# Cisco C8400 Series Secure Routers Configuration Guide

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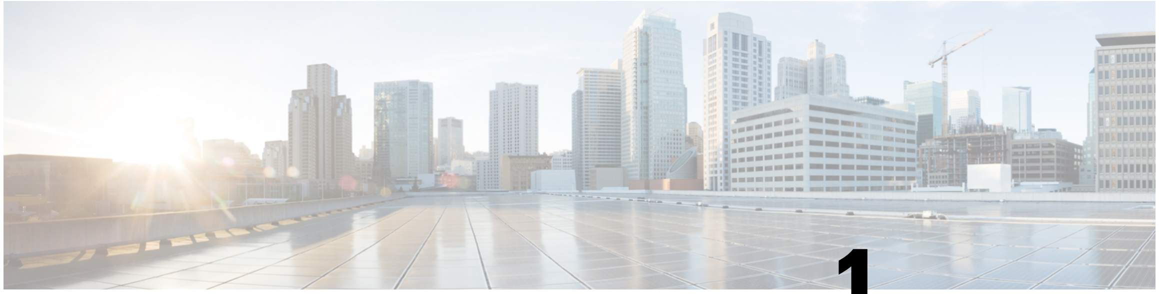


CHAPTER 1

# Preface

This preface describes the objectives and organization of this document and explains how to find additional information on related products and services.

## Objectives

This document provides an overview of software functionality for Cisco 8400 Series Secure Routers.

It is not intended as a comprehensive guide to all of the software features that can be run using the Cisco 8400 Series Secure Routers but only the software aspects that are specific to this platform.

For information on general software features that are also available on the Cisco 8400 Series Secure Routers, see the Cisco IOS XE technology guide for that specific software feature.

## Document revision history

The Document Revision History records technical changes to this document. The table shows the Cisco IOS XE software release number and document revision number for the change, the date of the change, and a brief summary of the change.

| **Release No.** | **Date** | **Change Summary** |
|---|---|---|
| Cisco IOS XE 17.15.3 | June 30, 2025 | Cisco Catalyst C8475-G2 and C8455-G2 routers were introduced. |

CHAPTER 2

# Read Me First

### Feature Information

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

### Related References

- Cisco IOS Command References, All Releases

### Obtaining Documentation and Submitting a Service Request

- To receive timely, relevant information from Cisco, sign up at Cisco Profile Manager.
- To get the business impact you’re looking for with the technologies that matter, visit Cisco Services.
- To submit a service request, visit Cisco Support.
- To discover and browse secure, validated enterprise-class apps, products, solutions and services, visit Cisco Marketplace.
- To obtain general networking, training, and certification titles, visit Cisco Press.
- To find warranty information for a specific product or product family, access Cisco Warranty Finder.

CHAPTER 3

# C8400 Series Secure Routers

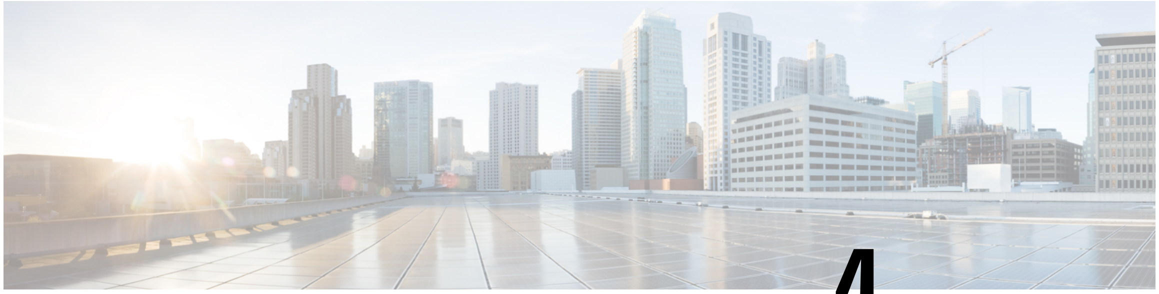
C8400 Series Secure Routers significantly increases services performance, router throughput, and router scale at lower costs.

This document covers configuration details for these models:

- C8475-G2
- C8455-G2

*Table 1: C8400 Series Secure Routers*

| Features | C8475-G2 | C8455-G2 |
|---|---|---|
| Support for In-Service Software Upgrade (ISSU) | Not supported | Not supported |
| Support for Unified Threat Defense(UTD) | Supported | Supported |
| Support for Fast Reroute(FRR) | Supported | Supported |
| Dynamic allocation of cores | Supported | Supported |



CHAPTER 4

# Software packaging and architecture

This chapter discusses the packaging and architecture of Cisco C8400 Series Secure Routers.

## Consolidated packages

A consolidated package is a single image composed of individual software subpackage files. A single consolidated package file is a bootable file, and the Cisco C84XX Series Platforms can be run using the consolidated package.

Each consolidated package also contains a provisioning file. A provisioning file is used for booting in cases where the individual subpackages are extracted from the consolidated package, or optional subpackages are used to run the router.

- For each version of consolidated package, the RPIOS subpackage is always different among consolidated packages.
- A consolidated package file is a bootable file. If the router is configured to run using the complete consolidated package, boot the router using the consolidated package file. If the router is configured to run using individual subpackages, boot the router using the provisioning file. For additional information on the advantages and disadvantages of running a complete consolidated package, see the *Running the Cisco Catalyst 8500 Series Edge Platforms: An Overview* section .
- If you need to install optional subpackages, then you must boot the router using the individual subpackage provisioning file method.

## Individual software subpackages

This section provides an overview of subpackages and the purpose of each individual subpackage. Every consolidated package will have all of these individual subpackages.

*Table 2: Individual SubPackages*

| SubPackage | Purpose |
|---|---|
| RPBase | Provides the operating system software for the Route Processor. |
| RPControl | Controls the control plane processes that interface between the IOS process and the rest of the platform. |
| RPAccess | Exports processing of restricted components, such as Secure Socket Layer (SSL), Secure Shell (SSH), and other security features. |
| RPIOS | Provides the Cisco IOS kernel, which is where IOS features are stored and run.<br>Each consolidated package has a different RPIOS. |

- Individual subpackages cannot be downloaded from Cisco.com individually. To get these individual subpackages, users must download a consolidated package and then extract the individual subpackages from the consolidated package using the command-line interface.
- If the router is being run using individual subpackages instead of being run using a complete consolidated package, the router must be booted using a provisioning file. A provisioning file is included in all consolidated packages and is extracted from the image along with the individual subpackages whenever individual subpackages are extracted

# Provision files

**Note** You must use the provisioning files to manage the boot process if you need to install optional subpackages.

Provisioning files manage the boot process when the device is configured to run using individual subpackages or optional subpackages. When individual subpackages are being used to run the device, it is configured to boot the provisioning file. The provisioning file manages the bootup of each individual subpackage.

Provisioning files are extracted automatically when individual subpackage files are extracted from a consolidated package.

Provisioning files are not necessary for running the router using the complete consolidated package; if you want to run the router using the complete consolidated package, simply boot the router using the consolidated package file.

