] NA[878]
DHCPv6
ARP             REQ[877]
DHCPv4
ACD&DAD         --[1]

Broadcast/Multicast converted to unicast messages from vlan 10    :
Protocol        Protocol message
NDP
DHCPv6
ARP
DHCPv4
ACD&DAD

Probe message on vlan 10   :
Type            Protocol message
PROBE_SEND      NS[1037] REQ[877]
PROBE_REPLY     NA[1037] REP[877]

Limited Broadcast to Local message on vlan 10    :
Type            Protocol message
NDP
DHCPv6
ARP
DHCPv4

Dropped messages on vlan 10   :
Feature           Protocol Msg [Total dropped]
Device-tracking:  NDP      RA  [1241]
                  reason:  Packet not authorized on port [1241]

                           NS  [2]
                  reason:  Silent drop [2]

                           NA  [1039]
                  reason:  Silent drop [1037]
                  reason:  Packet accepted but not forwarded [2]

                  ARP      REP [878]
                  reason:  Silent drop [877]
                  reason:  Packet accepted but not forwarded [1]

ACD&DAD:          --       -- [2]


Faults on vlan 10   :
```

show device-tracking database

To display details of the binding table database, enter the **show device-tracking database** command in privileged EXEC mode.

show device-tracking database [**address** { *hostname_address* | **all** } [**interface** *inteface_type_no*] [**vlanid** *vlan*] [**details**] | **details** | **interface** *inteface_type_no* [**details**] [**vlanid** *vlan*] | **mac** [*48_bit_hw_add*] [**details**] [**interface** *inteface_type_no*] [**vlanid** *vlan*] | **prefix** [*prefix_address* | **all**] [**details**] [**interface** *inteface_type_no*] | **vlanid** *vlanid* [**details**]]

Syntax Description	**address** {*hostname_address* | **all**}	Displays binding table information for a particular IP address or for all addresses
	interface *inteface_type_no*	Displays binding table information for the specified interface. Enter an interface type and number.
		Use the question mark (?) online help function to display the types of interfaces on the device.
	vlanid *vlan*	Displays binding table information for the VLAN ID you specify. The valid value range is from 1 to 4095.
	details	Displays detailed information.
	mac	Displays binding table information for the MAC address you specify.
	48_bit_hw_add	Enter a 48-bit hardware address.
	prefix	Displays binding table information for the IPv6 prefix you specify.
	prefix_address	Enter an IPv6 prefix.
	all	Displays binding table information for all the available IPv6 prefixes.

Command Modes	Privileged EXEC (#)

Command History	**Release**	**Modification**
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

Examples

The following is sample output for the **show device-tracking database details** command. The accompanying table describes the significant fields shown in the display.

```
Device# show device-tracking database details

 Binding table configuration:
 --------------------------
max/box  : no limit
max/vlan : no limit
```

```
max/port : no limit
max/mac  : no limit

Binding table current counters:
-----------------------------
dynamic : 5
local   : 1
total   : 5

Binding table counters by state:
--------------------------------
REACHABLE  : 5
     DOWN  : 1
    total  : 6

Codes: L - Local, S - Static, ND - Neighbor Discovery, ARP - Address Resolution Protocol,
DH4 - IPv4 DHCP, DH6 - IPv6 DHCP, PKT - Other Packet, API - API created
Preflevel flags (prlvl):
0001:MAC and LLA match     0002:Orig trunk          0004:Orig access
0008:Orig trusted trunk    0010:Orig trusted access  0020:DHCP assigned
0040:Cga authenticated     0080:Cert authenticated   0100:Statically assigned


     Network Layer Address   Link Layer Address   Interface  mode     vlan(prim)  prlvl
age     state       Time left   Filter   In Crimson  Client ID       Session ID
Policy (feature)
ARP 192.0.9.29              001b.4411.3ab7(S)    Te1/0/4    trunk    200 ( 200)  0003
6mn   REACHABLE   331 s      no       yes         0000.0000.0000  (unspecified)
sisf-01 (Device-tracking)
ARP 192.0.9.28              001b.4411.3ab7(S)    Te1/0/4    trunk    200 ( 200)  0003
6mn   REACHABLE   313 s      no       yes         0000.0000.0000  (unspecified)
sisf-01 (Device-tracking)
ARP 192.0.9.27              001b.4411.3ab7(S)    Te1/0/4    trunk    200 ( 200)  0003
6mn   REACHABLE   323 s      no       yes         0000.0000.0000  (unspecified)
sisf-01 (Device-tracking)
ARP 192.0.9.26              001b.4411.3ab7(S)    Te1/0/4    trunk    200 ( 200)  0003
6mn   REACHABLE   311 s      no       yes         0000.0000.0000  (unspecified)
sisf-01 (Device-tracking)
ARP 192.0.9.25              001b.4411.3ab7(S)    Te1/0/4    trunk    200 ( 200)  0003
6mn   REACHABLE   313 s      no       yes         0000.0000.0000  (unspecified)
sisf-01 (Device-tracking)
L   192.168.0.1            00a5.bf9d.0462(D)     Vl200      svi      200 ( 200)  0100
6mn   DOWN                  no       yes         0000.0000.0000  (unspecified)
sisf-01 (sisf_local)
```

Table 11: show device-tracking database details Field Descriptions

Field	Description
Binding table configuration: • max/box • max/vlan • max/port • max/mac	Displays binding table settings. The values correspond with what is configured using the **device-tracking binding** command in global configuration mode. • max/box: The value displayed here corresponds with the configured value for the **max-entries** *no_of_entries* keyword. • max/vlan: The value displayed here corresponds with the configured value for the **vlan-limit** *no_of_entries* keyword. • max/port: The value displayed here corresponds with the configured value for the **port-limit** *no_of_entries* keyword. • max/mac: The value displayed here corresponds with the configured value for the **mac-limit** *no_of_entries* keyword.
Binding table current counters: • dynamic • local • total	Displays the number of entries in the table. • dynamic: Dynamic entries are created by learning events that dynamically populate the binding table. • local: Local entries are automatically created when you configure an SVI on the device. One of ways in which SISF uses a local entry, is in the context of polling. If polling is enabled, the SVI address is used as the source address of an ARP probe. • total: The total is a sum of the dynamic, local, and static binding entries.
Binding table counters by state:	Displays the number of entries in each state. The state can be REACHABLE, STALE, DOWN.
Codes	Clarifies abbreviations that are used to signify learning events. The first column of a binding entry uses an abbreviated code, which tells you about the learning event that resulted in creation of that binding entry.

Field	Description
Preflevel flags (prlvl)	A list of preference level number codes and clarification for what the number codes in the `prlvl` column of the binding table mean.
	The codes signify a broad classification and multiple codes can apply to an entry. What is displayed in the `prlvl` column is a sum of these number codes and signifies a corresponding preference level.
	For example if an ARP entry (preference code: 0001) is learned from an access interface (preference code: 0004), the value displayed in the `prlvl` column is "0005".
	1 is the lowest preference level, and 100 is the highest.
	A binding entry with a higher preference is given preference in case of a collision. For example, if the same entry is seen on two different interfaces, the value in the `prlvl` column, determines which entry is retained.
Network Layer Address	The IP address of the host from which a packet is received.
Link Layer Address	The MAC address of the host.
Mode	Displays one of the following values: "invalid", "unsupp", "access", "trunk", "vpc", "svi", "virtual", "pseudowire", "unkn", "bdi", "pseudoport".
vlan(prim)	The host's VLAN ID
prlvl	A value between 1 and 100 is displayed, with 1 having the lowest preference level, and 100 having the highest preference level.
	See `Preflevel flags` above to know what the value displayed here means.
age	The total age of the entry in seconds (s) or minutes (mn) since the the last time the entry was refreshed. When it is refreshed (sign-of-life from the host), this value is reset.
state	The current state of an entry, which can be one of the stable or transitional states.
	Stable state values are: REACHABLE, DOWN, and STALE,
	Transitional states values are: VERIFY, INCOMPLETE, and TENTATIVE.

Field	Description
Time left	Displays the amount of time left until the next action in the current state.
In Crimson	A *yes* or *no* value which indicates if the entry has been added to another database. The information is then used by other applications, like Cisco DNA Center.
	Typically, all the entries that are in a binding table are also added to this database.
	This is used by the technical support team, for troubleshooting and to diagnose a problem.
Client ID	This field is applicable only to virtual machines (VMs) in Cisco Software-Defined Access (SDA) deployments.
	It refers to the actual MAC address of a VM in a bridged networking mode, where the hosting device is a wireless client with a non-promiscuous network interface (NIC).
Session ID	This field is applicable only to VMs in SDA deployments.
	It refers to an access session ID for a VM in a bridged networking mode. Each Session ID is associated with a Client ID. SISF maintains this association and transfers it along as the VM roams or moves across fabric edges in an SDA setup.
Policy (feature)	Displays the name of the policy applied to the interface or VLAN.
	The "(feature)" displayed is always "Device-tracking", because only SISF-based device-tracking supports the creation of binding entries.

show device-tracking events

To display SISF binding table-related events, enter the **show device-tracking events** command in privileged EXEC mode. The types of events that are displayed includes the creation of binding table entries and all updates to an entry. Updates may be state changes, or, changes in the MAC, VLAN, or interface information for an entry.

show device-tracking events

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

Command Default   SISF binding table events are displayed.

Command Modes   Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   The output of this command is used by the technical support team, for troubleshooting.

Examples

The following is sample output for the **show device-tracking events** command. It shows you the kind of binding table events that the system logs:

```
Device# show device-tracking events
 [Wed Mar 23 19:08:33.000] SSID 0 FSM Feature Table running for event ACTIVE_REGISTER in
state CREATING
 [Wed Mar 23 19:08:33.000] SSID 0 Transition from CREATING to READY upon event ACTIVE_REGISTER

