User Security Configuration Guide, Cisco IOS XE Release 3SE (Catalyst 3850 Switches)

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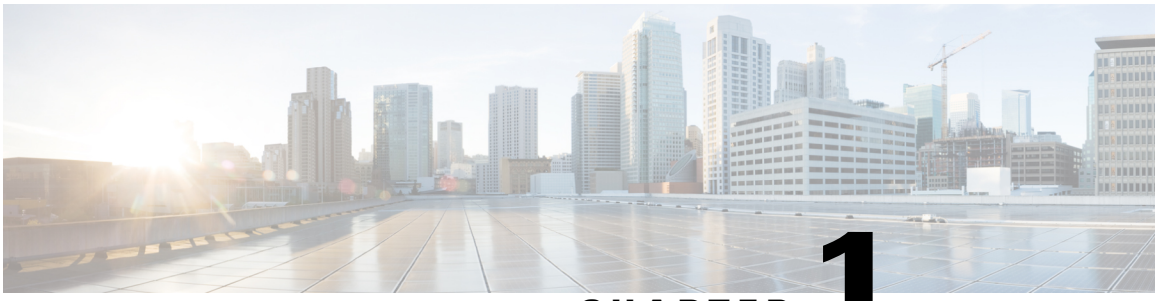


CHAPTER 1

Configuring Security with Passwords, Privileges, and Logins

Cisco IOS based networking devices provide several features that can be used to implement basic security for CLI sessions using only the operating system running on the device. These features include the following:

- Different levels of authorization for CLI sessions to control access to commands that can modify the status of the networking device versus commands that are used to monitor the device
- Assigning passwords to CLI sessions
- Requiring users log in to a networking device with a username
- Changing the privilege levels of commands to create new authorization levels for CLI sessions

This module is a guide to implementing a baseline level of security for your networking devices. It focuses on the least complex options available for implementing a baseline level of security. If you have networking devices installed in your network with no security options configured, or you are about to install a networking device and you need help understanding the how to implement a baseline of security, this document will help you.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for Configuring Security with Passwords, Privileges, and Logins

Your networking device must not be configured to use any local or remote authentication, authorization, and accounting (AAA) security features. This document describes only the non-AAA security features that can be configured locally on the networking device.

For information how to configure AAA security features that can be run locally on a networking device, or for information on how to configure remote AAA security using TACACS+ or RADIUS servers, see the *Securing User Services Configuration Guide Library*.

Information About Configuring Security with Passwords, Privileges, and Logins

Benefits of Creating a Security Scheme

The foundation of a good security scheme in the network is the protection of the user interfaces of the networking devices from unauthorized access. Protecting access to the user interfaces on your networking devices prevents unauthorized users from making configuration changes that can disrupt the stability of your network or compromise your network security.

The Cisco IOS XE features described in this document can be combined in many different ways to create a unique security scheme for each of your networking devices. Here are some possible examples that you can configure:

- You can enable non administrative users to run a subset of the administrative commands available on the networking device by lowering the entitlement level for the commands to the non administrative privilege level. This can be useful for the following scenarios:
  - ISPs that want their first-line technical support staff to perform tasks such as enabling new interfaces for new customers or resetting the connection for a customer whose connection has stopped passing traffic. See the Example: Configuring a Device to Allow Users to Shutdown and Enable Interfaces, on page 38 section for an example of how to do this.
  - When you want your first-line technical support staff to have the ability to clear console port sessions that were disconnected improperly from a terminal server. See the Example: Configuring

a Device to Allow Users to Clear Remote Sessions, on page 36 section for an example of how to do this.

- When you want your first-line technical support staff to have the ability to view, but not change, the configuration of a networking device to facilitate troubleshooting a networking problem. See the Example: Configuring a Device to Allow Users to View the Running Configuration, on page 37 section for an example of how to do this.

Cisco IOS XE CLI Modes

To aid in the configuration of Cisco devices, the Cisco IOS XE command-line interface is divided into different command modes. Each command mode has its own set of commands available for the configuration, maintenance, and monitoring of router and network operations. The commands available to you at any given time depend on the mode you are in. Entering a question mark(**?**) at the system prompt (device prompt) allows you to obtain a list of commands available for each command mode.

The use of specific commands allows you to navigate from one command mode to another. The standard order in which a user would access the modes is as follows: user EXEC mode; privileged EXEC mode; global configuration mode; specific configuration modes; configuration submodes; and configuration subsubmodes.

Note The default configuration of a Cisco IOS XE software based networking device only allows you to configure passwords to protect access to user EXEC mode (for local, and remote CLI sessions) and privileged EXEC mode. This document describes how you can provide additional levels of security by protecting access to other modes, and commands, using a combination of usernames, passwords and the **privilege** command.

Most EXEC mode commands are one-time commands, such as **show** or **more** commands, which show the current configuration status, and **clear** commands, which clear counters or interfaces. EXEC mode commands are not saved across reboots of the router.

From privileged EXEC mode, you can enter *global configuration mode* . In this mode, you can enter commands that configure general system characteristics. You also can use global configuration mode to enter specific configuration modes. Configuration modes, including global configuration mode, allow you to make changes to the running configuration. If you later save the configuration, these commands are stored across router reboots.

From global configuration mode you can enter a variety of protocol-specific or feature-specific configuration modes. The CLI hierarchy requires that you enter these specific configuration modes only through global configuration mode. For example, *interface configuration mode* , is a commonly used configuration mode.

From configuration modes, you can enter configuration submodes. Configuration submodes are used for the configuration of specific features within the scope of a given configuration mode. As an example, this chapter describes the *subinterface configuration mode* , a submode of the interface configuration mode.

ROM monitor mode is a separate mode used when the router cannot boot properly. If your system (router, switch, or access server) does not find a valid system image to load when it is booting, the system will enter ROM monitor mode. ROM monitor (ROMMON) mode can also be accessed by interrupting the boot sequence during startup. ROMMON is not covered in this document because it does not have any security features available in it.

User EXEC Mode

When you start a session on a router, you generally begin in *user EXEC mode* , which is one of two access levels of the EXEC mode. For security purposes, only a limited subset of EXEC commands are available in user EXEC mode. This level of access is reserved for tasks that do not change the configuration of the router, such as determining the router status.

If your device is configured to require users to log-in the log-in process will require a username and a password. You may try three times to enter a password before the connection attempt is refused.

User EXEC mode is set by default to privilege level 1. Privileged EXEC mode is set by default to privilege level 15. For more information see the Privileged EXEC Mode, on page 5. When you are logged into a networking device in user EXEC mode your session is running at privilege level 1. By default the EXEC commands at privilege level 1 are a subset of those available at privilege level 15. When you are logged into a networking device in privileged EXEC mode your session is running at privilege level 15. You can move commands to any privilege level between 1 and 15 using the **privilege** command. See the Cisco IOS XE Privilege Levels, on page 13 for more information on privilege levels and the **privilege** command.

In general, the user EXEC commands allow you to connect to remote devices, change terminal line settings on a temporary basis, perform basic tests, and list system information.

To list the available user EXEC commands, use the following command:

Command	Purpose
`Device(config)# ?`	Lists the user EXEC mode commands

The user EXEC mode prompt consists of the host name of the device followed by an angle bracket (>), as shown in the following example:

```
Device>
```

The default host name is generally Router, unless it has been changed during initial configuration using the **setup** EXEC command. You also change the host name using the **hostname** global configurationcommand.

Note Examples in Cisco IOS XE documentation assume the use of the default name of "Device." Different devices (for example, access servers) may use a different default name. If the device (router, access server, or switch) has been named with the **hostname** command, that name will appear as the prompt instead of the default name.

To list the commands available in user EXEC mode, enter a question mark (**?**) as shown in the following example:

```
Device> ?

Exec commands:
 <1-99>           Session number to resume
 connect          Open a terminal connection
 disconnect       Disconnect an existing telnet session
 enable           Turn on privileged commands
 exit             Exit from Exec mode
 help             Description of the interactive help system
 lat              Open a lat connection
 lock             Lock the terminal
```

```
login            Log in as a particular user
logout           Exit from Exec mode and log out
menu             Start a menu-based user interface
mbranch          Trace multicast route for branch of tree
mrbranch         Trace reverse multicast route to branch of tree
mtrace           Trace multicast route to group
name-connection  Name an existing telnet connection
pad              Open a X.29 PAD connection
ping             Send echo messages
resume           Resume an active telnet connection
show             Show running system information
systat           Display information about terminal lines
telnet           Open a telnet connection
terminal         Set terminal line parameters
tn3270           Open a tn3270 connection
trace            Trace route to destination
where            List active telnet connections
x3               Set X.3 parameters on PAD
```

The list of commands will vary depending on the software feature set and platform you are using.

Note You can enter commands in uppercase, lowercase, or mixed case. Only passwords are case sensitive. However, Cisco IOS XE documentation convention is to always present commands in lowercase.