- Each consolidated package contains two provisioning files. One of the provisioning files is always named “packages.conf”, while the other provisioning file will have a name based on the consolidated package naming structure. In any consolidated package, both provisioning files perform the exact same function.
- In most cases, the “packages.conf” provisioning file should be used to boot the router. Configuring the router to boot using this file is generally easier because the router can be configured to boot using “packages.conf”, so no changes have to be made to the boot statement when Cisco IOS XE is upgraded (the **boot system** *file-system*:**packages.conf** configuration command can remain unmodified before and after an upgrade).

- The provisioning file and individual subpackage files must be kept in the same directory. The provisioning file does not work properly if the individual subpackage files are in other directories.
- The provisioning filename can be renamed; the individual subpackage filenames cannot be renamed.
- After placing the provisioning file and the individual subpackage files in a directory and booting the router, it is highly advisable not to rename, delete, or alter any of these files. Renaming, deleting, or altering the files can lead to unpredictable router problems and behaviors.

# Upgrade field programmable hardware devices

A hardware programmable package file used to upgrade field programmable hardware devices is released as needed . A package file is provided for the field programmable device to customers in cases where a field upgrade is required. If the device contains an incompatible version of the hardware programmable firmware, then that firmware may need to be upgraded.

Generally an upgrade is only necessary in cases where a system message indicates one of the field programmable devices on the device needs an upgrade or a Cisco technical support representative suggests an upgrade.

# Processes

Cisco IOS XE has numerous components that run entirely as separate processes . This modular architecture increases network resiliency by distributing operating responsibility among separate processes rather than relying on Cisco IOS software for all operations.

## IOS process

The Cisco C8400 Series Secure Router run on a distributed software architecture that moves many operating system responsibilities out of the IOS process. In this architecture, IOS, which previously was responsible for almost all of the internal software processes, now runs as one of many Linux processes while allowing other Linux processes to share responsibility for running the router. This architecture allows for better allocation of memory so the router can run more efficiently.

## Dual IOS processes

The Cisco C8400 Series Routers run on a dual IOS process model that allows for increased high availability at all times.

Using SSO, a second IOS process can also be enabled . On a router configured with dual Route Processors, the second IOS process runs on the standby Route Processor.

The state of these dual IOS processes can be checked by entering the **show platform** command. A second IOS process increases fault tolerance. In the event of an active IOS failure, the second IOS process immediately becomes the active IOS process with little to no service disruption.

## File systems

This table provides a list of file systems that can be seen on the Cisco C8400 Series Secure Router.

*Table 3: File systems*

| File System | Description |
|---|---|
| bootflash: | The boot flash memory file system on the active RP. |
| cns: | The Cisco Networking Services file directory. |
| harddisk: | The hard disk file system on the active RP. |
| nvram: | Router NVRAM. You can copy the startup configuration to NVRAM or from NVRAM. |
| obfl: | The file system for Onboard Failure Logging files. |
| system: | The system memory file system, which includes the running configuration. |
| tar: | The archive file system. |
| tmpsys: | The temporary system files file system. |
| usb[0-1]: | The Universal Serial Bus (USB) flash drive file systems on the router. |

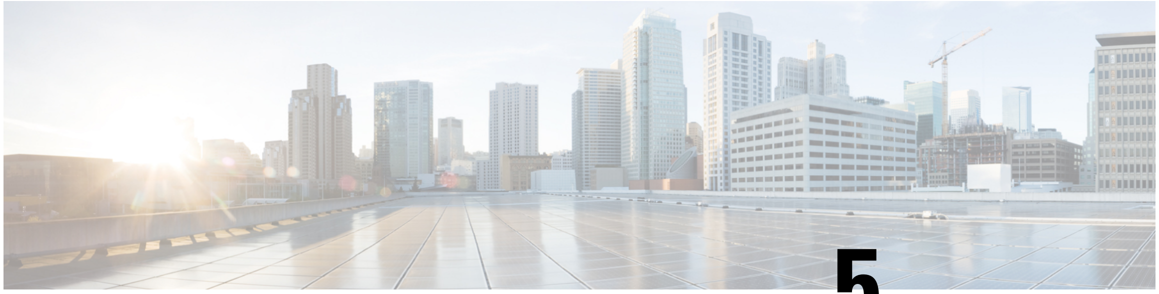
If you run into a file system not listed in the above table, enter the**?** help option or see the **copy** command reference for additional information on that file system.

# Autogenerated file directories and files

This table provides a list and descriptions of autogenerated files :

*Table 4: Autogenerated files*

| File or Directory | Description |
|---|---|
| crashinfo files | A crashinfo file may appear in the bootflash: or harddisk: file system.<br>These files provide descriptive information of a crash and may be useful for tuning or troubleshooting purposes, but the files are not part of router operations and can be erased without impacting the functioning of the router. |
| core directory | The storage area for.core files.<br>If this directory is erased, it will automatically regenerate itself at bootup. The .core files in this directory can be erased without impacting any router functionality, but the directory itself should not be erased. |
| lost+found directory | This directory is created on bootup if a system check is performed. Its appearance is completely normal and does not indicate any issues with the router. |
| tracelogs directory | The storage area for trace files.<br>Trace files are useful for troubleshooting. Trace files, however, are not part of router operations and can be erased without impacting the router’s performance. |



CHAPTER 5

# Deploy IOS-XE and SDWAN

## Overview

You can use the universalk9 image to deploy both Cisco IOS XE SD-WAN and Cisco IOS XE on Cisco IOS XE devices. This helps in seamless upgrades of both the SD-WAN and non SD-WAN features and deployments.

## Restrictions

## Autonomous or Controller Mode

Access the Cisco IOS XE and Cisco IOS XE SD-WAN functionality through Autonomous and Controller execution modes, respectively. The Autonomous mode is the default mode for the routers and includes the Cisco IOS XE functionality. To access Cisco IOS XE SD-WAN functionality switch to the Controller mode.

For more information, see https://www.cisco.com/c/en/us/td/docs/routers/sdwan/configuration/sdwan-xe-gs-book/install-upgrade-17-2-later.html#Cisco_Concept.dita_42020dbf-1563-484f-8824-a0b3f468e787

## Switch Between Controller and Autonomous Modes

The default mode of the device is autonomous mode. Use the **controller-mode** command in Privileged EXEC mode to switch between controller and autonomous modes.

The **controller-mode enable** command switches the device to controller mode

The **controller-mode disable** command switches the device to autonomous mode

For information see Cisco SD-WAN Getting Started Guide

# PnP Discovery Process

You can use the existing Plug and Play Workflow to determine the mode of the device.

The PnP-based discovery process determines the mode in which the device operates, based on the controller discovery and initiates a mode change, if required. This discovery is based on the controller profile attached to the device UID in the smart account/virtual account. The mode change results in a reboot of the device. Once reboot is complete, the device performs appropriate discovery process.