 [Wed Mar 23 19:08:33.000] SSID 1 FSM Feature Table running for event ACTIVE_REGISTER in
state CREATING
 [Wed Mar 23 19:08:33.000] SSID 1 Transition from CREATING to READY upon event ACTIVE_REGISTER

 [Wed Mar 23 19:09:25.000] SSID 0 FSM sisf_mac_fsm running for event MAC_TENTV in state
MAC-CREATING
 [Wed Mar 23 19:09:25.000] SSID 0 Transition from MAC-CREATING to MAC-TENTATIVE upon event
 MAC_TENTV
 [Wed Mar 23 19:09:25.000] SSID 1 Created Entry origin IPv4 ARP MAC 00a5.bf9c.e051 IPV4
10.0.0.1
 [Wed Mar 23 19:09:25.000] SSID 0 FSM sisf_mac_fsm running for event MAC_VERIFIED in state
 MAC-TENTATIVE
 [Wed Mar 23 19:09:25.000] SSID 0 Transition from MAC-TENTATIVE to MAC-REACHABLE upon event
 MAC_VERIFIED
 [Wed Mar 23 19:09:25.000] SSID 1 FSM Binding table running for event VALIDATE_LLA in state
 CREATING
 [Wed Mar 23 19:09:25.000] SSID 1 FSM Binding table running for event SET_TENTATIVE in state
 CREATING
 [Wed Mar 23 19:09:25.000] SSID 1 Transition from CREATING to TENTATIVE upon event
SET_TENTATIVE
 [Wed Mar 23 19:09:25.000] SSID 1 Entry State changed origin IPv4 ARP MAC 00a5.bf9c.e051
IPV4 10.0.0.1
```

```
[Wed Mar 23 20:07:27.000] SSID 0 FSM sisf_mac_fsm running for event MAC_DELETE_NOS in state
MAC-REACHABLE
[Wed Mar 23 20:07:27.000] SSID 0 Transition from MAC-REACHABLE to MAC-NONE upon event
MAC_DELETE_NOS
[Wed Mar 23 20:07:27.000] SSID 1 Transition from REACHABLE to NONE upon event DELETE
```

show device-tracking features

To display the device-tracking features that are enabled, enter the **show device-tracking features** command in privileged EXEC mode. The "features" include SISF-based device-tracking, and security features like IPv6 RA Guard, IPv6 DHCP Guard, Layer 2 DHCP Relay, and so on, that use SISF.

show device-tracking features

Syntax Description	This command has no arguments or keywords.

Command Modes	Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Examples

The following is sample output for the **show device-tracking features** command.

```
Device# show device-tracking features
Feature name    priority state
Device-tracking   128   READY
Source guard       32   READY
```

show device-tracking messages

To display a list of device-tracking related activities, enter the **show device-tracking messages** command in privileged EXEC mode.

show device-tracking messages   [**detailed** *no_of_messages*]

Syntax Description	**detailed** *no_of_messages*	Displays a more detailed format of the list of device-tracking messages. Enter a value between 1 and 255, to specify the number of messages that must be displayed in a detailed format.

Command Modes   Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

The following is sample output for the **show device-tracking messages** command. The summarized and detailed versions of the output are displayed:

```
Device# show device-tracking messages
[Wed Mar 23 19:09:25.000] VLAN 1, From Te1/0/2 MAC 00a5.bf9c.e051: ARP::REP, 10.0.0.1,
[Wed Mar 23 20:03:22.000] VLAN 1, From Te1/0/2 MAC 00a5.bf9c.e051: ARP::REP, 10.0.0.1,


Device# show device-tracking messages detailed 255
[Wed Mar 23 19:09:25.000] VLAN 1, From Te1/0/2 seclvl [guard], MAC 00a5.bf9c.e051: ARP::REP,

1 addresses advertised:
   IPv6 addr: 10.0.0.1,

[Wed Mar 23 20:03:22.000] VLAN 1, From Te1/0/2 seclvl [guard], MAC 00a5.bf9c.e051: ARP::REP,

1 addresses advertised:
   IPv6 addr: 10.0.0.1,
```

show device-tracking policies

To display *all* the device-tracking policies on the device, enter the **show device-tracking policies** command in privileged EXEC mode.

show device-tracking policies [**details** | **interface** *interface_type_no* [**details**] | **vlan** *vlanid*]

Syntax Description		
details	Displays information about the policy targets and policy parameters of all device-tracking policies on the device
interface *interface_type_no*	Displays all policies applied to the the specified interface. Enter an interface type and number.
	Use the question mark (?) online help function to display the types of interfaces on the device.
vlan *vlanid*	Displays all policies applied to the the specified VLAN. The valid value range is from 1 to 4095.

Command Modes Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Examples

The following is sample output for the **show device-tracking policies** command with the **details** keyword. It shows that there is only one policy on the device. It shows the target to which the policy is applied and the policy parameters.

```
Device# show device-tracking policies details

Target               Type  Policy                Feature        Target range
Te1/0/1              PORT  sisf-01               Device-tracking vlan all

Device-tracking policy sisf-01 configuration:
  security-level guard
  device-role node
  gleaning from Neighbor Discovery
  gleaning from DHCP6
  gleaning from ARP
  gleaning from DHCP4
  NOT gleaning from protocol unkn
  tracking enable
Policy sisf-01 is applied on the following targets:
Target               Type  Policy                Feature        Target range
Te1/0/1              PORT  sisf-01               Device-tracking vlan all
```

show device-tracking policy

To display information about a particular policy, enter the **show device-tracking policy** command in privileged EXEC mode. Displayed information includes the list of targets to which the policy is applied, and policy parameters.

show device-tracking policy *policy_name*

Syntax Description

policy_name	Enter the name of the policy.

Command Modes   Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Examples

The following is sample output for the **show device-tracking policy** command. Details of policy sisf-01 are displayed.

```
Device# show device-tracking policy sisf-01
Device-tracking policy sisf-01 configuration:
  security-level guard
  device-role node
  gleaning from Neighbor Discovery
  gleaning from DHCP6
  gleaning from ARP
  gleaning from DHCP4
  NOT gleaning from protocol unkn
  tracking enable
Policy sisf-01 is applied on the following targets:
Target              Type  Policy              Feature         Target range
Te1/0/1             PORT  sisf-01             Device-tracking vlan all
```

show dot1x

To display IEEE 802.1x statistics, administrative status, and operational status for a device or for the specified port, use the **show dot1x** command in user EXEC or privileged EXEC mode.

show dot1x [**all** [**count** | **details** | **statistics** | **summary**]] [**interface** *type number* [**details** | **statistics**]] [**statistics**]

Syntax Description		
	all	(Optional) Displays the IEEE 802.1x information for all interfaces.
	count	(Optional) Displays total number of authorized and unauthorized clients.
	details	(Optional) Displays the IEEE 802.1x interface details.
	statistics	(Optional) Displays the IEEE 802.1x statistics for all interfaces.
	summary	(Optional) Displays the IEEE 802.1x summary for all interfaces.
	interface *type number*	(Optional) Displays the IEEE 802.1x status for the specified port.

Command Modes   User EXEC (>)

Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

The following is sample output from the **show dot1x all** command:

```
Device# show dot1x all

Sysauthcontrol            Enabled
Dot1x Protocol Version        3
```

The following is sample 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
```

The following is sample 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 Fuji 16.9.2	This command was introduced.

The following is sample output from the **show eap pac peers** command:

```
Device# show eap pac peers

No PACs stored
```

Related Commands

Command	Description
clear eap sessions	Clears EAP session information for the device or for the spe

show ip access-lists

To display the contents of all current IP access lists, use the **show ip access-lists** command in user EXEC or privileged EXEC modes.

show ip access-lists [*access-list-number access-list-number-expanded-range access-list-name* | **dynamic** [*dynamic-access-list-name*] | **interface** *name number* [**in** | **out**]]

Syntax Description		
	access-list-number	(Optional) Number of the IP access list to display.
	access-list-number-expanded-range	(Optional) Expanded range of the IP access list to display.
	access-list-name	(Optional) Name of the IP access list to display.
	dynamic *dynamic-access-list-name*	(Optional) Displays the specified dynamic IP access lists.
	interface *name number*	(Optional) Displays the access list for the specified interface.
	in	(Optional) Displays input interface statistics.
	out	(Optional) Displays output interface statistics.

✎

Note Statistics for OGACL is not supported

Command Default All standard and expanded IP access lists are displayed.

Command Modes User EXEC (>)

Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines The **show ip access-lists** command provides output identical to the **show access-lists** command, except that it is IP-specific and allows you to specify a particular access list.

The output of the **show ip access-lists interface** command does not display dACL or ACL filter IDs. This is because the ACLs are attached to the virtual ports created by multidomain authentication for each authentication session; instead of the physical interface. To display dACL or ACL filter IDs, use the **show ip access-lists** *access-list-name* command. The *access-list-name* should be taken from the **show access-session interface** *interface-name* **detail** command output. The *access-list-name* is case sensitive.

Examples The following is a sample output from the **show ip access-lists** command when all access lists are requested:

```
Device# show ip access-lists

Extended IP access list 101
   deny udp any any eq nntp
   permit tcp any any
   permit udp any any eq tftp
   permit icmp any any
   permit udp any any eq domain
Role-based IP access list r1
    10 permit tcp dst eq telnet
    20 permit udp
FQDN IP access list facl
    10 permit ip host 10.1.1.1 host dynamic www.google.com
    20 permit tcp 10.10.0.0 0.255.255.255 eq ftp host dynamic www.cisco.com log
    30 permit udp host dynamic www.youtube.com any
    40 permit ip 10.3.4.0 0.0.0.255 any
Extended Resolved IP access list facl
    200000 permit tcp 10.0.0.0 0.255.255.255 eq ftp host 10.10.10.1 log
    200001 permit tcp 10.0.0.0 0.255.255.255 eq ftp host 10.10.10.2 log
    300000 permit udp host dynamic 10.11.11.11 any
    300001 permit udp host dynamic 10.11.11.12 any
    400000 permit ip 10.3.4.0 0.0.0.255 any
```

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

Table 12: show ip access-lists Field Descriptions

Field	Description
Extended IP access list	Extended IP access-list name/number.
Role-based IP access list	Role-based IP access-list name.
FQDN IP access list	FQDN IP access-list name.
Extended Resolved IP access list	Extended resolved IP access-list name.
deny	Packets to reject.
udp	User Datagram Protocol.
any	Source host or destination host.
eq	Packets on a given port number.
nntp	Network News Transport Protocol.
permit	Packets to forward.
dynamic	Dynamically resolves domain name.
tcp	Transmission Control Protocol.
tftp	Trivial File Transfer Protocol.
icmp	Internet Control Message Protocol.
domain	Domain name service.