Privileged EXEC Mode

In order to have access to all commands, you must enter *privileged EXEC mode* , which is the second level of access for the EXEC mode. Normally, you must enter a password to enter privileged EXEC mode. In privileged EXEC mode, you can enter any EXEC command, because privileged EXEC mode is a superset of the user EXEC mode commands.

Because many privileged EXEC mode commands set operating parameters, privileged EXEC level access should be password protected to prevent unauthorized use. The privileged EXEC command set includes those commands contained in user EXEC mode. Privileged EXEC mode also provides access to configuration modes through the **configure**command, and includes advanced testing commands, such as **debug**.

Privileged EXEC mode is set by default to privilege level 15. User EXEC mode is set by default to privilege level 1. For more information see the User EXEC Mode, on page 4. When you are logged into a networking device in privileged EXEC mode your session is running at privilege level 15. When you are logged into a networking device in user EXEC mode your session is running at privilege level 1. By default the EXEC commands at privilege level 15 are a superset of those available at privilege level 1. You can move commands to any privilege level between 1 and 15 using the **privilege** command. See the Cisco IOS XE Privilege Levels, on page 13 for more information on privilege levels and the **privilege** command.

The privileged EXEC mode prompt consists of the host name of the device followed by a pound sign(#), as shown in the following example:

```
Device#
```

To access privileged EXEC mode, use the following command:

Command	Purpose

`Device>` **enable**
`Password`
`Device#` **exit**
`Device>`
	Enables privileged EXEC mode.
	• If a privileged EXEC mode password has been configured the system will prompt you for a password after you issue the enable command.
	• Use the exit command to leave privileged EXEC mode.

Note Privileged EXEC mode is sometimes referred to as "enable mode," because the **enable** command is used to enter the mode.

If a password has been configured on the system, you will be prompted to enter it before being allowed access to privileged EXEC mode. The password is not displayed on the screen and is case sensitive. If an enable password has not been set, privileged EXEC mode can be accessed only by a local CLI session (terminal connected to the console port).

If you attempt to access privileged EXEC mode on a router over a remote connection, such as a telnet connection, and you have not configured a password for privileged EXEC mode you will see the **% No password set** error message. For more information on remote connections see the Remote CLI Sessions, on page 10. The system administrator uses the **enable secret** or **enable password**global configuration commands to set the password that restricts access to privileged EXEC mode. For information on configuring a password for privileged EXEC mode, see the Protecting Access to Privileged EXEC Mode, on page 18.

To return to user EXEC mode, use the following command:

Command	Purpose
`Device#` **disable**	Exits from privileged EXEC mode to user EXEC mode.

The following example shows the process of accessing privileged EXEC mode:

```
Device> enable
Password:<letmein>
Device#
```

Note that the password will not be displayed as you type, but is shown here for illustrational purposes. To list the commands available in privileged EXEC mode, issue the **?** command at the prompt. From privileged EXEC mode you can access global configuration mode, which is described in the following section.

Note Because the privileged EXEC command set contains all of the commands available in user EXEC mode, some commands can be entered in either mode. In Cisco IOS XE documentation, commands that can be entered in either user EXEC mode or privileged EXEC mode are referred to as EXEC mode commands. If user or privileged is not specified in the documentation, assume that you can enter the referenced commands in either mode.

Global Configuration Mode

The term "global" is used to indicate characteristics or features that affect the system as a whole. Global configuration mode is used to configure your system globally, or to enter specific configuration modes to configure specific elements such as interfaces or protocols. Use the **configure terminal**privileged EXEC command to enter global configuration mode.

To access global configuration mode, use the following command in privileged EXEC mode:

Command	Purpose
`Device#` **configure terminal**	From privileged EXEC mode, enters global configuration mode.

The following example shows the process of entering global configuration mode from privileged EXEC mode:

```
Device# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Device(config)#
```

Note that the system prompt changes to indicate that you are now in global configuration mode. The prompt for global configuration mode consists of the host-name of the device followed by (config) and the pound sign (#). To list the commands available in privileged EXEC mode, issue the **?** command at the prompt.

Commands entered in global configuration mode update the running configuration file as soon as they are entered. In other words, changes to the configuration take effect each time you press the Enter or Return key at the end of a valid command. However, these changes are not saved into the startup configuration file until you issue the **copy running-config startup-config** EXEC mode command. This behavior is explained in more detail later in this document.

As shown in the example above, the system dialogue prompts you to end your configuration session (exit configuration mode) by pressing the Control (Ctrl) and "z" keys simultaneously; when you press these keys, **^Z** is printed to the screen. You can actually end your configuration session by entering the Ctrl-Z key combination, using the **end** command, using the Ctrl-C key combination. The **end** command is the recommended way to indicate to the system that you are done with the current configuration session.

Caution If you use Ctrl-Z at the end of a command line in which a valid command has been typed, that command will be added to the running configuration file. In other words, using Ctrl-Z is equivalent to hitting the Enter (Carriage Return) key before exiting. For this reason, it is safer to end your configuration session using the **end** command. Alternatively, you can use the Ctrl-C key combination to end your configuration session without sending a Carriage Return signal.

You can also use the **exit** command to return from global configuration mode to EXEC mode, but this only works in global configuration mode. Pressing Ctrl-Z or entering the **end** command will always take you back to EXEC mode regardless of which configuration mode or configuration submode you are in.

To exit global configuration command mode and return to privileged EXEC mode, use one of the following commands:

Command	Purpose
`Device(config)#` **end** or `Device(config)#` **^Z**	Ends the current configuration session and returns to privileged EXEC mode.
`Device(config)#` **exit**	Exits the current command mode and returns to the preceding mode. For example, exits from global configuration mode to privileged EXEC mode.

From global configuration mode, you can enter a number of protocol-specific, platform-specific, and feature-specific configuration modes.

Interface configuration mode, described in the following section, is an example of a configuration mode you can enter from global configuration mode.

Interface Configuration Mode

One example of a specific configuration mode you enter from global configuration mode is interface configuration mode.

Many features are enabled on a per-interface basis. Interface configuration commands modify the operation of an interface such as an Ethernet, FDDI, or serial port. Interface configuration commands always follow an **interface** global configuration command, which defines the interface type.

For details on interface configuration commands that affect general interface parameters, such as bandwidth or clock rate, refer to the Release 12.2 *Cisco IOS Interface Configuration Guide* . For protocol-specific commands, refer to the appropriate Cisco IOS XE software command reference.

To access and list the interface configuration commands, use the following command:

Command	Purpose
`Device(config)#` **interface** *type number*	Specifies the interface to be configured, and enters interface configuration mode.

In the following example, the user enters interface configuration mode for serial interface 0. The new prompt, *hostname* (config-if)#, indicates interface configuration mode.

```
Device(config)# interface serial 0
Device(config-if)#
```

To exit interface configuration mode and return to global configuration mode, enter the **exit** command.

Configuration submodes are configuration modes entered from other configuration modes (besides global configuration mode). Configuration submodes are for the configuration of specific elements within the configuration mode. One example of a configuration submode is subinterface configuration mode, described in the following section.

Subinterface Configuration Mode

From interface configuration mode, you can enter subinterface configuration mode. Subinterface configuration mode is a submode of interface configuration mode. In subinterface configuration mode you can configure multiple virtual interfaces (called subinterfaces) on a single physical interface. Subinterfaces appear to be distinct physical interfaces to the various protocols.

For detailed information on how to configure subinterfaces, refer to the appropriate documentation module for a specific protocol in the Cisco IOS XE software documentation set.

To access subinterface configuration mode, use the following command in interface configuration mode:

Command	Purpose
`Device(config-if)#` **interface** *type number*	Specifies the virtual interface to be configured and enters subinterface configuration mode.

In the following example, a subinterface is configured for serial line 2, which is configured for Frame Relay encapsulation. The subinterface is identified as "2.1" to indicate that it is subinterface 1 of serial interface 2. The new prompt *hostname* (config-subif)# indicates subinterface configuration mode. The subinterface can be configured to support one or more Frame Relay PVCs.

```
Device(config)# interface serial 2
Device(config-if)# encapsulation frame-relay
Device(config-if)# interface serial 2.1
Device(config-subif)#
```

To exit subinterface configuration mode and return to interface configuration mode, use the **exit** command. To end your configuration session and return to privileged EXEC mode, press Ctrl-Z or enter the **end** command.

Cisco IOS XE CLI Sessions

Local CLI Sessions

Local CLI sessions require direct access to the the console port of the networking device. Local CLI sessions start in user EXEC mode. See the Cisco IOS XE CLI Modes, on page 3 for more information on the different modes that are supported on your networking device. All of the tasks required to configure and manage a networking device can be done using a local CLI session. The most common method for establishing a local CLI session is to connect the serial port on a PC to the console port of the networking device and then to launch a terminal emulation application on the PC. The type of cable and connectors required and the settings for the terminal emulation application on the PC are dependant on the type of networking device that you are configuring. See to the documentation for your networking device for more information on setting it up for a local CLI session.