Plug and Play (PnP) deployment include the following discovery process scenarios:

| Boot up Mode | Discovery Process | Mode Change |
|---|---|---|
| Autonomous | Plug and Play Connect Discovery or on-premise plug and play server discovery | No Mode change |
| Controller | Plug and Play Connect Discovery or on-premise plug and play server discovery | Mode change to autonomous mode |

CHAPTER 6

# Use Cisco IOS XE software

This chapter provides information to prepare you to configure the Cisco C8400 Series Secure Router :

# Access the CLI using a router console

The following sections describe how to access the command-line interface (CLI) using a directly-connected console or by using Telnet or a modem to obtain a remote console:

## Access the CLI using a directly-connected console

This section describes how to connect to the console port on the router and use the console interface to access the CLI.

The console port on a Cisco C8400 Series Secure Router is an EIA/TIA-232 asynchronous, serial connection with no flow control and an RJ-45 connector. The console port is located on the front panel of each router.

## Connect to the router console using telnet

Before you can access the router remotely using Telnet from a TCP/IP network, you need to configure the router to support virtual terminal lines (vtys) using the **line vty** global configuration command. You also should configure the vtys to require login and specify a password.

**Note** To prevent disabling login on the line, be careful that you specify a password with the **password** command when you configure the **login** line configuration command. If you are using authentication, authorization, and accounting (AAA), you should configure the **login authentication** line configuration command. To prevent disabling login on the line for AAA authentication when you configure a list with the **login authentication** command, you must also configure that list using the **aaa authentication login** global configuration command. For more information about AAA services, see the *Cisco IOS XE Security Configuration Guide,* and the *Cisco IOS Security Command Reference Guide* .

In addition, before you can make a Telnet connection to the router, you must have a valid host name for the router or have an IP address configured on the router. For more information about requirements for connecting to the router using Telnet, information about customizing your Telnet services, and using Telnet key sequences, see the *Cisco IOS Configuration Fundamentals Configuration Guide.*

# Understand command mode

The command modes available in the traditional Cisco IOS CLI are exactly the same as the command modes available in Cisco IOS XE.

You use the CLI to access Cisco IOS XE software. Because the CLI is divided into many different modes, the commands available to you at any given time depend on the mode that you are currently in. Entering a question mark (**?**) at the CLI prompt allows you to obtain a list of commands available for each command mode.

When you log in to the CLI, you are in user EXEC mode. User EXEC mode contains only a limited subset of commands. To have access to all commands, you must enter privileged EXEC mode, normally by using a password. From privileged EXEC mode, you can issue any EXEC command—user or privileged mode—or you can enter global configuration mode. Most EXEC commands are one-time commands. For example, **show** commands show important status information, and **clear** commands clear counters or interfaces. The EXEC commands are not saved when the software reboots.

Configuration modes allow you to make changes to the running configuration. If you later save the running configuration to the startup configuration, these changed commands are stored when the software is rebooted. To enter specific configuration modes, you must start at global configuration mode. From global configuration mode, you can enter interface configuration mode and a variety of other modes, such as protocol-specific modes.

ROM monitor mode is a separate mode used when the Cisco IOS XE software cannot load properly. If a valid software image is not found when the software boots or if the configuration file is corrupted at startup, the software might enter ROM monitor mode.

The following table describes how to access and exit various common command modes of the Cisco IOS XE software. It also shows examples of the prompts displayed for each mode.

*Table 5: Accessing and Exiting Command Modes*

| Command Mode | Access Method | Prompt | Exit Method |
|---|---|---|---|
| User EXEC | Log in. | `Router>` | Use the **logout** command. |

| Command Mode | Access Method | Prompt | Exit Method |
|---|---|---|---|
| Privileged EXEC | From user EXEC mode, use the **enable** EXEC command. | `Router#` | To return to user EXEC mode, use the **disable** command. |
| Global configuration | From privileged EXEC mode, use the **configure terminal** privileged EXEC command. | `Router(config)#` | To return to privileged EXEC mode from global configuration mode, use the **exit** or **end** command. |
| Interface configuration | From global configuration mode, specify an interface using an **interface** command. | `Router(config-if)#` | To return to global configuration mode, use the **exit** command.<br>To return to privileged EXEC mode, use the **end** command. |
| Diagnostic | The router boots up or accesses diagnostic mode in the following scenarios:<br>In some cases, diagnostic mode will be reached when the IOS process or processes fail. In most scenarios, however, the router will.<br>A user-configured access policy was configured using the **transport-map** command that directed the user into diagnostic mode. See the Chapter 4, “Console Port, Telnet, and SSH Handling” of this book for information on configuring access policies.<br>The router was accessed using a Route Processor auxiliary port.<br>A break signal (**Ctrl-C**, **Ctrl-Shift-6**, or the **send break** command ) was entered and the router was configured to go into diagnostic mode when the break signal was received. | `Router(diag)#` | If the IOS process failing is the reason for entering diagnostic mode, the IOS problem must be resolved and the router rebooted to get out of diagnostic mode.<br>If the router is in diagnostic mode because of a transport-map configuration, access the router through another port or using a method that is configured to connect to the Cisco IOS CLI.<br>If the router is accessed through the Route Processor auxiliary port, access the router through another port. Accessing the router through the auxiliary port is not useful for customer purposes anyway. |
| ROM monitor | From privileged EXEC mode, use the **reload** EXEC command. Press the **Break** key during the first 60 seconds while the system is booting. | `>` | To exit ROM monitor mode, use the **continue** command. |

# Get help

Entering a question mark (**?**) at the CLI prompt displays a list of commands available for each command mode. You can also get a list of keywords and arguments associated with any command by using the context-sensitive help feature.

To get help specific to a command mode, a command, a keyword, or an argument, use one of the commands listed in the following table:

*Table 6: Help Commands and Purpose*

| Command | Purpose |
|---|---|
| help | Provides a brief description of the help system in any command mode. |
| **abbreviated-command-entry?** | Provides a list of commands that begin with a particular character string. (No space between command and question mark.) |
| **abbreviated-command-entry<Tab>** | Completes a partial command name. |
| **?** | Lists all commands available for a particular command mode. |
| **command ?** | Lists the keywords or arguments that you must enter next on the command line. (Space between command and question mark.) |

# Finding command options

This section provides an example of how to display syntax for a command. The syntax can consist of optional or required keywords and arguments. To display keywords and arguments for a command, enter a question mark (**?**) at the configuration prompt or after entering part of a command followed by a space. The Cisco IOS XE software displays a list and brief description of available keywords and arguments. For example, if you were in global configuration mode and wanted to see all the keywords or arguments for the **arap** command, you would type **arap ?**.

The <cr> symbol in command help output stands for "carriage return." On older keyboards, the carriage return key is the Return key. On most modern keyboards, the carriage return key is the Enter key. The <cr> symbol at the end of command help output indicates that you have the option to press **Enter** to complete the command and that the arguments and keywords in the list preceding the <cr> symbol are optional. The <cr> symbol by itself indicates that no more arguments or keywords are available and that you must press **Enter** to complete the command.

The following table shows examples of how you can use the question mark (**?**) to assist you in entering commands.