The following is a sample output from the **show ip access-lists** command when the name of a specific access list is requested:

```
Device# show ip access-lists Internetfilter

Extended IP access list Internetfilter
   permit tcp any 192.0.2.0 255.255.255.255 eq telnet
   deny tcp any any
   deny udp any 192.0.2.0 255.255.255.255 lt 1024
   deny ip any any log
```

The following is a sample output from the **show ip access-lists** command using the **dynamic** keyword:

```
Device# show ip access-lists dynamic CM_SF#1

Extended IP access list CM_SF#1
    10 permit udp any any eq 5060 (650 matches)
    20 permit tcp any any eq 5060
    30 permit udp any any dscp ef (806184 matches)
```

Related Commands

Command	Description
deny	Sets conditions in a named IP access list or OGACL that will deny packets.
ip access-group	Applies an ACL or OGACL to an interface or a service policy map.
ip access-list	Defines an IP access list or OGACL by name or number.
object-group network	Defines network object groups for use in OGACLs.
object-group service	Defines service object groups for use in OGACLs.
permit	Sets conditions in a named IP access list or OGACL that will permit packets.
show object-group	Displays information about object groups that are configured.
show run interfaces cable	Displays statistics on the cable modem.

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 or privileged EXEC mode.

show ip dhcp snooping statistics [**detail**]

Syntax Description	**detail** (Optional) Displays detailed statistics information.

Command Modes   User EXEC (>)

Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines   In a device stack, all statistics are generated on the stack's active switch. If a new active device is elected, the statistics counters reset.

The following is sample 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
```

The following is sample 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 13: 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 **no ip dhcp snooping information option allow-untrusted** 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 **ip dhcp snooping verify mac-address** 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 device 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.

DHCP Snooping Statistic	Description
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 platform software dns-umbrella statistics

To display the Domain Name Syatem (DNS) umbrella statistics of a device, use the **show platform software dns-umbrella statistics** command in privileged EXEC mode.

show platform software dns-umbrella statistics

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC (>)

Command History

Release	Modification
Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Examples

The following is a sample output of the **show platform software dns-umbrella statistics** command:

```
Device> enable
Device# show platform software dns-umbrella statistics

=======================================
Umbrella Statistics
=======================================
Total Packets : 7848
DNSCrypt queries : 3940
DNSCrypt responses : 0
DNS queries : 0
DNS bypassed queries(Regex) : 0
DNS responses(Umbrella) : 0
DNS responses(Other) : 3906
Aged queries : 34
Dropped pkts : 0
```

show platform software umbrella switch F0

To display umbrella configuration of Embedded Service Processor (ESP) slot 0, use the **show platform software umbrella switch** {*switch_number* | **active** | **standby**} **F0** command in privileged EXEC mode.

show platform software umbrella switch {*switch_number* | **active** | **standby**} **F0** {**config** | **interface-info** | **local-domain**}

Syntax Description	switch {*switch_number* | **active** | **standby**}	Specifies the switch.
		• *switch_number*: ID of the switch. The range is from 1 to 8.
		• **active**: Specifies the active switch.
		• **standby**: Specifies the standby switch.
	config	Displays global configurations of ESP slot 0.
	interface-info	Displays interface-related configuration of ESP slot 0.
	local-domain	Displays local domain-related configuration of ESP slot 0.

Command Modes	Privileged EXEC (>)

Command History	Release	Modification
	Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Examples

The following is a sample output of the **show platform software umbrella switch active F0 config** command:

```
Device> show platform software umbrella switch active F0 config

+++ Umbrella Config +++


Umbrella feature:
------------------
Init: Enabled
Dnscrypt: disabled

Timeout:
------------------
udp timeout: 5

OrgId :
------------------
orgid : 2427270

Resolver config:

RESOLVER IP's
--------------------
```

```
 208.67.220.220
 208.67.222.222
 2620:119:35::35
 2620:119:53::53

Dnscrypt Info:

public_key:
magic_key:
serial number:

ProfileID   DeviceID          Mode        Resolver  Local-Domain   Tag
-----------------------------------------------------------------------------
```

show radius server-group

To display properties for the RADIUS server group, use the **show radius server-group** command in user EXEC or privileged EXEC mode.

show radius server-group {*name* | **all**}

Syntax Description	*name* Name of the server group. The character string used to name the group of servers must be defined using **the aaa group server radius** command.
	all Displays properties for all of the server groups.

Command Modes

User EXEC (>)

Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines

Use the **show radius server-group** command to display the server groups that you defined by using the **aaa group server radius** command.

The following is sample 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 14: 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.

Field	Description
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".
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 tech-support acl

To display access control list (ACL)-related information for technical support, use the **show tech-support acl** command in privileged EXEC mode.

show tech-support acl

Syntax Description	This command has no arguments or keywords.
Command Modes	Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Gibraltar 16.10.1	This command was introduced.
Cisco IOS XE Gibraltar 16.11.1	

Usage Guidelines The output of the **show tech-support acl** command is very long. To better manage this output, you can redirect the output to an external file (for example, **show tech-support acl | redirect flash:***show_tech_acl.txt*) in the local writable storage file system or remote file system.

The output of this command displays the following commands:

✎

Note On stackable platforms, these commands are executed on every switch in the stack. On modular platforms, like Catalyst 9400 Series Switches, these commands are run only on the active switch.

✎

Note The following list of commands is a sample of the commands available in the output; these may differ based on the platform.

- **show clock**
- **show version**
- **show running-config**
- **show module**
- **show interface**
- **show access-lists**
- **show logging**
- **show platform software fed switch** *switch-number* **acl counters hardware**
- **show platform software fed switch** *switch-number* **ifm mapping**
- **show platform hardware fed switch** *switch-number* **fwd-asic drops exceptions**
- **show platform software fed switch** *switch-number* **acl info**

- **show platform software fed switch** *switch-number* **acl**

- **show platform software fed switch** *switch-number* **acl usage**

- **show platform software fed switch** *switch-number* **acl policy intftype all cam**

- **show platform software fed switch** *switch-number* **acl cam brief**

- **show platform software fed switch** *switch-number* **acl policy intftype all vcu**

- **show platform hardware fed switch** *switch-number* **acl resource usage**

- **show platform hardware fed switch** *switch-number* **fwd-asic resource tcam table acl**

- **show platform hardware fed switch** *switch-number* **fwd-asic resource tcam utilization**

- **show platform software fed switch** *switch-number* **acl counters hardware**

- **show platform software classification switch** *switch-number* **all F0 class-group-manager class-group**

- **show platform software process database forwarding-manager switch** *switch-number* **R0 summary**

- **show platform software process database forwarding-manager switch** *switch-number* **F0 summary**

- **show platform software object-manager switch** *switch-number* **F0 pending-ack-update**

- **show platform software object-manager switch** *switch-number* **F0 pending-issue-update**

- **show platform software object-manager switch** *switch-number* **F0 error-object**

- **show platform software peer forwarding-manager switch** *switch-number* **F0**

- **show platform software access-list switch** *switch-number* **f0 statistics**

- **show platform software access-list switch** *switch-number* **r0 statistics**

- **show platform software trace message fed switch** *switch-number*

- **show platform software trace message forwarding-manager switch** *switch-number* **F0**

- **show platform software trace message forwarding-manager switch R0** *switch-number* **R0**

Examples

The following is sample output from the **show tech-support acl** command:

```
Device# show tech-support acl

.
.
.
------------------ show platform software fed switch 1 acl cam brief ------------------

Printing entries for region ACL_CONTROL (143) type 6 asic 0
================================================
TAQ-4 Index-0 (A:0,C:0) Valid StartF-1 StartA-1 SkipF-0 SkipA-0
Output IPv4 VACL

 VCU Result: Not In-Use

 L3 Length: 0000, L3 Protocol: 17 (UDP), L3 Tos: 00

 Source Address/Mask
 0.0.0.0/0.0.0.0
```

```
Destination Address/Mask
0.0.0.0/0.0.0.0

Router MAC: Disabled, Not First Fragment: Disabled, Small Offset: Disabled

L4 Source Port/Mask    L4 Destination Port/Mask
0x0044 (68)/0xffff     0x0043 (67)/0xffff

TCP Flags: 0x00 ( NOT SET )

ACTIONS:  Forward L3, Forward L2, Logging Disabled
ACL Priority: 2 (15 is Highest Priority)

-----------------------------------------
TAQ-4 Index-1 (A:0,C:0) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Output IPv4 VACL

VCU Result: Not In-Use

L3 Length: 0000, L3 Protocol: 17 (UDP), L3 Tos: 00

Source Address/Mask
0.0.0.0/0.0.0.0
Destination Address/Mask
0.0.0.0/0.0.0.0

Router MAC: Disabled, Not First Fragment: Disabled, Small Offset: Disabled

L4 Source Port/Mask    L4 Destination Port/Mask
0x0043 (67)/0xffff     0x0044 (68)/0xffff

TCP Flags: 0x00 ( NOT SET )

ACTIONS:  Forward L3, Forward L2, Logging Disabled
ACL Priority: 2 (15 is Highest Priority)

-----------------------------------------
TAQ-4 Index-2 (A:0,C:0) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Output IPv4 VACL