Remote CLI Sessions

Remote CLI sessions are created between a host such as a PC and a networking device such as a router over a network using a remote terminal access application such as Telnet and Secure Shell (SSH). Local CLI sessions start in user EXEC mode. See the Cisco IOS XE CLI Modes, on page 3 for more information on the different modes that are supported on your networking device. Most of the tasks required to configure and manage a networking device can be done using a remote CLI session. The exceptions are tasks that interact directly with the console port (such as recovering from a corrupted operating system (OS) by uploading a new OS image over the console port) and interacting with the networking device when it is in ROM Monitor Mode.

This document explains how to configure security for remote Telnet sessions. Telnet is the most common method for accessing a remote CLI session on a networking device.

Note SSH is a more secure alternative to Telnet. SSH provides encryption for the session traffic between your local management device such as a PC and the networking device that you are managing. Encrypting the session traffic with SSH prevents hackers that might intercept the traffic from being able to decode it. See Secure Shell Version 2 Support feature module for more information on using SSH.

Terminal Lines are Used for Local and Remote CLI Sessions

Cisco networking devices use the word lines to refer to the software components that manage local and remote CLI sessions. You use the **line console 0** global configuration command to enter line configuration mode to configure options, such as a password, for the console port.

```
Device# configure terminal
Device(config)# line console 0
Device(config-line)# password password-string
```

Remote CLI sessions use lines that are referred to virtual teletypewriter (VTY) lines. You use the **line vty** *line-number* [*ending-line-number*] global configuration command to enter line configuration mode to configure options, such as a password, for remote CLI sessions.

```
Device# configure terminal
Device(config)# line vty 0 4
Device(config-line)# password password-string
```

Protect Access to Cisco IOS XE EXEC Modes

Cisco IOS XE provides the ability to configure passwords that protect access to the following:

Protecting Access to User EXEC Mode

The first step in creating a secure environment for your networking device is protecting access to user EXEC mode by configuring passwords for local and remote CLI sessions.

You protect access to user EXEC mode for local CLI sessions by configuring a password on the console port. See the Configuring and Verifying a Password for Local CLI Sessions, on page 16.

You protect access to user EXEC mode for remote CLI sessions by configuring a password on the virtual terminal lines (VTYs). See the Configuring and Verifying a Password for Remote CLI Sessions, on page 14 for instructions on how to configure passwords for remote CLI sessions.

Protecting Access to Privileged EXEC mode

The second step in creating a secure environment for your networking device is protecting access to privileged EXEC mode with a password. The method for protecting access to privileged EXEC mode is the same for local and remote CLI sessions.

You protect access to privileged EXEC mode by configuring a password for it. This is sometimes referred to as the enable password because the command to enter privileged EXEC mode is **enable**.

Command	Purpose

enable
`Device> enable`
`Password`
`Device#`
	Enables privileged EXEC mode.
	• Enter your password if prompted. The password will not be shown in the terminal window.
	• The ">" at the end of the prompt string is changed to a "#" to indicate that you are in privileged EXEC mode.

Cisco IOS XE Password Encryption Levels

Some of the passwords that you configure on your networking device are saved in the configuration in plain text. This means that if you store a copy of the configuration file on a disk, anybody with access to the disk can discover the passwords by reading the configuration file. The following password types are stored as plain text in the configuration by default:

- Console passwords for local CLI sessions
- Virtual terminal line passwords for remote CLI sessions
- Username passwords using the default method for configuring the password
- Privileged EXEC mode password when it is configured with the **enable password** *password* command
- Authentication key chain passwords used by RIPv2 and EIGRP
- BGP passwords for authenticating BGP neighbors
- OSPF authentication keys for authenticating OSPF neighbors
- ISIS passwords for authenticating ISIS neighbors

This excerpt from a router configuration file shows examples of passwords and authentication keys that are stored as clear text.

```
!
enable password O9Jb6D
!
username username1 password 0 kV9sIj3
```

```
!
key chain trees
 key 1
  key-string willow
!
interface Ethernet1/0.1
 ip address 172.16.6.1 255.255.255.0
 ip router isis
 ip rip authentication key-chain trees
 ip authentication key-chain eigrp 1 trees
 ip ospf authentication-key j7876
 no snmp trap link-status
 isis password u7865k
!
line vty 0 4
 password V9jA5M
!
```

You can encrypt these clear text passwords in the configuration file by using the **service password-encryption** command. This should be considered only a minimal level of security because the encryption algorithm used by the **service password-encryption** command to encrypt passwords creates text strings that be decrypted using tools that are publicly available. You should still protect access to any electronic or paper copies of your configuration files after you use the **service password-encryption** command.

The **service password-encryption** command does not encrypt the passwords when they are sent to the remote device. Anybody with a network traffic analyzer who has access to you network can capture these passwords from the packets as they are transmitted between the devices. See the Configuring Password Encryption for Clear Text Passwords, on page 20 for more information on encrypting clear text passwords in configuration files.

Many of the Cisco IOS XE features that use clear text passwords can also be configured to use the more secure MD5 algorithm. The MD5 algorithm creates a text string in the configuration file that is much more difficult to decrypt. The MD5 algorithm does not send the password to the remote device. This prevents people using a traffic analyzer to capture traffic on your network from being able to discover your passwords.

You can determine the type of password encryption that has been used by the number that is stored with the password string in the configuration file of the networking device. The number 5 in the configuration excerpt below indicates that the enable secret password has been encrypted using the MD5 algorithm.

enable secret 5 1fGCS$rkYbR6.Z8xo4qCl3vghWQ0

The number 7 in the excerpt below indicates that the enable password has been encrypted using the less secure algorithm used by the **service password-encryption** command.

!

enable password 7 00081204

Cisco IOS XE CLI Session Usernames

After you have protected access to user EXEC mode and privileged EXEC mode by configuring passwords for them you can further increase the level of security on your networking device by configuring usernames to limit access to CLI sessions to your networking device to specific users.

Usernames that are intended to be used for managing a networking device can be modified with additional options such as:

See the *Cisco IOS Security Command Reference* . (http://www.cisco.com/en/US/docs/ios/security/command/reference/sec_book.html) for more information on how to configure the **username** command.

Cisco IOS XE Privilege Levels

The default configuration for Cisco IOS XE based networking devices uses privilege level 1 for user EXEC mode and privilege level 15 for privileged EXEC. The commands that can be run in user EXEC mode at privilege level 1 are a subset of the commands that can be run in privileged EXEC mode at privilege 15.

The **privilege** command is used to move commands from one privilege level to another. For example, some ISPs allow their first level technical support staff to enable and disable interfaces to activate new customer connections or to restart a connection that has stopped transmitting traffic. See the Example: Configuring a Device to Allow Users to Shutdown and Enable Interfaces, on page 38 for an example of how to configure this option.

The **privilege** command can also be used to assign a privilege level to a username so that when a user logs in with the username, the session will run at the privilege level specified by the **privilege** command. For example if you want your technical support staff to view the configuration on a networking device to help them troubleshoot network problems without being able to modify the configuration, you can create a username, configure it with privilege level 15, and configure it to run the **show running-config** command automatically. When a user logs in with the username the running configuration will be displayed automatically. The user's session will be logged out automatically after the user has viewed the last line of the configuration. See the Example: Configuring a Device to Allow Users to View the Running Configuration, on page 37 for an example of how to configure this option.

These command privileges can also be implemented when using AAA with TACACS+ and RADIUS. For example, TACACS+ provides two ways to control the authorization of router commands on a per-user or per-group basis. The first way is to assign privilege levels to commands and have the router verify with the TACACS+ server whether or not the user is authorized at the specified privilege level. The second way is to explicitly specify in the TACACS+ server, on a per-user or per-group basis, the commands that are allowed. For more information about implementing AAA with TACACS+ and RADIUS, see the technical note How to Assign Privilege Levels with TACACS+ and RADIUS .

Cisco IOS XE Password Configuration

Cisco IOS XE software does not prompt you to repeat any passwords that you configure to verify that you have entered the passwords exactly as you intended. New passwords, and changes to existing passwords, go into effect immediately after you press the Enter key at the end of a password configuration command string. If you make a mistake when you enter a new password and have saved the configuration on the networking device to its startup configuration file and exited privileged EXEC mode before you realize that you made a mistake, you may find that you are no longer able to manage the device.

The following are common situations that can happen:

- You make a mistake configuring a password for local CLI sessions on the console port.
    - If you have properly configured access to your networking device for remote CLI sessions, you can Telnet to it and reconfigure the password on the console port.
- You make a mistake configuring a password for remote Telnet or SSH sessions.
    - If you have properly configured access to your networking device for local CLI sessions, you can connect a terminal to it and reconfigure the password for the remote CLI sessions.

- You make a mistake configuring a password for privileged EXEC mode (enable password or enable secret password).
    - You will have to perform a lost password recovery procedure.
- You make a mistake configuring your username password, and the networking device requires that you log into it with your username.
    - If you do not have access to another account name, you will have to perform a lost password recovery procedure.