*Table 7: Finding Command Options*

| Command | Comment |
|---|---|
| `Router>` **`enable`**<br>`Password:` *`<password>`*<br>`Router#` | Enter the **enable** command and password to access privileged EXEC commands. You are in privileged EXEC mode when the prompt changes to a "# " from the "> "; for example, Router> to Router# . |
| `Router#`<br>**`configure terminal`**<br>`Enter configuration commands, one per line. End with CNTL/Z.`<br>`Router(config)#` | Enter the **configure terminal** privileged EXEC command to enter global configuration mode. You are in global configuration mode when the prompt changes to Router(config)# . |

| Command | Comment |
|---|---|
| `Router(config)# interface GigabitEthernet 0/0/0 ?` | Enter interface configuration mode by specifying the serial interface that you want to configure using the **interface GigabitEthernet 0/0/0** global configuration command.<br>Enter **?** to display what you must enter next on the command line. In this example, you must enter the serial interface slot number and port number, separated by a forward slash.<br>When the <cr> symbol is displayed, you can press Enter to complete the command.<br>You are in interface configuration mode when the prompt changes to Router(config-if)# . |
| `Router(config-if)# ?`<br>`Interface configuration commands:`<br>`  .`<br>`  .`<br>`  .`<br>`  ip                    Interface Internet Protocol`<br>`config commands`<br>`  keepalive             Enable keepalive`<br>`  lan-name              LAN Name command`<br>`  llc2                  LLC2 Interface Subcommands`<br>`  load-interval         Specify interval for load`<br>`calculation for an`<br>`                        interface`<br>`  locaddr-priority      Assign a priority group`<br>`  logging              Configure logging for interface`<br><br>`  loopback              Configure internal loopback on`<br>` an interface`<br>`  mac-address           Manually set interface MAC`<br>`address`<br>`  mls                   mls router sub/interface`<br>`commands`<br>`  mpoa                  MPOA interface configuration`<br>`commands`<br>`  mtu                   Set the interface Maximum`<br>`Transmission Unit (MTU)`<br>`  netbios               Use a defined NETBIOS access`<br>`list or enable`<br>`                        name-caching`<br>`  no                    Negate a command or set its`<br>`defaults`<br>`  nrzi-encoding         Enable use of NRZI encoding`<br>`  ntp                   Configure NTP`<br>`  .`<br>`  .`<br>`  .`<br>`Router(config-if)#` | Enter **?** to display a list of all the interface configuration commands available for the serial interface. This example shows only some of the available interface configuration commands. |

<table>
<tr><th>Command</th><th>Comment</th></tr>
<tr><td>

```
Router(config-if)# ip ?
Interface IP configuration subcommands:
  access-group        Specify access control for
packets
  accounting          Enable IP accounting on this
interface
  address             Set the IP address of an
interface
  authentication      authentication subcommands
  bandwidth-percent   Set EIGRP bandwidth limit
  broadcast-address   Set the broadcast address of an
 interface
  cgmp                Enable/disable CGMP
  directed-broadcast  Enable forwarding of directed
broadcasts
  dvmrp               DVMRP interface commands
  hello-interval      Configures IP-EIGRP hello
interval
  helper-address      Specify a destination address
for UDP broadcasts
  hold-time           Configures IP-EIGRP hold time
  .
  .
  .
Router(config-if)# ip
```

</td><td>

Enter the command that you want to configure for the interface. This example uses the **ip** command.

Enter **?** to display what you must enter next on the command line. This example shows only some of the available interface IP configuration commands.

</td></tr>
<tr><td>

```
Router(config-if)# ip address ?
  A.B.C.D             IP address
  negotiated          IP Address negotiated over PPP
Router(config-if)# ip address
```

</td><td>

Enter the command that you want to configure for the interface. This example uses the **ip address** command.

Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP address or the **negotiated** keyword.

A carriage return (<cr>) is not displayed; therefore, you must enter additional keywords or arguments to complete the command.

</td></tr>
<tr><td>

```
Router(config-if)# ip address 172.16.0.1 ?
  A.B.C.D             IP subnet mask
Router(config-if)# ip address 172.16.0.1
```

</td><td>

Enter the keyword or argument that you want to use. This example uses the 172.16.0.1 IP address.

Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP subnet mask.

A <cr> is not displayed; therefore, you must enter additional keywords or arguments to complete the command.

</td></tr>
<tr><td>

```
Router(config-if)# ip address 172.16.0.1 255.255.255.0
 ?
  secondary          Make this IP address a secondary
 address
  <cr>
Router(config-if)# ip address 172.16.0.1 255.255.255.0
```

</td><td>

Enter the IP subnet mask. This example uses the 255.255.255.0 IP subnet mask.

Enter **?** to display what you must enter next on the command line. In this example, you can enter the **secondary** keyword, or you can press **Enter**.

A <cr> is displayed; you can press **Enter** to complete the command, or you can enter another keyword.

</td></tr>
<tr><td>

```
Router(config-if)# ip address 172.16.0.1 255.255.255.0
Router(config-if)#
```

</td><td>

In this example, **Enter** is pressed to complete the command.

</td></tr>
</table>

# Use the no and default forms of commands

Almost every configuration command has a **no** form. In general, use the **no** form to disable a function. Use the command without the **no** keyword to re-enable a disabled function or to enable a function that is disabled by default. For example, IP routing is enabled by default. To disable IP routing, use the **no ip routing** command; to re-enable IP routing, use the **ip routing** command. The Cisco IOS software command reference publications provide the complete syntax for the configuration commands and describe what the **no** form of a command does.

Many CLI commands also have a **default** form. By issuing the command **default** *command-name* , you can configure the command to its default setting. The Cisco IOS software command reference publications describe the function of the **default** form of the command when the **default** form performs a different function than the plain and **no** forms of the command. To see what default commands are available on your system, enter **default ?** in the appropriate command mode.

# Save configuration changes

Use the **copy running-config startup-config** command to save your configuration changes to the startup configuration so that the changes will not be lost if the software reloads or a power outage occurs. For example:

```
Router# copy running-config startup-config
Building configuration...
```

It might take a minute or two to save the configuration. After the configuration has been saved, the following output appears:

```
[OK]
Router#
```

This task saves the configuration to NVRAM.

# Managing Configuration Files

On the Cisco C84XX Series Platforms , the startup configuration file is stored in the nvram: file system and the running-configuration files are stored in the system: file system. This configuration file storage setup is not unique to the Cisco C84XX Series Platforms and is used on several Cisco router platforms.

As a matter of routine maintenance on any Cisco router, users should backup the startup configuration file by copying the startup configuration file from NVRAM onto one of the router's other file systems and, additionally, onto a network server. Backing up the startup configuration file provides an easy method of recovering the startup configuration file in the event the startup configuration file in NVRAM becomes unusable for any reason.