VCU Result: Not In-Use

L3 Length: 0000, L3 Protocol: 17 (UDP), L3 Tos: 00

Source Address/Mask
0.0.0.0/0.0.0.0
Destination Address/Mask
0.0.0.0/0.0.0.0

Router MAC: Disabled, Not First Fragment: Disabled, Small Offset: Disabled

L4 Source Port/Mask    L4 Destination Port/Mask
0x0043 (67)/0xffff     0x0043 (67)/0xffff

TCP Flags: 0x00 ( NOT SET )

ACTIONS:  Forward L3, Forward L2, Logging Disabled
ACL Priority: 2 (15 is Highest Priority)

-----------------------------------------
TAQ-4 Index-3 (A:0,C:0) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Input IPv4 PACL

VCU Result: Not In-Use
```

```
L3 Length: 0000, L3 Protocol: 00 (HOPOPT), L3 Tos: 00

Source Address/Mask
0.0.0.0/0.0.0.0
Destination Address/Mask
0.0.0.0/0.0.0.0

Router MAC: Disabled, Not First Fragment: Disabled, Small Offset: Disabled

L4 Source Port/Mask    L4 Destination Port/Mask
0x0000 (0)/0x0000      0x0000 (0)/0x0000

TCP Flags: 0x00 ( NOT SET )

ACTIONS:  Drop L3, Drop L2, Logging Disabled
ACL Priority: 2 (15 is Highest Priority)

-----------------------------------------
TAQ-4 Index-4 (A:0,C:0) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Output IPv4 PACL

VCU Result: Not In-Use

L3 Length: 0000, L3 Protocol: 00 (HOPOPT), L3 Tos: 00

Source Address/Mask
0.0.0.0/0.0.0.0
Destination Address/Mask
0.0.0.0/0.0.0.0

Router MAC: Disabled, Not First Fragment: Disabled, Small Offset: Disabled

L4 Source Port/Mask    L4 Destination Port/Mask
0x0000 (0)/0x0000      0x0000 (0)/0x0000

TCP Flags: 0x00 ( NOT SET )

ACTIONS:  Drop L3, Drop L2, Logging Disabled
ACL Priority: 2 (15 is Highest Priority)

-----------------------------------------
TAQ-4 Index-5 (A:0,C:0) Valid StartF-0 StartA-0 SkipF-0 SkipA-0
Output MAC PACL

VLAN ID/MASK : 0x000 (000)/0x000

Source MAC/Mask : 0000.0000.0000/0000.0000.0000

Destination MAC/Mask : 0000.0000.0000/0000.0000.0000

isSnap: Disabled, isLLC: Disabled

ACTIONS:  Drop L3, Drop L2, Logging Disabled
ACL Priority: 2 (15 is Highest Priority)

.
.
.
```

Output fields are self-explanatory.

show tech-support identity

To display identity/802.1x-related information for technical support, use the **show tech-support identity** command in privileged EXEC mode.

show tech-support identity mac *mac-address* **interface** *interface-name*

Syntax Description	**mac** *mac-address* — Displays information about the client MAC address.
	interface *interface-name* — Displays information about the client interface.

Syntax Description

mac *mac-address*	Displays information about the client MAC address.
interface *interface-name*	Displays information about the client interface.

Command Modes   Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Gibraltar 16.10.1	This command was introduced.
Cisco IOS XE Gibraltar 16.11.1	

Usage Guidelines   The output of the **show tech-support platform** command is very long. To better manage this output, you can redirect the output to an external file (for example, **show tech-support identity mac** *mac-address* **interface** *interface-name* | **redirect flash:***filename*) in the local writable storage file system or remote file system.

The output of this command displays the following commands:

- **show clock**
- **show module**
- **show version**
- **show switch**
- **show redundancy**
- **show dot1x statistics**
- **show ip access-lists**
- **show interface**
- **show ip interface brief**
- **show vlan brief**
- **show running-config**
- **show logging**
- **show interface controller**
- **show platform authentication sbinfo interface**

- **show platform host-access-table**
- **show platform pm port-data**
- **show spanning-tree interface**
- **show access-session mac detail**
- **show platform authentication session mac**
- **show device-tracking database mac details**
- **show mac address-table address**
- **show access-session event-logging mac**
- **show authentication sessions mac details R0**
- **show ip admission cache R0**
- **show platform software wired-client R0**
- **show platform software wired-client F0**
- **show platform software process database forwarding-manager R0 summary**
- **show platform software process database forwarding-manager F0 summary**
- **show platform software object-manager F0 pending-ack-update**
- **show platform software object-manager F0 pending-issue-update**
- **show platform software object-manager F0 error-object**
- **show platform software peer forwarding-manager R0**
- **show platform software peer forwarding-manager F0**
- **show platform software VP R0 summary**
- **show platform software VP F0 summary**
- **show platform software fed punt cpuq**
- **show platform software fed punt cause summary**
- **show platform software fed inject cause summary**
- **show platform hardware fed fwd-asic drops exceptions**
- **show platform hardware fed fwd-asic resource tcam table acl**
- **show platform software fed acl counter hardware**
- **show platform software fed matm macTable**
- **show platform software fed ifm mappings**
- **show platform software trace message fed reverse**
- **show platform software trace message forwarding-manager R0 reverse**
- **show platform software trace message forwarding-manager F0 reverse**

- **show platform software trace message smd R0 reverse**

- **show authentication sessions mac details**

- **show platform software wired-client**

- **show platform software process database forwarding-manager summary**

- **show platform software object-manager pending-ack-update**

- **show platform software object-manager pending-issue-update**

- **show platform software object-manager error-object**

- **show platform software peer forwarding-manager**

- **show platform software VP summary**

- **show platform software trace message forwarding-manager reverse**

- **show ip admission cache**

- **show platform software trace message smd reverse**

- **show platform software fed punt cpuq**

- **show platform software fed punt cause summary**

- **show platform software fed inject cause summary**

- **show platform hardware fed fwd-asic drops exceptions**

- **show platform hardware fed fwd-asic resource tcam table acl**

- **show platform software fed acl counter hardware**

- **show platform software fed matm macTable**

- **show platform software fed ifm mappings**

- **show platform software trace message fed reverse**

Examples

The following is sample output from the **show tech-support identity** command:

```
Device# show tech-support identity mac 0000.0001.0003 interface gigabitethernet1/0/1

.
.
.
----------------- show platform software peer forwarding-manager R0  -----------------

IOSD Connection Information:

  MQIPC (reader) Connection State: Connected, Read-selected
    Connections: 1, Failures: 22
    3897 packet received (0 dropped), 466929 bytes
    Read attempts: 2352, Yields: 0
  BIPC Connection state: Connected, Ready
    Accepted: 1, Rejected: 0, Closed: 0, Backpressures: 0
    36 packets sent, 2808 bytes

SMD Connection Information:
```

```
  MQIPC (reader) Connection State: Connected, Read-selected
    Connections: 1, Failures: 30
    0 packet received (0 dropped), 0 bytes
    Read attempts: 1, Yields: 0
  MQIPC (writer) Connection State: Connected, Ready
    Connections: 1, Failures: 0, Backpressures: 0
    0 packet sent, 0 bytes

FP Peers Information:

  Slot: 0
    Peer state: connected
    OM ID: 0, Download attempts: 638
      Complete: 638, Yields: 0, Spurious: 0
      IPC Back-Pressure: 0, IPC-Log Back-Pressure: 0
    Back-Pressure asserted for IPC: 0, IPC-Log: 1
    Number of FP FMAN peer connection expected: 7
    Number of FP FMAN online msg received: 1
    IPC state: unknown

    Config IPC Context:
      State: Connected, Read-selected
      BIPC Handle: 0xdf3d48e8, BIPC FD: 36, Peer Context: 0xdf3e7158
      Tx Packets: 688, Messages: 2392, ACKs: 36
      Rx Packets: 37, Bytes: 2068

      IPC Log:
        Peer name: fman-log-bay0-peer0
        Flags: Recovery-Complete
        Send Seq: 36, Recv Seq: 36, Msgs Sent: 0, Msgs Recovered: 0

    Upstream FMRP IPC Context:
      State: Connected, Read-selected
      BIPC Handle: 0xdf3e7308, BIPC FD: 37, Peer Context: 0xdf3e7158
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 0, Bytes: 0

    Upstream FMRP-IOSd IPC Context:
      State: Connected, Read-selected
      BIPC Handle: 0xdf3f9c38, BIPC FD: 38, Peer Context: 0xdf3e7158
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 37, Bytes: 2864
      Rx ACK Requests: 1, Tx ACK Responses: 1

    Upstream FMRP-SMD IPC Context:
      State: Connected, Read-selected
      BIPC Handle: 0xdf40c568, BIPC FD: 39, Peer Context: 0xdf3e7158
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 0, Bytes: 0
      Rx ACK Requests: 0, Tx ACK Responses: 0

    Upstream FMRP-WNCD_0 IPC Context:
      State: Connected
      BIPC Handle: 0xdf4317c8, BIPC FD: 41, Peer Context: 0xdf3e7158
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 0, Bytes: 0
      Rx ACK Requests: 0, Tx ACK Responses: 0

    Upstream FMRP-WNCMGRD IPC Context:
      State: Connected
      BIPC Handle: 0xdf41ee98, BIPC FD: 40, Peer Context: 0xdf3e7158
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 0, Bytes: 0
```

```
        Rx ACK Requests: 0, Tx ACK Responses: 0

    Upstream FMRP-MOBILITYD IPC Context:
      State: Connected
      BIPC Handle: 0xdf4440f8, BIPC FD: 42, Peer Context: 0xdf3e7158
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 0, Bytes: 0
      Rx ACK Requests: 0, Tx ACK Responses: 0

Slot: 1
Peer state: connected
  OM ID: 1, Download attempts: 1
    Complete: 1, Yields: 0, Spurious: 0
    IPC Back-Pressure: 0, IPC-Log Back-Pressure: 0
  Back-Pressure asserted for IPC: 0, IPC-Log: 0
  Number of FP FMAN peer connection expected: 7
  Number of FP FMAN online msg received: 1
  IPC state: unknown