To protect yourself from having to perform a lost password recovery procedure open two CLI sessions to the networking device and keep one of them in privilege EXEC mode while you reset the passwords using the other session. You can use the same device (PC or terminal) to run the two CLI sessions or two different devices. You can use a local CLI session and a remote CLI session or two remote CLI sessions for this procedure. The CLI session that you use to configure the password can also be used to verify that the password was changed properly. The other CLI session that you keep in privileged EXEC mode can be used to change the password again if you made a mistake the first time you configured it.

You should not save password changes that you have made in the running configuration to the startup configuration until you have verified that your password was changed successfully. If you discover that you made a mistake configuring a password, and you were not able to correct the problem using the second CLI session technique described above, you can power cycle the networking device so that it returns to the previous passwords that are stored in the startup configuration.

How To Configure Security with Passwords Privileges and Logins

Protecting Access to User Exec Mode

Configuring and Verifying a Password for Remote CLI Sessions

This task will assign a password for remote CLI sessions. After you have completed this task the networking device will prompt you for a password the next time that you start a remote CLI session with it.

Cisco IOS XE based networking devices require that you have a password configured for remote CLI sessions. If you attempt to start a remote CLI session with a device that doesn't have a password configured for remote CLI sessions you will see a message that a password is required and has not been set. The remote CLI session will be terminated by the remote host.

Before You Begin

If you have not previously configured a password for remote CLI sessions, you must perform this task over a local CLI session using a terminal or a PC running a terminal emulation application, attached to the console port.

Your terminal, or terminal emulation application, must be configured with the settings that are used by the console port on the networking device. The console ports on most Cisco networking devices require the

following settings: 9600 baud, 8 data bits, 1 stop bit, no parity, and flow control is set to "none." See the documentation for your networking device if these settings do not work for your terminal.

To perform the verification step (Step 6) for this task, your networking device must have an interface that is in an operational state. The interface must have a valid IP address.

Note If you have not previously configured a password for remote CLI sessions, you must perform this task over a local CLI session using a terminal attached to the console port.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **line vty** *line-number* [*ending-line-number*]
4. **password** *password*
5. **end**
6. **telnet** *ip-address*
7. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**line vty** *line-number* [*ending-line-number*] **Example:** `Device(config)# line vty 0 4`	Enters line configuration mode.
Step 4	**password** *password* **Example:** `Device(config-line)# password H7x3U8`	The argument *password* is a character string that specifies the line password. The following rules apply to the *password* argument: • The first character cannot be a number. • The string can contain any alphanumeric characters, including spaces, up to 80 characters. You cannot specify the password in the format number-space-anything.

	Command or Action	Purpose
		• Passwords are case sensitive.
Step 5	**end** **Example:** `Device(config-line)# end`	Exits the current configuration mode and returns to privileged EXEC mode.
Step 6	**telnet** *ip-address* **Example:** `Device# telnet 172.16.1.1`	Start a remote CLI session with the networking device from your current CLI session using the IP address of an interface in the networking device that is in an operational state (interface up, line protocol up). • Enter the password that you configured is step 4 when prompted. **Note** This procedure is often referred to as a starting a recursive Telnet session because you are initiating a remote Telnet session with the networking device from the networking device itself.
Step 7	**exit** **Example:** `Device# exit`	Terminates the remote CLI session (recursive Telnet session) with the networking device.

Troubleshooting Tips

To display information for all users who have access to a lawful intercept view, issue the **show users lawful-intercept** command. (This command is available only to authorized lawful intercept view users.)

What to Do Next

Proceed to the Configuring and Verifying a Password for Local CLI Sessions, on page 16 .

Configuring and Verifying a Password for Local CLI Sessions

This task will assign a password for local CLI sessions over the console port. After you have completed this task, the networking device will prompt you for a password the next time that you start a local CLI session on the console port.

This task can be performed over a local CLI session using the console port or a remote CLI session. If you want to perform the optional step of verifying that you configured the password correctly you should perform this task using a local CLI session using the console port.

Before You Begin

If you want to perform the optional step of verifying the local CLI session password, you must perform this task using a local CLI session. You must have a terminal or a PC running a terminal emulation program, connected to the console port of the networking device. Your terminal must be configured with the settings

that are used by the console port on the networking device. The console ports on most Cisco networking devices require the following settings: 9600 baud, 8 data bits, 1 stop bit, no parity, and flow control is set to "none." See the documentation for your networking device if these settings do not work for your terminal.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **line console 0**
4. **password** *password*
5. **end**
6. **exit**
7. Press the Enter key.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**line console 0** **Example:** `Device(config)# line console 0`	Enters line configuration mode and selects the console port as the line that you are configuring.
Step 4	**password** *password* **Example:** `Device(config-line)# password Ji8F5Z`	The argument *password* is a character string that specifies the line password. The following rules apply to the *password* argument: • The first character cannot be a number. • The string can contain any alphanumeric characters, including spaces, up to 80 characters. You cannot specify the password in the format number-space-anything. • Passwords are case sensitive.
Step 5	**end** **Example:** `Device(config-line)# end`	Exits the current configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
Step 6	**exit** **Example:** `Device# exit`	Exits privileged EXEC mode.
Step 7	Press the Enter key.	(Optional) Initiates the local CLI session on the console port. • Enter the password that you configured is step 4 when prompted to verify that it was configured correctly. **Note** This step can be performed only if you are using a local CLI session to perform this task.

Troubleshooting Tips

If your new password is not accepted proceed to the Configuration Examples for Configuring Security with Passwords Privileges and Logins for instructions on what to do next.

What to Do Next

Proceed to the Protecting Access to Privileged EXEC Mode, on page 18.

Protecting Access to Privileged EXEC Mode

Configuring and Verifying the Enable Password

Cisco no longer recommends that you use the **enable password** command to configure a password for privileged EXEC mode. The password that you enter with the **enable password** command is stored as plain text in the configuration file of the networking device. You can encrypt the password for the **enable password** command in the configuration file of the networking device using the **service password-encryption** command. However the encryption level used by the **service password-encryption** command can be decrypted using tools available on the Internet.

Instead of using the **enable password**command, Cisco recommends using the **enable secret** commandbecause it encrypts the password that you configure with it with strong encryption . For more information on password encryption issues see the Cisco IOS XE Password Encryption Levels, on page 11. For information on configuring the **enable secret**command see the Configuring and Verifying the Enable Secret Password, on page 21.

Note The networking device must not have a password configured by the **enable secret** command in order to perform this task successfully. If you have already configured a password for privileged EXEC mode using the **enable secret** command, the password configured takes precedences over the password that you configure in this task using the **enable password** command.

You cannot use the same password for the **enable secret** command and the **enable** *password* command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **enable password** *password*
4. **end**
5. **exit**
6. **enable**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

Step 3	**enable password** *password*
	
	Example:
	
	`Device(config)# enable password t6D77CdKq`
		The argument *password* is a character string that specifies the enable password. The following rules apply to the *password* argument:
		
		• Must contain from 1 to 25 uppercase and lowercase alphanumeric characters.
		
		• Must not have a number as the first character.
		
		• 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:
		
		  • Enter abc
		
		  • Type Crtl-v

	Command or Action	Purpose
		• Enter ?123
Step 4	**end** **Example:** `Device(config)# end`	Exits the current configuration mode and returns to privileged EXEC mode.
Step 5	**exit** **Example:** `Device# exit`	Exits privileged EXEC mode.
Step 6	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter the password you configured in step 3.

Troubleshooting Tips

If your new password is not accepted, proceed to the Recovering from Lost or Misconfigured Passwords for Privileged EXEC Mode section for instructions on what to do next.

What to Do Next

Encrypt the clear text enable password in the configuration file of the networking device using the procedure described in Configuring Password Encryption for Clear Text Passwords, on page 20.

Configuring Password Encryption for Clear Text Passwords

Cisco IOS XE stores passwords in clear text in network device configuration files for several features such as passwords for local and remote CLI sessions, and passwords for neighbor authentication for routing protocols. Clear text passwords are a security risk because anybody with access to archived copies of the configuration files can discover the passwords that are stored as clear text. The **service password-encryption** command can be used to encrypt clear text commands in the configuration files of networking devices. See the Cisco IOS XE Password Encryption Levels, on page 11 for more information.

Perform the following steps to configure password encryption for passwords that are stored as clear text in the configuration files of your networking device.

Before You Begin

You must have at least one feature that uses clear text passwords configured on your networking device for this command to have any immediate effect.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **service password-encryption**
4. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**service password-encryption** **Example:** `Device(config)# service password-encryption`	Enables Password encryption for all passwords clear text passwords, including username passwords, authentication key passwords, the privileged command password, console and virtual terminal line access passwords, and Border Gateway Protocol neighbor passwords.
Step 4	**end** **Example:** `Device(config)# end`	Exits the current configuration mode and returns to privileged EXEC mode.