The **copy** command can be used to backup startup configuration files. The following examples show the startup configuration file in NVRAM being backed up:

### Example 1: Copying a Startup Configuration File to Bootflash

```
Router# dir bootflash:
```

```
Directory of bootflash:/
  11 drwx 16384 Sep 18 2020 15:16:35 +00:00 lost+found
1648321 drwx 4096 Oct 22 2020 12:08:47 +00:00 .installer
97921 drwx 4096 Sep 18 2020 15:18:00 +00:00 .rollback_timer
12 -rw- 1910 Oct 22 2020 12:09:09 +00:00 mode_event_log
1566721 drwx 4096 Sep 18 2020 15:33:23 +00:00 core
1215841 drwx 4096 Oct 22 2020 12:09:48 +00:00 .prst_sync
1289281 drwx 4096 Sep 18 2020 15:18:18 +00:00 bootlog_history
13 -rw- 133219 Oct 22 2020 12:09:34 +00:00 memleak.tcl
14 -rw- 20109 Sep 18 2020 15:18:39 +00:00 ios_core.p7b
15 -rwx 1314 Sep 18 2020 15:18:39 +00:00 trustidrootx3_ca.ca
391681 drwx 4096 Oct 6 2020 15:08:54 +00:00 .dbpersist
522241 drwx 4096 Sep 18 2020 15:32:59 +00:00 .inv
783361 drwx 49152 Oct 27 2020 08:36:44 +00:00 tracelogs
832321 drwx 4096 Sep 18 2020 15:19:17 +00:00 pnp-info
1207681 drwx 4096 Sep 18 2020 15:19:20 +00:00 onep
750721 drwx 4096 Oct 22 2020 12:09:57 +00:00 license_evlog
946561 drwx 4096 Sep 18 2020 15:19:24 +00:00 guest-share
383521 drwx 4096 Sep 18 2020 15:34:13 +00:00 pnp-tech
1583041 drwx 4096 Oct 22 2020 11:27:38 +00:00 EFI
16 -rw- 34 Oct 6 2020 13:56:03 +00:00 pnp-tech-time
17 -rw- 82790 Oct 6 2020 13:56:14 +00:00 pnp-tech-discovery-summary
18 -rw- 8425 Oct 6 2020 15:09:18 +00:00 1g_snake
19 -rw- 6858 Oct 7 2020 10:53:21 +00:00 100g_snake
20 -rw- 4705 Oct 22 2020 13:01:54 +00:00 startup-config

26975526912 bytes total (25538875392 bytes free)
Router# copy nvram:startup-config bootflash:
Destination filename [startup-config]?
3517 bytes copied in 0.647 secs (5436 bytes/sec)
```

### Example 2: Copying a Startup Configuration File to USB Flash Disk

```
Router# dir usb0:
Directory of usb0:/
43261 -rwx 208904396 Oct 27 2020 14:10:20 -07:00
c8000aep-universalk9.17.02.01.SPA.bin
255497216 bytes total (40190464 bytes free)
Router# copy nvram:startup-config usb0:
Destination filename [startup-config]?
3172 bytes copied in 0.214 secs (14822 bytes/sec)
Router# dir usb0:
Directory of usb0:/
43261 -rwx 208904396 Oct 27 2020 14:10:20 -07:00
c8000aep-universalk9.17.02.01.SPA.bin
15:40:45 -07:00 startup-config255497216 bytes total (40186880 bytes free)
```

### Example 3: Copying a Startup Configuration File to a TFTP Server

```
Router# copy bootflash:startup-config tftp:
Address or name of remote host []? 172.17.16.81
Destination filename [pe24_asr-1002-confg]? /auto/tftp-users/user/startup-config
!!
3517 bytes copied in 0.122 secs (28828 bytes/sec)
```

For more detailed information on managing configuration files, see the *Managing Configuration Files* section in the *Cisco IOS XE Configuration Fundamentals Configuration Guide*

# Dynamic allocation of cores

Dynamic core allocations provide flexibility for users to leverage the CPU cores for different services and/or CEF/IPSec performances. The Cisco C8400 Series Secure Routers are equipped with either 24-cores or 16-cores and have the flexibility to allocate cores into the service plane from the data plane. The core allocation is based on the customer configuration of the different services available on these platforms.

You can use the **platform resource { service-plane-heavy | data-plane-heavy }** command to adjust the cores across service plane and data plane. However, you have to reboot the device for the configured profile to take effect.

```
Router(config)# platform resource { service-plane-heavy | data-plane-heavy }
```

**Note** By default, when a device boots up, the core allocation is data-plane-heavy for Autonomous mode and service-plane-heavy for Controller mode.

This command output shows the CPU cores allocation on C8475-G2:

```
Router# show platform software cpu allocation

CPU alloc information:

  Control plane cpu alloc: 0-1

  Data plane cpu alloc: 0,2-23

  Service plane cpu alloc: 0

  Slow control plane cpu alloc:
  Template used: default-data_plane_heavy
```

This command output shows the CPU cores allocation on C8455-G2:

```
Router# show platform software cpu allocation

CPU alloc information:

  Control plane cpu alloc: 0-1

  Data plane cpu alloc: 0,2-15

  Service plane cpu alloc: 0

  Slow control plane cpu alloc:
  Template used: default-data_plane_heavy
```

# Filter the output of the show and more commands

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

To use this functionality, enter a **show** or **more** command followed by the "pipe" character ( | ); one of the keywords **begin**, **include**, or **exclude**; and a regular expression on which you want to search or filter (the expression is case sensitive):

**show** *command* | {**append** | **begin** | **exclude** | **include** | **redirect** | **section** | **tee**} *regular-expression*

The output matches certain lines of information in the configuration file. The following example illustrates how to use output modifiers with the **show interface** command when you want the output to include only lines in which the expression “protocol” appears:

```
Router# show interface | include protocol
FastEthernet0/0 is up, line protocol is up
Serial4/0 is up, line protocol is up
Serial4/1 is up, line protocol is up
Serial4/2 is administratively down, line protocol is down
Serial4/3 is administratively down, line protocol is down
```

# Disable front-panel USB ports

## SUMMARY STEPS

1. enable
2. configure terminal
3. platform usb disable
4. end
5. write memory

## DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | enable<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | configure terminal<br>**Example:**<br>`Device# configure terminal` | Enters global configurationmode. |
| **Step 3** | platform usb disable<br>**Example:**<br>`Device # platform usb disable` | Disables USB ports.<br>**Note**<br>For re-enabling of front-panel usb ports, use the no form of command (**no platform usb disable**). |
| **Step 4** | end<br>**Example:**<br>`Device(config-router-af)# end` | Exits address family configuration mode and returns to privileged EXEC mode. |
| **Step 5** | write memory | Save to configuration. |

| | Command or Action | Purpose |
|---|---|---|
| | | **Example: Disabling Front-Panel USB Ports On Autonomous, Controller and vManage Mode**<br>The following example shows the configuration of disabling front-panel USB ports on autonomous, controller and vManage mode:<br>`13RU#sh run \| inc usb`<br>`platform usb disable`<br>`13RU#`<br>To verify the disabling of USB ports on your device, use the following show command:<br>**show platform usb status**<br>`Router#show platform usb status`<br>`USB enabled`<br>`Router#` |