  Config IPC Context:
    State: Connected, Read-selected
    BIPC Handle: 0xdf45e4d8, BIPC FD: 48, Peer Context: 0xdf470e18
    Tx Packets: 20, Messages: 704, ACKs: 1
    Rx Packets: 2, Bytes: 108

    IPC Log:
      Peer name: fman-log-bay0-peer1
      Flags: Recovery-Complete
      Send Seq: 1, Recv Seq: 1, Msgs Sent: 0, Msgs Recovered: 0

  Upstream FMRP IPC Context:
    State: Connected, Read-selected
    BIPC Handle: 0xdf470fc8, BIPC FD: 49, Peer Context: 0xdf470e18
    TX Packets: 0, Bytes: 0, Drops: 0
    Rx Packets: 0, Bytes: 0

  Upstream FMRP-IOSd IPC Context:
    State: Connected, Read-selected
    BIPC Handle: 0xdf4838f8, BIPC FD: 50, Peer Context: 0xdf470e18
    TX Packets: 0, Bytes: 0, Drops: 0
    Rx Packets: 0, Bytes: 0
    Rx ACK Requests: 0, Tx ACK Responses: 0

  Upstream FMRP-SMD IPC Context:
    State: Connected, Read-selected
    BIPC Handle: 0xdf496228, BIPC FD: 51, Peer Context: 0xdf470e18
    TX Packets: 0, Bytes: 0, Drops: 0
    Rx Packets: 0, Bytes: 0
    Rx ACK Requests: 0, Tx ACK Responses: 0

  Upstream FMRP-WNCD_0 IPC Context:
    State: Connected
    BIPC Handle: 0xdf4bb488, BIPC FD: 53, Peer Context: 0xdf470e18
    TX Packets: 0, Bytes: 0, Drops: 0
    Rx Packets: 0, Bytes: 0
    Rx ACK Requests: 0, Tx ACK Responses: 0

  Upstream FMRP-WNCMGRD IPC Context:
    State: Connected
    BIPC Handle: 0xdf4a8b58, BIPC FD: 52, Peer Context: 0xdf470e18
    TX Packets: 0, Bytes: 0, Drops: 0
    Rx Packets: 0, Bytes: 0
    Rx ACK Requests: 0, Tx ACK Responses: 0
```

```
         Upstream FMRP-MOBILITYD IPC Context:
           State: Connected
           BIPC Handle: 0xdf4cddb8, BIPC FD: 54, Peer Context: 0xdf470e18
           TX Packets: 0, Bytes: 0, Drops: 0
           Rx Packets: 0, Bytes: 0
           Rx ACK Requests: 0, Tx ACK Responses: 0




----------------- show platform software peer forwarding-manager R0  -----------------

IOSD Connection Information:

  MQIPC (reader) Connection State: Connected, Read-selected
    Connections: 1, Failures: 22
    3897 packet received (0 dropped), 466929 bytes
    Read attempts: 2352, Yields: 0
  BIPC Connection state: Connected, Ready
    Accepted: 1, Rejected: 0, Closed: 0, Backpressures: 0
    36 packets sent, 2808 bytes

SMD Connection Information:

  MQIPC (reader) Connection State: Connected, Read-selected
    Connections: 1, Failures: 30
    0 packet received (0 dropped), 0 bytes
    Read attempts: 1, Yields: 0
  MQIPC (writer) Connection State: Connected, Ready
    Connections: 1, Failures: 0, Backpressures: 0
    0 packet sent, 0 bytes

FP Peers Information:

  Slot: 0
    Peer state: connected
    OM ID: 0, Download attempts: 638
      Complete: 638, Yields: 0, Spurious: 0
      IPC Back-Pressure: 0, IPC-Log Back-Pressure: 0
    Back-Pressure asserted for IPC: 0, IPC-Log: 1
    Number of FP FMAN peer connection expected: 7
    Number of FP FMAN online msg received: 1
    IPC state: unknown

    Config IPC Context:
      State: Connected, Read-selected
      BIPC Handle: 0xdf3d48e8, BIPC FD: 36, Peer Context: 0xdf3e7158
      Tx Packets: 688, Messages: 2392, ACKs: 36
      Rx Packets: 37, Bytes: 2068

      IPC Log:
        Peer name: fman-log-bay0-peer0
        Flags: Recovery-Complete
        Send Seq: 36, Recv Seq: 36, Msgs Sent: 0, Msgs Recovered: 0

    Upstream FMRP IPC Context:
      State: Connected, Read-selected
      BIPC Handle: 0xdf3e7308, BIPC FD: 37, Peer Context: 0xdf3e7158
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 0, Bytes: 0

    Upstream FMRP-IOSd IPC Context:
      State: Connected, Read-selected
      BIPC Handle: 0xdf3f9c38, BIPC FD: 38, Peer Context: 0xdf3e7158
```

```
                    TX Packets: 0, Bytes: 0, Drops: 0
                    Rx Packets: 37, Bytes: 2864
                    Rx ACK Requests: 1, Tx ACK Responses: 1

                Upstream FMRP-SMD IPC Context:
                    State: Connected, Read-selected
                    BIPC Handle: 0xdf40c568, BIPC FD: 39, Peer Context: 0xdf3e7158
                    TX Packets: 0, Bytes: 0, Drops: 0
                    Rx Packets: 0, Bytes: 0
                    Rx ACK Requests: 0, Tx ACK Responses: 0

                Upstream FMRP-WNCD_0 IPC Context:
                    State: Connected
                    BIPC Handle: 0xdf4317c8, BIPC FD: 41, Peer Context: 0xdf3e7158
                    TX Packets: 0, Bytes: 0, Drops: 0
                    Rx Packets: 0, Bytes: 0
                    Rx ACK Requests: 0, Tx ACK Responses: 0

                Upstream FMRP-WNCMGRD IPC Context:
                    State: Connected
                    BIPC Handle: 0xdf41ee98, BIPC FD: 40, Peer Context: 0xdf3e7158
                    TX Packets: 0, Bytes: 0, Drops: 0
                    Rx Packets: 0, Bytes: 0
                    Rx ACK Requests: 0, Tx ACK Responses: 0

                Upstream FMRP-MOBILITYD IPC Context:
                    State: Connected
                    BIPC Handle: 0xdf4440f8, BIPC FD: 42, Peer Context: 0xdf3e7158
                    TX Packets: 0, Bytes: 0, Drops: 0
                    Rx Packets: 0, Bytes: 0
                    Rx ACK Requests: 0, Tx ACK Responses: 0

            Slot: 1
            Peer state: connected
                OM ID: 1, Download attempts: 1
                    Complete: 1, Yields: 0, Spurious: 0
                    IPC Back-Pressure: 0, IPC-Log Back-Pressure: 0
                Back-Pressure asserted for IPC: 0, IPC-Log: 0
                Number of FP FMAN peer connection expected: 7
                Number of FP FMAN online msg received: 1
                IPC state: unknown

                Config IPC Context:
                    State: Connected, Read-selected
                    BIPC Handle: 0xdf45e4d8, BIPC FD: 48, Peer Context: 0xdf470e18
                    Tx Packets: 20, Messages: 704, ACKs: 1
                    Rx Packets: 2, Bytes: 108

                    IPC Log:
                        Peer name: fman-log-bay0-peer1
                        Flags: Recovery-Complete
                        Send Seq: 1, Recv Seq: 1, Msgs Sent: 0, Msgs Recovered: 0

                Upstream FMRP IPC Context:
                    State: Connected, Read-selected
                    BIPC Handle: 0xdf470fc8, BIPC FD: 49, Peer Context: 0xdf470e18
                    TX Packets: 0, Bytes: 0, Drops: 0
                    Rx Packets: 0, Bytes: 0

                Upstream FMRP-IOSd IPC Context:
                    State: Connected, Read-selected
                    BIPC Handle: 0xdf4838f8, BIPC FD: 50, Peer Context: 0xdf470e18
                    TX Packets: 0, Bytes: 0, Drops: 0
                    Rx Packets: 0, Bytes: 0
```

```
      Rx ACK Requests: 0, Tx ACK Responses: 0

    Upstream FMRP-SMD IPC Context:
      State: Connected, Read-selected
      BIPC Handle: 0xdf496228, BIPC FD: 51, Peer Context: 0xdf470e18
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 0, Bytes: 0
      Rx ACK Requests: 0, Tx ACK Responses: 0

    Upstream FMRP-WNCD_0 IPC Context:
      State: Connected
      BIPC Handle: 0xdf4bb488, BIPC FD: 53, Peer Context: 0xdf470e18
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 0, Bytes: 0
      Rx ACK Requests: 0, Tx ACK Responses: 0

    Upstream FMRP-WNCMGRD IPC Context:
      State: Connected
      BIPC Handle: 0xdf4a8b58, BIPC FD: 52, Peer Context: 0xdf470e18
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 0, Bytes: 0
      Rx ACK Requests: 0, Tx ACK Responses: 0

    Upstream FMRP-MOBILITYD IPC Context:
      State: Connected
      BIPC Handle: 0xdf4cddb8, BIPC FD: 54, Peer Context: 0xdf470e18
      TX Packets: 0, Bytes: 0, Drops: 0
      Rx Packets: 0, Bytes: 0
      Rx ACK Requests: 0, Tx ACK Responses: 0




----------------- show platform software VP R0 summary ------------------


Forwarding Manager Vlan Port Information

  Vlan    Intf-ID   Stp-state
  ------------------------------------------------------------------------
  1       7         Forwarding
  1       9         Forwarding
  1       17        Forwarding
  1       27        Forwarding
  1       28        Forwarding
  1       29        Forwarding
  1       30        Forwarding
  1       31        Forwarding
  1       40        Forwarding
  1       41        Forwarding


Forwarding Manager Vlan Port Information

  Vlan    Intf-ID   Stp-state
  ------------------------------------------------------------------------
  1       49        Forwarding
  1       51        Forwarding
  1       63        Forwarding
  1       72        Forwarding
  1       73        Forwarding
  1       74        Forwarding
```