Configuring and Verifying the Enable Secret Password

Cisco recommends that you use the **enable secret** command, instead of the **enable** *password* command to configure a password for privileged EXEC mode. The password created by the **enable secret** command is encrypted with the more secure MD5 algorithm.

Note You cannot use the same password for the **enable secret** command and the **enable** *password* command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Perform one of the following steps:
   - **enable secret** *password*
   - **enable secret 5** *previously-encrypted-password*
4. **end**
5. **exit**
6. **enable**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.

Step 3	Perform one of the following steps:
	• **enable secret** *password*
	• **enable secret 5** *previously-encrypted-password*
	
	Example:
	`Device(config)# enable secret t6D77CdKq`
	
	Example:
	`Device(config)# enable secret 5 $1$/x6H$RhnDI3yLC4GA01aJnHLQ4/`
		The argument *password* is a character string that specifies the **enable secret** password. The following rules apply to the *password* argument:
		• Must contain from 1 to 25 uppercase and lowercase alphanumeric characters.
		• Must not have a number as the first character.
		• 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:
		  • Enter abc
		  • Type Crtl-v
		  • Enter ?123
		
		or

	Command or Action	Purpose
		Sets a previously encrypted password for privileged EXEC mode by entering the number 5 before the previously encrypted string. You must enter an exact copy of a password from a configuration file that was previously encrypted by the **enable secret** command to use this method.
Step 4	**end** **Example:** `Device(config)# end`	Exits the current configuration mode and returns to privileged EXEC mode.
Step 5	**exit** **Example:** `Device# exit`	Exits privileged EXEC mode.
Step 6	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter the password that you configured in Step 3.

Troubleshooting Tips

If your new password is not accepted proceed to the Configuration Examples for Configuring Security with Passwords Privileges and Logins for instructions on what to do next.

What to Do Next

If you have finished configuring passwords for local and remote CLI sessions and you want to configure additional security features, such as usernames, and privilege levels proceed to the Configuring Security Options to Manage Access to CLI Sessions and Commands, on page 25.

Configuring a Device to Allow Users to View the Running Configuration

To access the running configuration of a device using the **show running-config** command at a privilege level lower than level 15, perform the following task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **privilege exec all level** *level command-string*
4. **file privilege** *level*
5. **privilege configure all level** *level command-string*
6. **end**
7. **show privilege**
8. **show running-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**privilege exec all level** *level command-string* **Example:** `Device(config)# privilege exec all level 5 show running-config`	Changes the privilege level of the specified command from one privilege level to another.
Step 4	**file privilege** *level* **Example:** `Device(config)# file privilege 5`	Allows a user of the privilege level to execute commands that involve the file system on a device.
Step 5	**privilege configure all level** *level command-string* **Example:** `Device(config)# privilege configure all level 5 logging`	Allows a user of a privilege level to see specific configuration commands. For example, allows the user of privilege level 5 to see the logging configuration commands in the running configuration.
Step 6	**end** **Example:** `Device(config)# end`	Exits global configuration mode and returns to privileged EXEC mode.

	Command or Action	Purpose
Step 7	**show privilege** **Example:** `Device# show privilege`	Displays the current privilege level.
Step 8	**show running-config** **Example:** `Device# show running-config`	Displays the current running configuration for the specified privilege level.

The following output for the **show running-config** command displays the logging configuration commands in the running configuration. Users with a privilege level below 15 can view the running configuration after configuring the **privilege configure all level** *level command-string* command.

```
Device# show running-config

Building configuration...

Current configuration : 128 bytes
!
boot-start-marker
boot-end-marker
!
no logging queue-limit
logging buffered 10000000
no logging rate-limit
!
!
!
end
```

Configuring Security Options to Manage Access to CLI Sessions and Commands

The tasks in this section describe how to configure your networking device to permit the use of a subset of privileged EXEC mode commands by users who should not have access to all of of the commands available in privileged EXEC mode.

These tasks are beneficial for companies that have multiple levels of network support staff and the company wants the staff at each level to have access to a different subset of the privileged EXEC mode commands.

In this task the users who should not have access to all of of the commands available in privileged EXEC mode are referred to as the first-line technical support staff.

This section contains the following procedures:

Configuring the Networking Device for the First-Line Technical Support Staff

This task describes how to configure the networking device for first-line technical support users. First-line technical support staff are usually not allowed to run all of the commands available in privileged EXEC mode

(privilege level 15) on a networking device. They are prevented from running commands that they are not authorized for by not being granted access to the password assigned to privileged EXEC mode or to other roles that have been configured on the networking device.

The **privilege** command is used to move commands from one privilege level to another in order to create the additional levels of administration of a networking device that is required by companies that have different levels of network support staff with different skill levels.

The default configuration of a Cisco IOS XE device permits two types of users to access the CLI. The first type of user is a person who is only allowed to access user EXEC mode. The second type of user is a person who is allowed access to privileged EXEC mode. A user who is only allowed to access user EXEC mode is not allowed to view or change the configuration of the networking device, or to make any changes to the operational status of the networking device. On the other hand, a user who is allowed access to privileged EXEC mode can make any change to a networking device that is allowed by the CLI.

In this task the two commands that normally run at privilege level 15 are reset to privilege level 7 using the privilege command in order that first-line technical support users will be allowed to run the two commands. The two commands for which the privilege levels will be reset are the **clear counters** command and **reload** command.

- The **clear counters** command is used to reset the counter fields on interfaces for statistics such as packets received, packets transmitted, and errors. When a first-line technical support user is troubleshooting an interface related connectivity issue between networking devices, or with remote users connecting to the network, it is useful to reset the interface statistics to zero and them monitor the interfaces for a period of time to see if the values in the interface statistics counters change.
- The **reload** command is used initiate a reboot sequence for the networking device. One common use of the reload command by first-line technical support staff is to cause the networking device to reboot during a maintenance window so that it loads a new operating system that was previously copied onto the networking device's file system by a user with a higher level of authority.

Any user that is permitted to know the **enable secret** password that is assigned to the first-line technical support user role privilege level can access the networking device as a first-line technical support user. You can add an additional level of security by configuring a username on the networking device and requiring that the users know the username and the password. Configuring a username as an additional level of security is described in the Configuring a Device to Require a Username for the First-Line Technical Support Staff, on page 31.

Note You must not have the **aaa new-model** command enabled on the networking device. You must not have the **login local** command configured for the local CLI sessions over the console port or the remote CLI sessions.

Note For clarity, only the arguments and keywords that are relevant for each step are shown in the syn the steps in this task. See the Cisco IOS command reference book for your Cisco IOS release for information on the additional arguments and keywords that can be used with these commands.

Caution Do not use the no form of the **privilege** command to reset the privilege level of a command to its because it might not return the configuration to the correct default state. Use the **reset** keyword fo **privilege** command instead to return a command to its default privilege level. For example, to rem **privilege exec level** *reload* command from the configuration and return the **reload** command to its privilege of 15, use the **privilege exec reset** *reload* command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **enable secret level** *level password*
4. **privilege exec level** *level command-string*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enters privileged EXEC mode. Enter the password when prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**enable secret level** *level password* **Example:** `Device(config)# enable secret level 7 Zy72sKj`	Configures a new enable secret password for privilege level 7.

	Command or Action	Purpose
Step 4	**privilege exec level** *level command-string* **Example:** `Device(config)# privilege exec level 7 clear counters`	Changes the privilege level of the **clear counters** command from privilege level 15 to privilege level 7.
Step 5	**end** **Example:** `Device(config)# end`	Exits global configuration mode.

Verifying the Configuration for the First-Line Technical Support Staff

This task describes how to verify that the network device is configured correctly for the first-line technical support staff.

Before You Begin

The following commands must have been modified to run at privilege level 7 for this task:

- **clear counters**
- **reload**

SUMMARY STEPS

1. **enable** *level password*
2. **show privilege**
3. **clear counters**
4. **clear ip route** *
5. **reload in time**
6. **reload cancel**
7. **disable**
8. **show privilege**

DETAILED STEPS

Step 1 **enable** *level password*

Logs the user into the networking device at the privilege level specified for the level argument.

Example:

```
Device> enable 7 Zy72sKj
```

Step 2 **show privilege**
Displays the privilege level of the current CLI session

Example:

```
Device# show privilege

Current privilege level is 7
```

Step 3 **clear counters**
The clear counters command clears the interface counters. This command has been changed from privilege level 15 to privilege level 7.

Example:

```
Device# clear counters

Clear "show interface" counters on all interfaces [confirm]
Device#
02:41:37: %CLEAR-5-COUNTERS: Clear counter on all interfaces by console
```

Step 4 **clear ip route ***
The *ip route* argument string for the **clear** command should not be allowed because it was not changed from privilege level 15 to privilege level 7.