# Power off a router

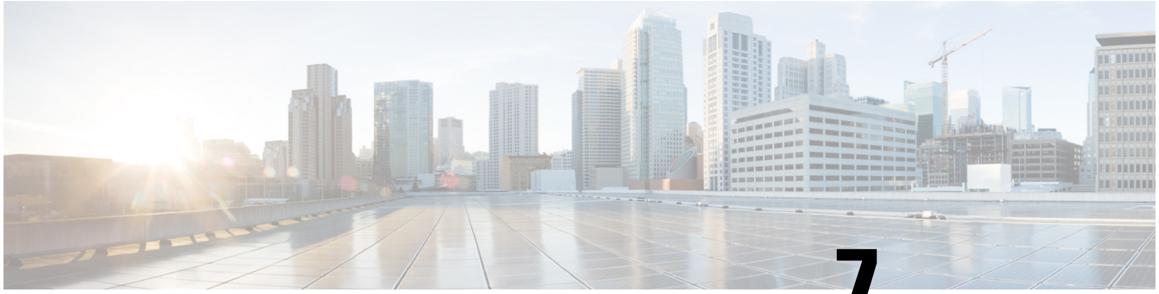
Before you turn off a power supply, make certain the chassis is grounded and you perform a soft shutdown on the power supply. Not performing a soft shutdown will often not harm the router, but may cause problems in certain scenarios.

To perform a soft shutdown before powering off the router, enter the **reload** command to halt the system and then wait for ROM Monitor to execute before proceeding to the next step.

The following screenshot shows an example of this process:

```
Router# reload
Proceed with reload? [confirm]
...(Some messages are omitted here)
Initializing Hardware...
```

Place the power supply switch in the Off position after seeing this message.



CHAPTER 7

# Bay configuration

## Bay configuration for C8455-G2

| Bay Number | EPA | Port Configuration | Port Configuration |
|---|---|---|---|
| Bay 0 | 1GE | 8x 1GE SFP | 0/0/0<br>0/0/1<br>0/0/2<br>0/0/3<br>0/0/4<br>0/0/5<br>0/0/6<br>0/0/7 |
| | 1/10GE | 2x 10GE SFP+ | 0/0/8<br>0/0/9 |
| | 10/25GE | 2x 25G SFP28 | 0/0/10<br>0/0/11 |

# Bay configuration for C8475-G2

| Bay Number | EPA | Port Configuration | Port Configuration |
|---|---|---|---|
| Bay 0 | 1GE | 8x 1GE SFP | 0/0/0<br>0/0/1<br>0/0/2<br>0/0/3<br>0/0/4<br>0/0/5<br>0/0/6<br>0/0/7 |
| | 1/10GE | 8x 10GE SFP+ | 0/0/8<br>0/0/9<br>0/0/10<br>0/0/11<br>0/0/12<br>0/0/13<br>0/0/14<br>0/0/15 |
| | 10/25GE | 4x 25G SFP28 | 0/0/16<br>0/0/17<br>0/0/18<br>0/0/19 |

CHAPTER 8

# Consolidated package management

This chapter discusses how consolidated packages are managed and are used to run the Cisco C8400 Secure Series Routers.

# Run a consolidated package

The Cisco C8400 Series Secure Routers can be configured to run using a consolidated package.

When the router is configured to run using a consolidated package, the entire consolidated package file is copied onto the router or accessed by the router via TFTP or another network transport method. The router runs using the consolidated package file.

A consolidated package can be booted and utilized using TFTP or another network transport method.Running the router using a consolidated package may be the right method of running the router in certain networking environments.

The consolidated package should be stored on bootflash:, usb[0-1]:, or a remote file system when this method is used to run the router.

## Managing and Configuring the Router to Run Using Consolidated Packages

This section discusses the following topics:

## Quick start software upgrade

The following instructions provide a quick start version of upgrading the software. These instructions assume you have access to the consolidated package and that the files will be stored in a bootflash: file system and has enough room for the file or files.

For more detailed installation examples, see the other sections of this chapter.

To upgrade the software using a quick start version, perform the following steps:

### SUMMARY STEPS

1. Copy the consolidated package into bootflash: using the **copy** *URL-to-image* **bootflash:** command.

2. Enter the **dir bootflash:** command to verify your consolidated package in the directory.
3. Set up the boot parameters for your boot. Set the configuration register to 0x2 by entering the **config-register 0x2102** global configuration command, and enter the **boot system flash bootflash:***image-name*
4. Enter **copy running-config startup-config** to save your configuration.
5. Enter the **reload** command to reload the router and finish the boot. The upgraded software should be running when the reload completes.

#### DETAILED STEPS

#### Procedure

**Step 1** Copy the consolidated package into bootflash: using the **copy** *URL-to-image* **bootflash:** command.

**Step 2** Enter the **dir bootflash:** command to verify your consolidated package in the directory.

**Step 3** Set up the boot parameters for your boot. Set the configuration register to 0x2 by entering the **config-register 0x2102** global configuration command, and enter the **boot system flash bootflash:***image-name*

**Step 4** Enter **copy running-config startup-config** to save your configuration.

**Step 5** Enter the **reload** command to reload the router and finish the boot. The upgraded software should be running when the reload completes.

# Install the software using install commands

From Cisco IOS XE 17.15.3a, Cisco 8300 Series Secure Routers are shipped in install mode by default. Users can boot the platform, and upgrade to Cisco IOS XE software versions using a set of **install** commands.

## Restrictions

- ISSU is not covered in this feature.
- Install mode requires a reboot of the system.

## Information about installing the software using install commands

From Cisco IOS XE 17.15.3a release, for routers shipped in install mode, a set of **install** commands can be used for starting, upgrading and downgrading of platforms in install mode. This update is applicable to the Cisco 8300 Series Secure Routers.

The table describes the differences between Bundle mode and Install mode:

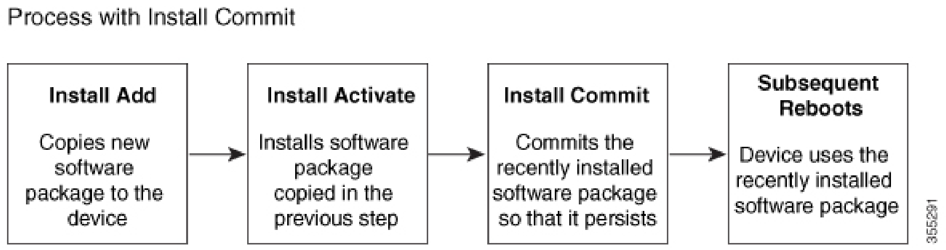
*Table 8: Bundle mode vs Install mode*

| Bundle Mode | Install Mode |
|---|---|
| This mode provides a consolidated boot process, using local (hard disk, flash) or remote (TFTP) .bin image.<br>**Note**<br>Bundle boot from USB and TFTP Boot is not supported. | This mode uses the local (bootflash) packages.conf file for the boot process. |
| This mode uses a single .bin file. | .bin file is replaced with expanded .pkg files in this mode. |
| CLI:<br>`#boot system file <filename>` | CLI:<br>`#install add file bootflash: [activate commit]` |
| To upgrade in this mode, point the boot system to the new image. | To upgrade in this mode, use the **install** commands. |
| Image Auto-Upgrade: When a new Field-Replaceable Unit (FRU) is inserted in a modular chassis, manual intervention is required to get the new FRU running with the same version as the active FRUs. | Image Auto-Upgrade: When a new FRU is inserted in a modular chassis, the joining FRU is auto-upgraded to the image version in sync with the active FRUs. |
| Rollback: Rollback to the previous image with multiple Software Maintenance Updates (SMUs) may require multiple reloads. | Rollback: Enables rollback to an earlier version of Cisco IOS XE software, including multiple patches in single reload. |

# Install mode process flow

The install mode process flow comprises three commands to perform installation and upgrade of software on platforms–**install add**, **install activate**, and **install commit**.