```
------------------ show platform software VP R0 summary ------------------


Forwarding Manager Vlan Port Information

   Vlan    Intf-ID   Stp-state
   --------------------------------------------------------------------------
   1       7         Forwarding
   1       9         Forwarding
   1       17        Forwarding
   1       27        Forwarding
   1       28        Forwarding
   1       29        Forwarding
   1       30        Forwarding
   1       31        Forwarding
   1       40        Forwarding
   1       41        Forwarding


Forwarding Manager Vlan Port Information

   Vlan    Intf-ID   Stp-state
   --------------------------------------------------------------------------
   1       49        Forwarding
   1       51        Forwarding
   1       63        Forwarding
   1       72        Forwarding
   1       73        Forwarding
   1       74        Forwarding
.
.
.
```

show umbrella

To display the Cisco Umbrella Integration feature-related configuration, use the **show umbrella** command in user EXEC or privileged EXEC mode.

show umbrella {**config** | **deviceid** [**detailed**] | **dnscrypt**}

Syntax Description		
	config	Displays global configurations of the device.
	deviceid	Displays device registration details.
	dnscrypt	Displays DNSCrypt-related configurations.

Command Modes

User EXEC (>)

Privileged EXEC (>)

Command History	**Release**	**Modification**
	Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Examples

The following is a sample output of the **show umbrella config** command:

```
Device> show umbrella config

Umbrella Configuration
=========================
  Token: 0C6ED7E376DD4D2E04492CE7EDFF1A7C00250986
  API-KEY: NONE
  OrganizationID: 2427270
  Local Domain Regex parameter-map name: NONE
  DNSCrypt: Enabled
 Public-key: B735:1140:206F:225D:3E2B:D822:D7FD:691E:A1C3:3CC8:D666:8D0C:BE04:BFAB:CA43:FB79

  UDP Timeout: 5 seconds
  Resolver address:
      1. 208.67.220.220
      2. 208.67.222.222
      3. 2620:119:53::53
      4. 2620:119:35::35
Umbrella Interface Config:
      Number of interfaces with "umbrella out" config: 1
        1. GigabitEthernet1/0/48
            Mode      :  OUT
            VRF       :  global(Id: 0)
      Number of interfaces with "umbrella in" config: 1
        1. GigabitEthernet1/0/1
            Mode      :  IN
            DCA       :  Disabled
            Tag       :  test
            Device-id :  010a2c41b8ab019c
            VRF       :  global(Id: 0)

  Configured Umbrella Parameter-maps:
```

```
       1. global
```

The following is a sample output of the **show umbrella deviceid detailed** command:

```
Device> show umbrella deviceid detailed

Device registration details
 1.GigabitEthernet1/0/2
      Tag             : guest
      Device-id       : 010a6aef0b443f0f
      Description     : Device Id received successfully
      WAN interface   : GigabitEthernet1/0/1
      WAN VRF used    : global(Id: 0)
```

The following is a sample output of the **show umbrella dnscrypt** command:

```
Device> show umbrella dnscrypt

DNSCrypt: Enabled
Public-key: B735:1140:206F:225D:3E2B:D822:D7FD:691E:A1C3:3CC8:D666:8D0C:BE04:BFAB:CA43:FB79
Certificate Update Status:
Last Successful Attempt : 10:55:40 UTC Apr 14 2016
Last Failed Attempt : 10:55:10 UTC Apr 14 2016
Certificate Details:
Certificate Magic : DNSC
Major Version : 0x0001
Minor Version : 0x0000
Query Magic : 0x717744506545635A
Serial Number : 1435874751
Start Time : 1435874751 (22:05:51 UTC Jul 2 2015)
End Time : 1467410751 (22:05:51 UTC Jul 1 2016)
Server Public Key :
ABA1:F000:D394:8045:672D:73E0:EAE6:F181:19D0:2A62:3791:EFAD:B04E:40B7:B6F9:C40B
Client Secret Key Hash :
BBC3:409F:5CB5:C3F3:06BD:A385:78DA:4CED:62BC:3985:1C41:BCCE:1342:DF13:B71E:F4CF
Client Public key :
ECE2:8295:2157:6797:6BE2:C563:A5A9:C5FC:C20D:ADAF:EB3C:A1A2:C09A:40AD:CAEA:FF76
NM key Hash :
F9C2:2C2C:330A:1972:D484:4DD8:8E5C:71FF:6775:53A7:0344:5484:B78D:01B1:B938:E884
```

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*]

Syntax Description	*map-name* (Optional) Name of a specific VLAN access map.

Command Modes   Privileged EXEC (#)

Command History	**Release**	**Modification**
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

Examples   The following is sample output from the **show vlan access-map** command:

```
Device# show vlan access-map

Vlan access-map "vmap4"  10
  Match clauses:
    ip  address: al2
  Action:
    forward
Vlan access-map "vmap4"  20
  Match clauses:
    ip  address: al2
  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*}

Syntax Description		
access-map *name*	(Optional) Displays filtering information for the specified VLAN access map.	
vlan *vlan-id*	(Optional) Displays filtering information for the specified VLAN. The range is 1 to 4094.	

Command Modes   Privileged EXEC (#)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	This command was introduced.

Examples   The following is sample 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 Modes Privileged EXEC (#)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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.

Examples This example shows how to display the members of a specified VLAN group:

```
Device# show vlan group group-name group2
vlan group group1 :40-45
```

This example shows how to display number of users in each of the VLANs in a group:

```
Device# show vlan group group-name group2 user_count

  VLAN     : Count
-------------------
  40       : 5
  41       : 8
  42       : 12
  43       : 2
  44       : 9
  45       : 0
```

ssci-based-on-sci

To compute the Short Secure Channel Identifier (SSCI) value based on the Secure Channel Identifier (SCI) value, use the **ssci-based-on-sci** command in MKA-policy configuration mode. To disable SSCI computation based on SCI, use the **no** form of this command.

ssci-based-on-sci
no ssci-based-on-sci

Syntax Description   This command has no arguments or keywords.

Command Default   SSCI value computation based on SCI value is disabled.

Command Modes   MKA-policy configuration (config-mka-policy)

Command History

Release	Modification
Cisco IOS XE Gibraltar 16.12.3	This command was introduced.

Usage Guidelines   The higher the SCI value, the lower is the SSCI value.

Examples   The following example shows how to enable the SSCI computation based on SCI:

```
Device> enable
Device# configure terminal
Device(config)# mka policy 2
Device(config-mka-policy)# ssci-based-on-sci
```

Related Commands

Command	Description
mka policy	Configures an MKA policy.
confidentiality-offset	Sets the confidentiality offset for MACsec operations.
delay-protection	Configures MKA to use delay protection in sending MKPDU.
include-icv-indicator	Includes ICV indicator in MKPDU.
key-server	Configures MKA key-server options.
macsec-cipher-suite	Configures cipher suite for deriving SAK.
sak-rekey	Configures the SAK rekey interval.
send-secure-announcements	Configures MKA to send secure announcements in sending MKPDUs.
use-updated-eth-header	Uses the updated Ethernet header for ICV calculation.

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		
static	Enables aging for statically configured secure addresses on this port.
time *time*	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.
type	Sets the aging type.
absolute	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.
inactivity	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 (config-if)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# interface gigabitethernet1/0/1
Device(config-if)# switchport port-security aging time 120
```

```
Device(config-if)# end
```

This example sets the aging time as 2 minutes for inactivity aging type with aging enabled for configured secure addresses on the port:

```
Device> enable
Device# configure terminal
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
Device(config-if)# end
```

This example shows how to disable aging for configured secure addresses:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet1/0/2
Device(config-if)# no switchport port-security aging static
Device(config-if)# end
```

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 (config-if)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	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 device 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** command.

This example shows how to configure a secure MAC address and a VLAN ID on a port:

```
Device> enable
Device# configure terminal
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
Device(config-if)# end
```

This example shows how to enable sticky learning and to enter two sticky secure MAC addresses on a port:

```
Device> enable
Device# configure terminal
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
Device(config-if)# end
```

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		
value	Sets the maximum number of secure MAC addresses for the interface. The default setting is 1.	
vlan	(Optional) For trunk ports, sets the maximum number of secure MAC addresses on a VLAN or range of VLANs. If the **vlan** keyword is not entered, the default value is used.	
vlan-list	(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.	
access	(Optional) On an access port only, specifies the VLAN as an access 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.

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 (config-if

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	This command was introduced.