Example:

```
Device# clear ip route *
                                                                    ^
% Invalid input detected at '^' marker.
```

Step 5 **reload in time**
The reload command causes the networking device to reboot.

Example:

```
Device# reload in

10
Reload scheduled in 10 minutes by console
Proceed with reload? [confirm]

Device#

***
*** --- SHUTDOWN in 0:10:00 ---
***
```

```
02:59:50: %SYS-5-SCHEDULED_RELOAD: Reload requested for 23:08:30 PST Sun Mar 20
```

Step 6 **reload cancel**

The **reload cancel** terminates a reload that was previously setup with the the **reload in** *time* command.

Example:

```
Device# reload cancel

***
*** --- SHUTDOWN ABORTED ---
***
04:34:08: %SYS-5-SCHEDULED_RELOAD_CANCELLED:  Scheduled reload cancelled at 15:38:46 PST Sun Mar 27
 2005
```

Step 7 **disable**

Exits the current privilege level and returns to privilege level 1.

Example:

```
Device# disable
```

Step 8 **show privilege**

Displays the privilege level of the current CLI session

Example:

```
Device> show privilege

Current privilege level is 1
```

Troubleshooting Tips

If your configuration does not work the way that you want it to and you want to remove the privilege commands from the configuration, use the **reset** keyword for the **privilege** command to return the commands to their default privilege level. For example, to remove the command **privilege exec level** *reload* command from the configuration and return the **reload** command to its default privilege of 15 use the **privilege exec reset** *reload*command.

What to Do Next

If you want to add an additional level of security by requiring that the first level technical staff use a login name, proceed to the Configuring a Device to Require a Username for the First-Line Technical Support Staff, on page 31.

Configuring a Device to Require a Username for the First-Line Technical Support Staff

This task configures the networking device to require that the first-line technical support staff login to the networking device with a login name of admin. The admin username configured in this task is assigned the privilege level of 7 which will allow users who log in with this name to run the commands that were reassigned to privilege level 7 in the previous task. When a user successfully logs in with the admin username, the CLI session will automatically enter privilege level 7.

Before Cisco IOS XE Release 2.3, two types of passwords were associated with usernames: Type 0, which is a clear text password visible to any user who has access to privileged mode on the router, and type 7, which has a password encrypted by the **service password encryption** command.

In Cisco IOS XE Release 2.3 and later releases, the new **secret** keyword for the **username** command allows you to configure Message Digest 5 (MD5) encryption for username passwords.

Before You Begin

The following commands must have been modified to run at privilege level 7 for this task:

- **clear counters**
- **reload**

See the Configuring the Networking Device for the First-Line Technical Support Staff, on page 25 for instructions on how to change the privilege level for a command.

Note MD5 encryption for the **username** command is not supported in versions of Cisco IOS software prior to Cisco IOS XE Release 2.3.

You must not have the aaa-new model command enabled on the networking device. You must not have the **login local** command configured for the local CLI sessions over the console port or the remote CLI sessions.

Note For clarity, only the arguments and keywords that are relevant for each step are shown in the syn the steps in this task. Refer to the Cisco IOS command reference book for your Cisco IOS XE rel further information on the additional arguments and keywords that can be used with these comma

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **username** *username* **privilege** *level* **secret** *password*
4. **end**
5. **disable**
6. **login** *username*
7. **show privilege**
8. **clear counters**
9. **clear** *ip route* *
10. **reload in** *time*
11. **reload cancel**
12. **disable**
13. **show privilege**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enters privileged EXEC mode. Enter the password when prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**username** *username* **privilege** *level* **secret** *password* **Example:** `Device(config)# username admin privilege 7 secret Kd65xZa`	Creates a username and applies MD5 encryption to the *password* text string.
Step 4	**end** **Example:** `Device(config)# end`	Exits global configuration mode.

	Command or Action	Purpose
Step 5	**disable** **Example:** `Device# disable`	Exits the current privilege level and returns to user EXEC mode.
Step 6	**login** *username* **Example:** `Device> login admin`	Logs in the user. Enter the username and password you configured in step 3 when prompted.

Step 7	**show privilege**
	
	Example:
	`Device# show privilege`
	`Current privilege level is 7`
		The **show privilege** command displays the privilege level of the CLI session.

Step 8	**clear counters**
	
	Example:
	`Device# clear counters`
	`Clear "show interface" counters on all interfaces [confirm]`
	`Device#`
	`02:41:37: %CLEAR-5-COUNTERS: Clear counter on all interfaces by console`
		The **clear counters** command clears the interface counters. This command has been changed from privilege level 15 to privilege level 7.

Step 9	**clear** *ip route* ***
	
	Example:
	`Device# clear ip route *`
	`^`
	`% Invalid input detected at '^' marker.`
		The *ip route* argument string for the **clear** command is not allowed because it was not changed from privilege level 15 to privilege level 7.

Step 10	**reload in** *time*
	
	Example:
	`Device# reload in`
	`10`
	`Reload scheduled in 10 minutes by console`
	`Proceed with reload? [confirm]`
	`Device#`
	`***`
	`*** --- SHUTDOWN in 0:10:00 ---`
	`***`
	`02:59:50: %SYS-5-SCHEDULED_RELOAD: Reload requested for 23:08:30 PST Sun Mar 20`
		The reload command causes the networking device to reboot.

	Command or Action	Purpose

Step 11	**reload cancel**
	
	Example:
	`Device# reload cancel`
	`***`
	`*** --- SHUTDOWN ABORTED ---`
	`***`
	`04:34:08: %SYS-5-SCHEDULED_RELOAD_CANCELLED: Scheduled reload cancelled at 15:38:46 PST Sun Mar 27 2005`
		The **reload cancel** command terminates a reload that was previously setup with the the **reload in** *time* command.

Step 12	**disable** **Example:** `Device# disable`	Exits the current privilege level and returns to user EXEC mode.

Step 13	**show privilege**
	
	Example:
	`Device> show privilege`
	`Current privilege level is 1`
		Displays the privilege level of the current CLI session

Recovering from a Lost or Misconfigured Password for Local Sessions

There are three methods that can be used to recover from a lost or misconfigured password for local CLI sessions over console port. The method that you will use depends on the current configuration of your networking device.

Networking Device Is Configured to Allow Remote CLI Sessions

The fastest method to recover from a lost, or misconfigured password for local CLI sessions is to establish a remote CLI session with the networking device and repeat the Configuring and Verifying a Password for Local CLI Sessions, on page 16. Your networking device must be configured to allow remote CLI sessions and you must know the remote CLI session password to perform this procedure.

Networking Device Is Not Configured to Allow Remote CLI Sessions

- If you cannot establish a remote session to your networking device, and you have not saved the misconfigured local CLI session password to the startup configuration, you can restart the networking device. When the networking device starts up again it will read the startup configuration file. The previous local CLI session password is restored.

Caution Restarting a networking device will cause it to stop forwarding traffic. This will also cause an interruption in any services that are running on the networking device, such as a DHCP server service, to stop. You should only restart a networking device during a period of time that has been allocated for network maintenance.

Recovering from a Lost or Misconfigured Password for Remote Sessions

There are three methods that can be used to recover from a lost, or misconfigured remote CLI session password. The method that you will use depends on the current configuration of your networking device.

Networking Device Is Configured to Allow Local CLI Sessions

The fastest method to recover from a lost, or misconfigured password for remote CLI sessions is to establish a local CLI session with the networking device and repeat the Configuring and Verifying a Password for Remote CLI Sessions, on page 14. Your networking device must be configured to allow local CLI sessions and you must know the local CLI session password to perform this procedure.

Networking Device Is Not Configured to Allow Local CLI Sessions

- If you cannot establish a local CLI session to your networking device, and you have not saved the misconfigured remote CLI session password to the startup configuration, you can restart the networking device. When the networking device starts up again it will read the startup configuration file. The previous remote CLI session password is restored.

Caution Restarting a networking device will cause it to stop forwarding traffic. This will also cause an interruption in any services that are running on the networking device, such as a DHCP server service, to stop. You should only restart a networking device during a period of time that has been allocated for network maintenance.

Recovering from Lost or Misconfigured Passwords for Privileged EXEC Mode

There are two methods that can be used to recover from a lost, or misconfigured Privileged EXEC Mode password. The method that you will use depends on the current configuration of your networking device.

A Misconfigured Privileged EXEC Mode Password Has Not Been Saved

- If you have not saved the misconfigured privileged EXEC mode password to the startup configuration, you can restart the networking device. When the networking device starts up again it will read the startup configuration file. The previous privileged EXEC mode password is restored.

Caution Restarting a networking device will cause it to stop forwarding traffic. This will also cause an interruption in any services that are running on the networking device, such as a DHCP server service, to stop. You should only restart a networking device during a period of time that has been allocated for network maintenance.

Configuration Examples for Configuring Security with Passwords Privileges and Logins

Example: Configuring a Device to Allow Users to Clear Remote Sessions

The following example shows how to configure a networking device to allow a non administrative user to clear remote CLI session virtual terminal (VTY) lines.