The flow chart explains the install process with **install** commands:


Process with Install Commit
Install Add
Copies new software package to the device
Install Activate
Installs software package copied in the previous step
Install Commit
Commits the recently installed software package so that it persists
Subsequent Reboots
Device uses the recently installed software package
355291

The **install add** command copies the software package from a local or remote location to the platform. The location can be FTP, HTTP, HTTPs, or TFTP. The command extracts individual components of the .package file into subpackages and packages.conf files. It also validates the file to ensure that the image file is specific to the platform on which it is being installed.

The **install activate** command performs the required validations and provisions the packages previously added using the **install add** command. It also triggers a system reload.

The **install commit** command confirms the packages previously activated using the **install activate** command, and makes the updates persistent over reloads.

**Note** Installing an update replaces any previously installed software image. At any time, only one image can be installed in a device.

A list install commands available:

***Table 9: List of install commands***

| Command | Syntax | Purpose |
|---|---|---|
| **install add** | **install add file** *location:filename.bin* | Copies the contents of the image, package, and SMUs to the software repository. File location may be local or remote. This command does the following:<br>• Validates the file–checksum, platform compatibility checks, and so on.<br>• Extracts individual components of the package into subpackages and packages.conf<br>• Copies the image into the local inventory and makes it available for the next steps. |
| **install activate** | **install activate** | Activates the package added using the **install add** command.<br>• Use the **show install summary** command to see which image is inactive. This image will get activated.<br>• System reloads on executing this command. Confirm if you want to proceed with the activation. Use this command with the **prompt-level none** keyword to automatically ignore any confirmation prompts. |

| Command | Syntax | Purpose |
|---|---|---|
| **(install activate) auto abort-timer** | **install activate auto-abort timer** *<30-1200>* | The **auto-abort timer** starts automatically, with a default value of 120 minutes. If the **install commit** command is not executed within the time provided, the activation process is terminated, and the system returns to the last-committed state.<br>• You can change the time value while executing the **install activate** command.<br>• The **install commit** command stops the timer, and continues the installation process.<br>• The **install activate auto-abort timer stop** command stops the timer without committing the package.<br>• Use this command with the **prompt-level none** keyword to automatically ignore any confirmation prompts.<br>• This command is valid only in the three-step install variant. |
| **install commit** | **install commit** | Commits the package activated using the **install activate** command, and makes it persistent over reloads.<br>• Use the **show install summary** command to see which image is uncommitted. This image will get committed. |

| Command | Syntax | Purpose |
|---|---|---|
| **install abort** | **install abort** | Terminates the installation and returns the system to the last-committed state.<br>• This command is applicable only when the package is in activated status (uncommitted state).<br>• If you have already committed the image using the **install commit** command, use the **install rollback to** command to return to the preferred version. |
| **install remove** | **install remove {file** *<filename>* **\| inactive}** | Deletes inactive packages from the platform repository. Use this command to free up space.<br>• **file**: Removes specified files.<br>• **inactive**: Removes all the inactive files. |
| **install rollback to** | **install rollback to {base \| label \| committed \| id}** | Rolls back the software set to a saved installation point or to the last-committed installation point. The following are the characteristics of this command:<br>• Requires reload.<br>• Is applicable only when the package is in committed state.<br>• Use this command with the **prompt-level none** keyword to automatically ignore any confirmation prompts.<br>**Note**<br>If you are performing install rollback to a previous image, the previous image must be installed in install mode. Only SMU rollback is possible in bundle mode. |

| Command | Syntax | Purpose |
|---|---|---|
| **install deactivate** | **install deactivate file** <*filename*> | Removes a package from the platform repository. This command is supported only for SMUs.<br>• Use this command with the **prompt-level none** keyword to automatically ignore any confirmation prompts. |

The following show commands are also available:

*Table 10: List of show Commands*

| Command | Syntax | Purpose |
|---|---|---|
| **show install log** | **show install log** | Provides the history and details of all install operations that have been performed since the platform was booted. |
| **show install package** | **show install package** <*filename*> | Provides details about the .pkg/.bin file that is specified. |
| **show install summary** | **show install summary** | Provides an overview of the image versions and their corresponding install states for all the FRUs.<br>• The table that is displayed will state for which FRUs this information is applicable.<br>• If all the FRUs are in sync in terms of the images present and their state, only one table is displayed.<br>• If, however, there is a difference in the image or state information among the FRUs, each FRU that differs from the rest of the stack is listed in a separate table. |
| **show install active** | **show install active** | Provides information about the active packages for all the FRUs.<br>If there is a difference in the information among the FRUs, each FRU that differs from the rest of the stack is listed in a separate table. |

| Command | Syntax | Purpose |
|---|---|---|
| **show install inactive** | **show install inactive** | Provides information about the inactive packages, if any, for all the FRUs.<br>If there is a difference in the information among the FRUs, each FRU that differs from the rest of the stack is listed in a separate table. |
| **show install committed** | **show install committed** | Provides information about the committed packages for all the FRUs.<br>If there is a difference in the information among the FRUs, each FRU that differs from the rest of the stack is listed in a separate table. |
| **show install uncommitted** | **show install uncommitted** | Provides information about uncommitted packages, if any, for all the FRUs.<br>If there is a difference in the information among the FRUs, each FRU that differs from the rest of the stack is listed in a separate table. |
| **show install rollback** | **show install rollback {point-id \| label}** | Displays the package associated with a saved installation point. |
| **show version** | **show version [rp-slot] [installed [user-interface] \| provisioned \| running]** | Displays information about the current package, along with hardware and platform information. |

# Boot the platform in install mode

You can install, activate, and commit a software package using a single command (one-step install) or multiple separate commands (three-step install).

If the platform is working in bundle mode, the one-step install procedure must be used to initially convert the platform from bundle mode to install mode. Subsequent installs and upgrades on the platform can be done with either one-step or three-step variants.

# One-step installation or converting from bundle mode to install mode

**Note**

- All the CLI actions (for example, add, activate, and so on) are executed on all the available FRUs.
- The configuration save prompt will appear if an unsaved configuration is detected.
- The reload prompt will appear after the second step in this workflow. Use the **prompt-level none** keyword to automatically ignore the confirmation prompts.
- If the prompt-level is set to None, and there is an unsaved configuration, the install fails. You must save the configuration before reissuing the command.