Usage Guidelines

The maximum number of secure MAC addresses that you can configure on a device 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 Fast EtherChannel or Gigabit EtherChannel 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** 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> enable
Device# configure terminal
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
Device(config-if)# end
```

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		
protect	Sets the security violation protect mode.	
restrict	Sets the security violation restrict mode.	
shutdown	Sets the security violation shutdown mode.	
shutdown vlan	Sets the security violation mode to per-VLAN shutdown.	

Command Default   The default violation mode is **shutdown**.

Command Modes   Interface configuration (config-if)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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 Fast EtherChannel or Gigabit EtherChannel 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 shows how to configure a port to shut down only the VLAN if a MAC security violation occurs:

```
Device> enable
Device# configure terminal
Device(config)# interface gigabitethernet2/0/2
Device(config)# switchport port-security violation shutdown vlan
Device(config)# exit
```

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

Syntax Description

| *name* | Name of the private TACACS+ server host. |

Command Default No TACACS+ server is configured.

Command Modes

Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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> enable
Device# configure terminal
Device(config)# tacacs server server1
Device(config-server-tacacs)# end
```

Related Commands

Command	Description
address ipv6 (TACACS+)	Configures the IPv6 address of the TACACS+ server.
key (TACACS+)	Configures the per-server encryption key on the TACACS+ server.
port (TACACS+)	Specifies the TCP port to be used for TACACS+ connections.
send-nat-address (TACACS+)	Sends a client's post-NAT address to the TACACS+ server.
single-connection (TACACS+)	Enables all TACACS packets to be sent to the same server using a single TCP connection.
timeout(TACACS+)	Configures the time to wait for a reply from the specified TACACS server.

tls

To configure Transport Layer Security (TLS) parameters, use the **tls** command in radius server configuration mode. To return to the default setting, use the **no** form of this command.

tls [**connectiontimeout** *connection-timeout-value* | **idletimeout** *idle-timeout-value* | [**ip** | **ipv6**] { **radius source-interface** *interface-name* | **vrf forwarding** *forwarding-table-name* } | **match-server-identity** { **email-address** *email-address* | **hostname** *hostname* | **ip-address** *ip-address* } | **port** *port-number* | **retries** *number-of-connection-retries* | **trustpoint** { **client** *trustpoint name* | **server** *trustpoint name* }]

no tls

Syntax Description		
connectiontimeout *connection-timeout-value*	(Optional) Configures the DTLS connection timeout value.
idletimeout *idle-timeout-value*	(Optional) Configures the DTLS idle timeout value.
[**ip** | **ipv6**] {**radius source-interface** *interface-name* | **vrf forwarding** *forwarding-table-name*}	(Optional) Configures IP or IPv6 source parameters.
match-server-identity {**email-address** *email-address* | **hostname** *host-name* | **ip-address** *ip-address*}	Configures RadSec certification validation parameters.
port *port-number*	(Optional) Configures the DTLS port number.
retries *number-of-connection-retries*	(Optional) Configures the number of DTLS connection retries.
trustpoint {**client** *trustpoint name* | **server** *trustpoint name*}	(Optional) Configures the DTLS trustpoint for the client and the server.

Command Default

- The default value of TLS connection timeout is 5 seconds.

- The default value of TLS idle timeout is 60 seconds.

- The default TLS port number is 2083.

- The default value of TLS connection retries is 5.

Command Modes　Radius server configuration mode (config-radius-server)

Command History

Release	Modification
Cisco IOS XE Bengaluru 17.4.1	This command was introduced.

Usage Guidelines　We recommended that you use the same server type, either only TLS or only Datagram Transport Layer Security (DTLS), under a authentication, authorization, and accounting (AAA) server group.

Examples　The following example shows how to configure the TLS idle timeout value to 5 seconds:

```
Device> enable
Device# configure terminal
Device(config)# radius server R1
Device(config-radius-server)# tls idletimeout 5
Device(config-radius-server)# end
```

Related Commands

Command	Description
show aaa servers	Displays information related to the TLS server.
clear aaa counters servers radius	Clears the RADIUS TLS-specific statistics.
debug radius radsec	Enables RADIUS TLS-specific debugs.

token (Parameter Map)

To configure the application programming interface (API) key used for authorization during device registration, use the **token** command in parameter-map type inspect configuration mode. To remove the unique identifier, use the **no** form of this command.

token *value*
no token

Syntax Description	*value*	The API token. You can obtain this from the Cisco Umbrella registration server.

Command Default	No token is created for the parameter map.

Command Modes	Parameter-map type inspect configuration (config-profile)

Command History	**Release**	**Modification**
	Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Usage Guidelines	The **token** command is a mandatory configuration for the **umbrella in** and **umbrella out** commands. To change an existing token to a new token, remove the **umbrella in** command and reconfigure it on the interface for policies of the new token to be applied.

Examples	The following example shows how to configure a Cisco Umbrella token:

```
Device> enable
Device# configure terminal
Device(config)# parameter-map type umbrella global
Device(config-profile)# token AADDD5FF6E510B28921A20C9B98EEEFF
```

Related Commands	**Command**	**Description**
	parameter-map type umbrella global	Configures a parameter-map type in umbrella mode.
	umbrella	Configures the Cisco Umbrella Connector on an interface.

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		
enable	Enables tracking.	
reachable-lifetime	(Optional) Specifies the maximum amount of time a reachable entry is considered to be directly or indirectly reachable without proof of reachability.	
	• The **reachable-lifetime** keyword can be used only with the **enable** keyword.	
	• Use of the **reachable-lifetime** keyword overrides the global reachable lifetime configured by the **ipv6 neighbor binding reachable-lifetime** command.	
value	Lifetime value, in seconds. The range is from 1 to 86400, and the default is 300.	
infinite	Keeps an entry in a reachable or stale state for an infinite amount of time.	
disable	Disables tracking.	
stale-lifetime	(Optional) Keeps the time entry in a stale state, which overwrites the global stale-lifetime configuration.	
	• The stale lifetime is 86,400 seconds.	
	• The **stale-lifetime** keyword can be used only with the **disable** keyword.	
	• Use of the **stale-lifetime** keyword overrides the global stale lifetime configured by the **ipv6 neighbor binding stale-lifetime** command.	

Command Default   The time entry is kept in a reachable state.

Command Modes   IPv6 snooping configuration (config-ipv6-snooping)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	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 policy1and configures an entry to stay in the binding table for an infinite length of time on a trusted port:

```
Device> enable
Device# configure terminal
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# tracking disable stale-lifetime infinite
Device(config-ipv6-snooping)# end
```

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 (config-nd-inspection)
	IPv6 snooping configuration (config-ipv6-snooping)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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, and configures the port to be trusted:

```
Device> enable
Device# configure terminal
Device(config)# ipv6  nd inspection  policy1
Device(config-nd-inspection)# trusted-port
Device(config-nd-inspection)# end
```

This example shows how to define an IPv6 snooping policy name as policy1, and configures the port to be trusted:

```
Device> enable
Device# configure terminal
Device(config)# ipv6 snooping policy policy1
Device(config-ipv6-snooping)# trusted-port
Device(config-ipv6-snooping)# end
```

umbrella

To configure the Cisco Umbrella Connector on an interface, use the **umbrella** command in interface configuration mode. To remove this configuration, use the **no** form of this command.

umbrella {**in** *tag-name* | **out**}
no umbrella {**in** | **out**}

Syntax Description		
in		Configures the Cisco Umbrella Connector on an interface that is connected to a client.
tag-name		The interface tag name.
		The length should not exceed 49 characters.
out		Configures the Cisco Umbrella Connector on an interface that is used to reach the umbrella server.

Command Default	No default behavior or values.

Command Modes	Interface configuration (config-if)

Command History	Release	Modification
	Cisco IOS XE Amsterdam 17.1.1	This command was introduced.

Usage Guidelines   You should configure the **umbrella out** command before you configure the **umbrella in** command. Registration is successful only when port 443 is in Open state and allows traffic to pass through the existing firewall.

The **umbrella in** and **umbrella out** commands cannot be configured on the same interface.

Examples   The following example shows how to configure the Cisco Umbrella Connector on an interface:

```
Device> enable
Device# configure terminal
Device(config)# interface GigabitEthernet 1/0/1
Device(config-if)# umbrella out
Device(config-if)# exit
Device(config)# interface GigabitEthernet 1/0/2
Device(config-if)# umbrella in mydevice_tag
```

Related Commands	**Command**	**Description**
	show umbrella config	Displays the Cisco Umbrella Integration configurations of the device.

use-updated-eth-header

To enable interoperability between devices and any port on a device that includes the updated Ethernet header in MACsec Key Agreement Protocol Data Units (MKPDUs) for integrity check value (ICV) calculation, use the **ssci-based-on-sci** command in MKA-policy configuration mode. To disable the updated ethernet header in MKPDUs for ICV calculation, use the **no** form of this command.

use-updated-eth-header
no use-updated-eth-header

Syntax Description	This command has no arguments or keywords.
Command Default	The Ethernet header for ICV calculation is disabled.
Command Modes	MKA-policy configuration (config-mka-policy)

Command History

Release	Modification
Cisco IOS XE Gibraltar 16.12.1	This command was introduced.

Usage Guidelines   The updated Ethernet header is non-standard. Enabling this option ensures that an MACsec Key Agreement (MKA) session between the devices can be set up.

Examples   The following example shows how to enable the updated Ethernet header in MKPDUs for ICV calculation:

```
Device> enable
Device# configure terminal
Device(config)# mka policy 2
Device(config-mka-policy)# use-updated-eth-header
```

Related Commands

Command	Description
mka policy	Configures an MKA policy.
confidentiality-offset	Sets the confidentiality offset for MACsec operations.
delay-protection	Configures MKA to use delay protection in sending MKPDU.
include-icv-indicator	Includes ICV indicator in MKPDU.
key-server	Configures MKA key-server options.
macsec-cipher-suite	Configures cipher suite for deriving SAK.
sak-rekey	Configures the SAK rekey interval.
send-secure-announcements	Configures MKA to send secure announcements in sending MKPDUs.
ssci-based-on-sci	Computes SSCI based on the SCI.

username

To establish the username-based authentication system, use the **username** command in global configuration mode. To remove an established username-based authentication, use the **no** form of this command.

username *name* [**aaa attribute list** *aaa-list-name*]
username *name* [**access-class** *access-list-number*]
username *name* [**algorithm-type** {**md5** | **scrypt** | **sha256** }]
username *name* [**autocommand** *command*]
username *name* [**callback-dialstring** *telephone-number*]
username *name* [**callback-line** [**tty**]*line-number* [*ending-line-number*]]
username *name* [**callback-rotary** *rotary-group-number*]
username *name* [**common-criteria-policy** *policy-name*]
username *name* [**dnis**]
username *name* [**mac**]
username *name* [**nocallback-verify**]
username *name* [**noescape**]
username *name* [**nohangup**]
username *name* [**nopassword** | **password** *password* | **password** *encryption-type encrypted-password*]
username *name* [**one-time** {**password** {**0** | **6** | **7** |*password*} | **secret** {**0** | **5** | **8** | **9** |*password*}}]
username *name* [**password** *secret*]
username *name* [**privilege** *level*]
username *name* [**secret** {**0** | **5** |*password*}]
username *name* [**serial-number**]
username *name* [**user-maxlinks** *number*]
username *name* [**view** *view-name*]
no username *name*