The first section is an excerpt of the running configuration for this example. The following sections show you how this example is used.

The following section is an excerpt of the running-configuration:

```
!
privilege exec level 7 clear line
!
no aaa new-model
!
!
username admin privilege 7 secret 5 $1$tmIw$1aM7sadKhWMpkVTzxNw1J.
!
privilege exec level 7 clear line
!
! the privilege exec level 7 clear command below is entered automatically
! when you enter the privilege exec level 7 clear line command above, do
! not enter it again
!
privilege exec level 7 clear
!
```

The following section using the **login** command shows the user logging in to the networking device with the username of admin:

```
R1> login
Username: admin
Password:
```

The following section using the **show privilege** command shows that the current privilege level is 7:

```
R1# show privilege

Current privilege level is 7
R1#
```

The following section using the **show user** command shows that two users (admin and root) are currently logged in to the networking device:

```
R1# show user

    Line       User       Host(s)              Idle       Location
*  0 con 0     admin      idle                 00:00:00
```

```
   2 vty 0     root       idle                 00:00:17 172.16.6.2
  Interface    User               Mode         Idle     Peer Address
```

The following section using the **clear line** *2* command terminates the remote CLI session in use by the username root:

```
R1# clear line  2

[confirm]
 [OK]
```

The following section using the **show user** command shows that admin is the only user currently logged in to the networking device:

```
R1# show user
    Line       User       Host(s)              Idle       Location
*  0 con 0     admin      idle                 00:00:00
  Interface    User               Mode         Idle     Peer Address
```

Example: Configuring a Device to Allow Users to View the Running Configuration

For Users With Privilege Level 15

The following example shows how to configure the networking device to allow a non administrative users (no access to privileged EXEC mode) to view the running configuration automatically. This example requires that the username is configured for privilege level 15 because many of the commands in the configuration file can be viewed only by users who have access to privilege level 15.

The solution is to temporarily allow the user access to privilege level 15 while running the **show running-config** command and then terminating the CLI session when the end of the configuration file has been viewed. In this example the networking device will automatically terminate the CLI session when the end of the configuration file has been viewed. No further configuration steps are required.

Caution You must include the **noescape** keyword for the **username** command to prevent the user from entering an escape character that will terminate viewing the configuration file and leave the session running at privilege level 15.

```
!
!
username viewconf privilege 15 noescape secret 5 $1$zA9C$TDWD/Q0zwp/5xRwRqdgc/.
username viewconf autocommand show running-config
!
```

For Users With Privilege Level Lower Than Level 15

The following example shows how to configure a networking device to allow a user with privilege level lower than level 15 to view the running configuration.

```
Device> enable
Device# configure terminal
Device(config)# privilege exec all level 5 show running-config
Device(config)# file privilege 5
Device(config)# privilege configure all level 5 logging
Device(config)# end
Device# show privilege
```

```
Current privilege level is 5

Device# show running-config

Building configuration...

Current configuration : 128 bytes
!
boot-start-marker
boot-end-marker
!
no logging queue-limit
logging buffered 10000000
no logging rate-limit
!
!
!
end
```

Example: Configuring a Device to Allow Users to Shutdown and Enable Interfaces

The following example shows how to configure a networking device to allow non administrative users to shutdown and enable interfaces.

The first section is an an excerpt of the running configuration for this example. The following sections show you how this example is used.

The following section is an excerpt of the running-configuration:

```
!
no aaa new-model
!
username admin privilege 7 secret 5 $1$tmIw$1aM7sadKhWMpkVTzxNw1J.
!
privilege interface all level 7 shutdown
privilege interface all level 7 no shutdown
privilege configure level 7 interface
privilege exec level 7 configure terminal
!
! the privilege exec level 7 configure command below is entered automatically
! when you enter the privilege exec level 7 configure terminal command above, do
! not enter it again
!
privilege exec level 7 configure
!
```

The following section using the **login** command shows the user logging in to the networking device with the username of admin:

```
R1> login
Username: admin
Password:
```

The following section using the **show privilege** command shows that the current privilege level is 7:

```
R1# show privilege
Current privilege level is 7
```

The following section using the **show user** command shows that admin is the only user currently logged in to the networking device:

```
R1# show user
    Line       User       Host(s)              Idle       Location
```

```
*  0 con 0     admin      idle                 00:00:00
  Interface    User               Mode         Idle     Peer Address
```

The following section shows that the admin user is permitted to shutdown and enable an interface:

```
R1# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)# interface ethernet 1/0
R1(config-if)# shutdown
R1(config-if)# no shutdown
R1(config-if)# exit
R1#
```

Where to Go Next

Once you have established a baseline of security for your networking devices you can consider more advanced options such as:

- Role-Based CLI Access--The role-based CLI access feature offers a more comprehensive set of options than the **privilege** command (described in this document) for network managers who want to allow different levels of technical support staff to have different levels of access to CLI commands.
- AAA Security--Many Cisco networking devices offer an advanced level of security using authentication, authorization and accounting (AAA) features. All of the tasks described in this document, and other - more advanced security features - can be implemented using AAA on the networking device in conjunction with a remote TACACS+ or RADIUS server. For information how to configure AAA security features that can be run locally on a networking device, or for information on how to configure remote AAA security using TACACS+ or RADIUS servers, see the *Cisco IOS XE Security Configuration Guide:Securing User Services* , Release 2.

Additional References

The following sections provide references related to Configuring Security with Passwords and, Login Usernames for CLI Sessions on Networking Devices.

Related Documents

Related Topic	Document Title
Managing user access to CLI commands and configuration information	"Role-Based CLI Access" in the *Cisco IOS XE Security Configuration Guide: Securing User Services* , Release 2
AAA Security Features	*Cisco IOS XE Security Configuration Guide: Securing User Services* , Release 2
Assigning privilege levels with TACACS+ and RADIUS	How to Assign Privilege Levels with TACACS+ and RADIUS

Standards

Standard	Title
No new or modified RFCs are supported by this functionality, and support for existing RFCs has not been modified.	--

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this functionality, and support for existing RFCs has not been modified.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

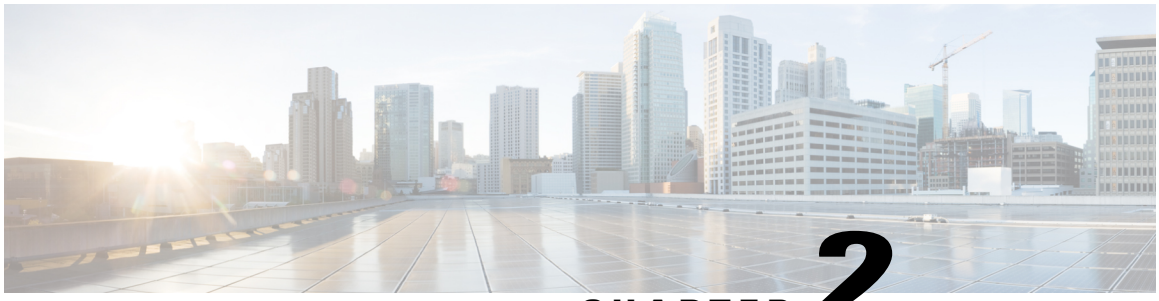
Feature Information for Configuring Security with Passwords Privileges and Logins

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 1: Feature Information for Configuring Security with Passwords, Privilege Levels, and Login Usernames for CLI Sessions on Networking Devices

Feature Name	Releases	Feature Configuration Information
Enhanced Password Security	Cisco IOS XE 3.2SE Cisco IOS XE 3.3SE	Using the Enhanced Password Security feature, you can configure MD5 encryption for username passwords. MD5 encryption is a one-way hash function that makes reversal of an encrypted password impossible, providing strong encryption protection. Using MD5 encryption, you cannot retrieve clear text passwords. MD5 encrypted passwords cannot be used with protocols that require that the clear text password be retrievable, such as Challenge Handshake Authentication Protocol (CHAP). In Cisco IOS XE Release 3.2SE, this feature was supported on the following platforms: • Catalyst 3850 Series Switches • Cisco 5760 Wireless LAN Controller In Cisco IOS XE Release 3.3SE, this feature was supported on the following platforms: • Catalyst 3650 Series Switches • Cisco Catalyst 3850 Series Switches.



CHAPTER 2

Image Verification

The Image Verification feature allows users to automatically verify the integrity of Cisco IOS XE images and provisioning files. Thus, users can be sure that an image or provisioning file is protected from accidental corruption, which can occur at any time during transit, starting from the moment the files are generated by Cisco until they reach the user.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Restrictions for Image Verification

Image Verification is applied to and attempted on any file; however, if the file is not an image file or provisioning file, image verification will not occur and you will see the following error, "SIGNATURE-4-NOT_PRESENT."

Note The Image Verification feature can only be used to check the integrity of a Cisco IOS XE software image or provisioning file that is stored on a Cisco IOS XE device. It cannot be used to check the integrity of an image on a remote file system or an image running in memory.

Information About Image Verification

Note Throughout this document, any references to Cisco IOS XE images, also applies to provisioning files.

Benefits of Image Verification

The efficiency of Cisco IOS XE routers is improved because the routers can now automatically detect when the integrity of an image or provisioning file is accidentally corrupted as a result of transmission errors or disk corruption.

How Image Verification Works

Because a production image undergoes a sequence of transfers before it is copied into the memory of a router, the integrity of the image is at risk of accidental corruption every time a transfer occurs. When downloading an image from Cisco.com, a user can run a message-digest5 (MD5) hash on the downloaded image and verify that the MD5 digest posted on Cisco.com is the same as the MD5 digest that is computed on the user's server. However, many users choose not to run an MD5 digest because it is 128-bits long and the verification is manual. Image verification allows the user to automatically validate the integrity of all downloaded images, thereby, significantly reducing user interaction.

How to Use Image Verification

Globally Verifying the Integrity of an Image

The **file verify auto** command enables image verification globally; that is, all images that are to be copied (via the **copy** command) or reloaded (via the **reload** command) are automatically verified. Although both the **copy** and **reload** commands have a **/verify** keyword that enables image verification, you must issue the keyword each time you want to copy or reload an image. The **file verify auto** command enables image verification by default, so you no longer have to specify image verification multiple times.

If you have enabled image verification by default but prefer to disable verification for a specific image copy or reload, the **/noverify** keyword, along with either the **copy** or the **reload** command, will override the **file verify auto** command.

Use this task to enable automatic image verification.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **file verify auto**
4. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**file verify auto** **Example:** `Device(config)# file verify auto`	Enables automatic image verification.
Step 4	**exit** **Example:** `Device(config)# exit`	Exits global configuration mode. You must exit global configuration mode if you are going to copy or reload an image.

What to Do Next

After issuing the **file verify auto** command, you do not have to issue the **/verify** keyword with the **copy** or the **reload** command because each image that is copied or reloaded will be automatically verified.

Verifying the Integrity of an Image That Is About to Be Copied

When issuing the **copy** command, you can verify the integrity of the copied file by entering the **/verify** keyword. If the integrity check fails, the copied file will be deleted. If the file that is about to be copied does not have an embedded hash (an old image), you will be prompted whether or not to continue with the copying process. If you choose to continue, the file will be successfully copied; if you choose not to continue, the copied file will be deleted.

Without the **/verify** keyword, the **copy** command could copy a file that is not valid. Thus, after the **copy** command has been successfully executed, you can issue the **verify** command at any time to check the integrity of the files that are in the storage of the router.

Use this task to verify the integrity of an image before it is copied onto a router.

SUMMARY STEPS

1. **enable**
2. **copy** [**/erase**] [**/verify**| **/noverify**] *source-url destination-url*
3. **verify** [**/md5** [*md5-value*]] *filesystem: file-url*]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**copy** [**/erase**] [**/verify**| **/noverify**] *source-url destination-url* **Example:** `Device# copy /verify tftp://10.1.1.1/cat3k_caa-universalk9.SSA.16.1.0.EFT3-1.bin flash:`	Copies any file from a source to a destination. • **/verify** --Verifies the signature of the destination file. If verification fails, the file will be deleted. • **/noverify** --Does not verify the signature of the destination file before the image is copied. **Note** **/noverify** is often issued if the **file verify auto** command is enabled, which automatically verifies the signature of all images that are copied.
Step 3	**verify** [**/md5** [*md5-value*]] *filesystem: file-url*] **Example:** `Device# flash: tftp://10.1.1.1/cat3k_caa-universalk9.SSA.16.1.0.EFT3-1.bin flash:`	(Optional) Verifies the integrity of the images in the Device's storage.

Verifying the Integrity of an Image That Is About to Be Reloaded

By issuing the **reload** command with the /**verify** keyword, the image that is about to be loaded onto your system will be checked for integrity. If the /**verify** keyword is specified, image verification will occur before the system initiates the reboot. Thus, if verification fails, the image will not be loaded.

Note Because different platforms obtain the file that is to be loaded in various ways, the file specified in BOOTVAR will be verified. If a file is not specified, the first file on each subsystem will be verified. On certain platforms, because of variables such as the configuration register, the file that is verified may not be the file that is loaded.

Use this task to verify the integrity of an image before it is reloaded onto a router.

SUMMARY STEPS

1. **enable**
2. **reload** [[**warm**] [**/verify**| **/noverify**] *text* | [**warm**] [**/verify**| **/noverify**] **in** [*hh* **:** *mm* [*text*] | [**warm**] [**/verify**| **/noverify**] **at** *hh* **:** *mm* [*month day* | *day month*] [*text*] | [**warm**] [**/verify**| **/noverify**] **cancel**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**reload** [[**warm**] [**/verify**| **/noverify**] *text*	[**warm**] [**/verify**| **/noverify**] **in** [*hh* **:** *mm* [*text*]	[**warm**] [**/verify**| **/noverify**] **at** *hh* **:** *mm* [*month day*	*day month*] [*text*]	[**warm**] [**/verify**| **/noverify**] **cancel**] **Example:** `Device# reload /verify`	Reloads the operating system. • **/verify**--Verifies the signature of the destination file. If verification fails, the file will be deleted. • **/noverify** --Does not verify the signature of the destination file before the image is reloaded. **Note** **/noverify** is often issued if the **file verify auto** command is enabled, which automatically verifies the signature of all images that are copied.

Configuration Examples for Image Verification

Global Image Verification Example

The following example shows how to enable automatic image verification. After enabling this command, image verification will automatically occur for all images that are either copied (via the **copy** command) or reloaded (via the **reload** command).

```
Device(config)# file verify auto
```

Image Verification via the copy Command Example

The following example shows how to specify image verification before copying an image:

```
Device# copy /verify tftp://10.1.1.1/jdoe/c7200-js-mz disk0:
Destination filename [c7200-js-mz]?
Accessing tftp://10.1.1.1/jdoe/c7200-js-mz...
Loading jdoe/c7200-js-mz from 10.1.1.1 (via FastEthernet0/0):!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 19879944 bytes]
19879944 bytes copied in 108.632 secs (183003 bytes/sec)
Verifying file integrity of disk0:/c7200-js-mz
.....................................................................................
.....................................................................................
.....................................................................................
.........................Done!
Embedded Hash   MD5 :CFA258948C4ECE52085DCF428A426DCD
Computed Hash       MD5 :CFA258948C4ECE52085DCF428A426DCD
CCO Hash               MD5 :44A7B9BDDD9638128C35528466318183
Signature Verified
```

Image Verification via the reload Command Example

The following example shows how to specify image verification before reloading an image onto the Device:

```
Device# reload /verify
Verifying file integrity of bootflash:c7200-kboot-mz.121-8a.E
%ERROR:Signature not found in file bootflash:c7200-kboot-mz.121-8a.E.
Signature not present. Proceed with verify? [confirm]
Verifying file disk0:c7200-js-mz
.....................................................................
.....................................................Done!
Embedded Hash     MD5 :CFA258948C4ECE52085DCF428A426DCD
Computed Hash      MD5 :CFA258948C4ECE52085DCF428A426DCD
CCO Hash          MD5 :44A7B9BDDD9638128C35528466318183
Signature Verified
Proceed with reload? [confirm]n
```

Verify Command Sample Output Example

The following example shows how to specify image verification via the **verify** command:

```
Device# verify disk0:c7200-js-mz
%Filesystem does not support verify operations
Verifying file integrity of disk0:c7200-js-mz.....................................
.....................................................................................Done!
Embedded Hash     MD5 :CFA258948C4ECE52085DCF428A426DCD
Computed Hash      MD5 :CFA258948C4ECE52085DCF428A426DCD
CCO Hash          MD5 :44A7B9BDDD9638128C35528466318183
Signature Verified
```

Additional References

The following sections provide references related to the Image Verification feature.

Related Documents

Related Topic	Document Title
Configuration tasks and information for loading, maintaining, and rebooting system images	Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide
Additional commands for loading, maintaining, and rebooting system images	Cisco IOS Master Command List, All Releases

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/techsupport

Feature Information for Image Verification

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to . An account on Cisco.com is not required.

Table 2: Feature Information for Image Verification

Feature Name	Releases	Feature Information
Image Verification	Cisco IOS XE 3.2SE Cisco IOS XE 3.3SE	The Image Verification feature allows users to automatically verify the integrity of Cisco IOS XE images. In Cisco IOS XE Release 3.2SE, this feature was supported on the following platforms: • Catalyst 3850 Series Switches • Cisco 5760 Wireless LAN Controller In Cisco IOS XE Release 3.3SE, this feature was supported on the following platforms: • Catalyst 3650 Series Switches • Cisco Catalyst 3850 Series Switches. The following commands were introduced or modified: **copy**, **file verify auto**, **reload**, **verify**.