Syntax Description		
name	Hostname, server name, user ID, or command name. The *name* argument can be only one word. Blank spaces and quotation marks are not allowed.	
aaa attribute list *aaa-list-name*	(Optional) Uses the specified authentication, authorization, and accounting (AAA) method list.	
access-class *access-list-number*	(Optional) Specifies an outgoing access list that overrides the access list specified in the **access-class** command that is available in line configuration mode. It is used for the duration of the user's session.	
algorithm-type	(Optional) Specifies the algorithm to use for hashing the plaintext secret for the user. • **md5**: Encodes the password using the MD5 algorithm. • **scrypt**: Encodes the password using the SCRYPT hashing algorithm. • **sha256**: Encodes the password using the PBKDF2 hashing algorithm.	

autocommand *command*	(Optional) Causes the specified **autocommand**command to be issued automatically after the user logs in. When the specified **autocommand** command is complete, the session is terminated. Because the command can be of any length and can contain embedded spaces, commands using the **autocommand** keyword must be the last option on the line.
callback-dialstring *telephone-number*	(Optional) Permits you to specify a telephone number to pass to the Data Circuit-terminating Equipment (DCE) device; for asynchronous callback only.
callback-line *line-number*	(Optional) Specifies relative number of the terminal line (or the first line in a contiguous group) on which you enable a specific username for callback; for asynchronous callback only. Numbering begins with zero.
ending-line-number	(Optional) Relative number of the last line in a contiguous group on which you want to enable a specific username for callback. If you omit the keyword (such as **tty**), then line number and ending line number are absolute rather than relative line numbers.
tty	(Optional) Specifies standard asynchronous line; for asynchronous callback only.
callback-rotary *rotary-group-number*	(Optional) Permits you to specify a rotary group number on which you want to enable a specific username for callback; for asynchronous callback only. The next available line in the rotary group is selected. Range: 1 to 100.
common-criteria-policy	(Optional) Specifies the name of the common criteria policy.
dnis	(Optional) Does not require a password when obtained through the Dialed Number Identification Service (DNIS).
mac	(Optional) Allows a MAC address to be used as the username for MAC filtering done locally.
nocallback-verify	(Optional) Specifies that authentication is not required for EXEC callback on the specified line.
noescape	(Optional) Prevents the user from using an escape character on the host to which that user is connected.
nohangup	(Optional) Prevents Cisco IOS software from disconnecting the user after an automatic command (set up with the **autocommand** keyword) is run. Instead, the user gets another user EXEC prompt.
nopassword	(Optional) No password is required for the user to log in. This is usually the most useful keyword to use in combination with the **autocommand** keyword.
password	(Optional) Specifies a password to access the *name* argument. The password must be from 1 to 25 characters, can contain embedded spaces, and must be the last option specified in the **username** command.
password	Password that the user enters.

encryption-type	Single-digit number that defines whether the text immediately following the **password** is encrypted, and if so, what type of encryption is used. Defined encryption types are 0, which means that the text immediately following the **password** is not encrypted, and 6 and 7, which means that the text is encrypted using a Cisco-defined encryption algorithm.
encrypted-password	Encrypted password that the user enters.
one-time	(Optional) Specifies that the username and password is valid for only one time. This configuration is used to prevent default credentials from remaining in user configurations. • **0**: Specifies that an unencrypted password or secret (depending on the configuration) follows. • **6**: Specifies that an encrypt password follows. • **7**: Specifies that a hidden password follows. • **5**: Specifies that a MD5 HASHED secret follows. • **8**: Specifies that a PBKDF2 HASHED secret follows. • **9**: Specifies that a SCRYPT HASHED secret follows.
secret	(Optional) Specifies a secret for the user.
secret	For Challenge Handshake Authentication Protocol (CHAP) authentication. Specifies the secret for the local device or the remote device. The secret is encrypted when it is stored on the local device. The secret can consist of any string of up to 11 ASCII characters. There is no limit to the number of username and password combinations that can be specified, allowing any number of remote devices to be authenticated.
privilege *privilege-level*	(Optional) Sets the privilege level for the user. Range: 1 to 15.
serial-number	(Optional) Specifies the serial number.
user-maxlinks *number*	(Optional) Specifies the maximum number of inbound links allowed for the user.
view *view-name*	(Optional) Associates a CLI view name, which is specified with the **parser view** command, with the local AAA database; for CLI view only.

Command Default No username-based authentication system is established.

Command Modes Global configuration (config)

Command History

Release	Modi
Cisco IOS XE Fuji 16.9.2	This c introd

Usage Guidelines The **username** command provides username or password authentication, or both, for login purposes only.

Multiple **username** commands can be used to specify options for a single user.

Add a username entry for each remote system with which the local device communicates, and from which it requires authentication. The remote device must have a username entry for the local device. This entry must have the same password as the local device's entry for that remote device.

This command can be useful for defining usernames that get special treatment. For example, you can use this command to define an *info* username that does not require a password, but connects the user to a general purpose information service.

The **username** command is required as part of the configuration for CHAP. Add a username entry for each remote system from which the local device requires authentication.

To enable the local device to respond to remote CHAP challenges, one **username** *name* entry must be the same as the **hostname** entry that has already been assigned to the other device. To avoid the situation of a privilege level 1 user entering into a higher privilege level, configure a per-user privilege level other than 1, for example, 0 or 2 through 15. Per-user privilege levels override virtual terminal privilege levels.

CLI and Lawful Intercept Views

Both CLI views and lawful intercept views restrict access to specified commands and configuration information. A lawful intercept view allows the user to secure access to lawful intercept commands that are held within the TAP-MIB, which is a special set of SNMP commands that store information about calls and users.

Users who are specified via the **lawful-intercept** keyword are placed in the lawful-intercept view by default if no other privilege level or view name is explicitly specified.

If no value is specified for the *secret* argument, and the **debug serial-interface** command is enabled, an error is displayed when a link is established and the CHAP challenge is not implemented. The CHAP debugging information is available using the **debug ppp negotiation**, **debug serial-interface**, and **debug serial-packet** commands.

Examples

The following example shows how to implement a service similar to the UNIX **who** command, which can be entered at the login prompt, and lists the current users of the device:

```
Device> enable
Device# configure terminal
Device(config)# username who nopassword nohangup autocommand show users
```

The following example shows how to implement an information service that does not require a password to be used:

```
Device> enable
Device# configure terminal
Device(config)# username info nopassword noescape autocommand telnet nic.ddn.mil
```

The following example shows how to implement an ID that works even if all the TACACS+ servers break:

```
Device> enable
Device# configure terminal
Device(config)# username superuser password superpassword
```

The following example shows how to enable CHAP on interface serial 0 of server_l. It also defines a password for a remote server named server_r.

```
hostname server_l
```

```
username server_r password theirsystem
interface serial 0
 encapsulation ppp
 ppp authentication chap
```

The following is a sample output from the **show running-config** command displaying the passwords that are encrypted:

```
hostname server_l
username server_r password 7 121F0A18
interface serial 0
 encapsulation ppp
 ppp authentication chap
```

The following example shows how a privilege level 1 user is denied access to privilege levels higher than 1:

```
Device> enable
Device# configure terminal
Device(config)# username user privilege 0 password 0 cisco
Device(config)# username user2 privilege 2 password 0 cisco
```

The following example shows how to remove username-based authentication for user2:

```
Device> enable
Device# configure terminal
Device(config)# no username user2
```

Related Commands

Command	Description
debug ppp negotiation	Displays PPP packets sent during PPP startup, where PPP op
debug serial-interface	Displays information about a serial connection failure.
debug serial-packet	Displays more detailed serial interface debugging informatio using the **debug serial interface** command.

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 device. To delete a VLAN map entry, use the **no** form of this command.

vlan access-map *name* [*number*]
no vlan access-map *name* [*number*]

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 (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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.

Examples　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> enable
Device# configure terminal
Device(config)# vlan access-map vac1
Device(config-access-map)# match ip address acl1
Device(config-access-map)# action forward
Device(config-access-map)# end
```

This example shows how to delete VLAN map vac1:

```
Device> enable
Device# configure terminal
Device(config)# no vlan access-map vac1
Device(config)# exit
```

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
show vlan dot1q tag native	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. Use the **no** form of this command to remove the map.

vlan filter *mapname* **vlan-list** {*list* | **all**}
no vlan filter *mapname* **vlan-list** {*list* | **all**}

Syntax Description		
	mapname	Name of the VLAN map entry.
	vlan-list	Specifies which VLANs to apply the map to.
	list	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.
	all	Adds the map to all VLANs.

Command Default There are no VLAN filters.

Command Modes Global configuration (config)

Command History

Release	Modification
Cisco IOS XE Fuji 16.9.2	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.

Examples This example applies VLAN map entry map1 to VLANs 20 and 30:

```
Device> enable
Device# configure terminal
Device(config)# vlan filter map1 vlan-list 20, 30
Device(config)# exit
```

This example shows how to delete VLAN map entry mac1 from VLAN 20:

```
Device> enable
Device# configure terminal
Device(config)# no vlan filter map1 vlan-list 20
Device(config)# exit
```

You can verify your settings by entering the **show vlan filter** 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	*group-name*	Name of the VLAN group. The group name may contain up to 32 characters and must begin with a letter.
	vlan-list *vlan-list*	Specifies one or more VLANs to be added to the VLAN group. The *vlan-list* 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 Modes   Global configuration (config)

Command History	Release	Modification
	Cisco IOS XE Fuji 16.9.2	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.

Examples   This example shows how to map VLANs 7 through 9 and 11 to a VLAN group:

```
Device> enable
Device# configure terminal
Device(config)# vlan group group1 vlan-list 7-9,11
Device(config)# exit
```

This example shows how to remove VLAN 7 from the VLAN group:

```
Device> enable
Device# configure terminal
Device(config)# no vlan group group1 vlan-list 7
Device(config)# exit
```