Use the one-step install procedure described below to convert a platform running in bundle boot mode to install mode. After the command is executed, the platform reboots in install boot mode.

Later, the one-step install procedure can also be used to upgrade the platform.

This procedure uses the **install add file activate commit** command in privileged EXEC mode to install a software package, and to upgrade the platform to a new version.

### SUMMARY STEPS

1. **enable**
2. **install add file location:** *filename* [**activate commit**]
3. **exit**

### DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device>enable` | Enables privileged EXEC mode. Enter your password, if prompted. |
| **Step 2** | **install add file location:** *filename* [**activate commit**]<br>**Example:**<br>`Device#install add file bootflash:c8kg2be-universalk9.17.15.03prd1.SPA.bin activate commit` | Copies the software install package from a local or remote location (through FTP, HTTP, HTTPs, or TFTP) to the platform and extracts the individual components of the .package file into subpackages and packages.conf files. It also performs a validation and compatibility check for the platform and image versions, activates the package, and commits the package to make it persistent across reloads.<br>The platform reloads after this command is run. |
| **Step 3** | **exit**<br>**Example:**<br>`Device#exit` | Exits privileged EXEC mode and returns to user EXEC mode. |

# Three-step installation

**Note**

- All the CLI actions (for example, add, activate, and so on) are executed on all the available FRUs.
- The configuration save prompt will appear if an unsaved configuration is detected.
- The reload prompt will appear after the install activate step in this workflow. Use the **prompt-level none** keyword to automatically ignore the confirmation prompts.

The three-step installation procedure can be used only after the platform is in install mode. This option provides more flexibility and control to the customer during installation.

This procedure uses individual **install add**, **install activate**, and **install commit** commands for installing a software package, and to upgrade the platform to a new version.

## SUMMARY STEPS

1. **enable**
2. **install add file location:** *filename*
3. **show install summary**
4. **install activate** [**auto-abort-timer** <*time*>]
5. **install abort**
6. **install commit**
7. **install rollback to committed**
8. **install remove** {**file** *filesystem: filename* | **inactive**}
9. **show install summary**
10. **exit**

## DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Device>enable` | Enables privileged EXEC mode. Enter your password, if prompted. |
| **Step 2** | **install add file location:** *filename*<br>**Example:**<br>`Device#install add file bootflash:c8kg2be-universalk9.17.15.03prd1.SPA.bin` | Copies the software install package from a remote location (through FTP, HTTP, HTTPs, or TFTP) to the platform, and extracts the individual components of the .package file into subpackages and packages.conf files. |
| **Step 3** | **show install summary**<br>**Example:**<br>`Device#show install summary` | (Optional) Provides an overview of the image versions and their corresponding install state for all the FRUs. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 4** | **install activate** [**auto-abort-timer** <*time*>]<br>**Example:**<br>`Device# install activate auto-abort-timer 120` | Activates the previously added package and reloads the platform.<br>• When doing a full software install, do not provide a package filename.<br>• In the three-step variant, **auto-abort-timer** starts automatically with the **install activate** command; the default for the timer is 120 minutes. If the **install commit** command is not run before the timer expires, the install process is automatically terminated. The platform reloads and boots up with the last committed version. |
| **Step 5** | **install abort**<br>**Example:**<br>`Device#install abort` | (Optional) Terminates the software install activation and returns the platform to the last committed version.<br>• Use this command only when the image is in activated state, and not when the image is in committed state. |
| **Step 6** | **install commit**<br>**Example:**<br>`Device#install commit` | Commits the new package installation and makes the changes persistent over reloads. |
| **Step 7** | **install rollback to committed**<br>**Example:**<br>`Device#install rollback to committed` | (Optional) Rolls back the platform to the last committed state. |
| **Step 8** | **install remove** {**file** *filesystem: filename* \| **inactive**}<br>**Example:**<br>`Device#install remove inactive` | (Optional) Deletes software installation files.<br>• **file**: Deletes a specific file<br>• **inactive**: Deletes all the unused and inactive installation files. |
| **Step 9** | **show install summary**<br>**Example:**<br>`Device#show install summary` | (Optional) Displays information about the current state of the system. The output of this command varies according to the **install** commands run prior to this command. |
| **Step 10** | **exit**<br>**Example:**<br>`Device#exit` | Exits privileged EXEC mode and returns to user EXEC mode. |

# Upgrade in install mode

Use either the one-step installation or the three-step installation to upgrade the platform in install mode.

## Downgrade in install mode

Use the **install rollback** command to downgrade the platform to a previous version by pointing it to the appropriate image, provided the image you are downgrading to was installed in install mode.

The **install rollback** command reloads the platform and boots it with the previous image.

**Note** The **install rollback** command succeeds only if you have not removed the previous file using the **install remove inactive** command.

Alternatively, you can downgrade by installing the older image using the **install** commands.

## Terminate a software installation

You can terminate the activation of a software package in the following ways:

- When the platform reloads after activating a new image, the auto-abort-timer is triggered (in the three-step install variant). If the timer expires before issuing the **install commit** command, the installation process is terminated, and the platform reloads and boots with the last committed version of the software image.

  Alternatively, use the **install auto-abort-timer stop** command to stop this timer, without using the **install commit** command. The new image remains uncommitted in this process.

- Using the **install abort** command returns the platform to the version that was running before installing the new software. Use this command before issuing the **install commit** command.

## Configuration examples for installing the software using install commands

This is an example of the one-step installation or converting from bundle mode to install mode:

```
Router# install add file bootflash:c8kg2be-universalk9.17.15.03.SPA.bin activate commit

May  6 08:35:19.308: %INSTALL-5-INSTALL_START_INFO: R0/0: install_mgr: Started install
add_activate_commit bootflash:c8kg2be-universalk9.17.15.03.SPA.bininstall_add_activate_commit:
 START Tue May 06 08:35:19 UTC 2025
install_add: START Tue May 06 08:35:19 UTC 2025
install_add: Adding IMG
--- Starting initial file syncing ---
Copying bootflash:c8kg2be-universalk9.17.15.03.SPA.bin from  R0 to  R0
Info: Finished copying to the selected
Finished initial file syncing

--- Starting Add ---
Performing Add on all members
Checking status of Add on [R0]
Add: Passed on [R0]
Image added. Version: 17.15.03.0.5635

Finished Add

install_activate: START Tue May 06 08:36:08 UTC 2025
install_activate: Activating IMG
Following packages shall be activated:
/bootflash/c8kg2be-rpboot.17.15.03.SPA.pkg
```

```
/bootflash/c8kg2be-firmware_nim_xdsl.17.15.03.SPA.pkg
/bootflash/c8kg2be-mono-universalk9.17.15.03.SPA.pkg
/bootflash/c8kg2be-firmware_sm_1t3e3.17.15.03.SPA.pkg
/bootflash/c8kg2be-firmware_sm_async.17.15.03.SPA.pkg
/bootflash/c8kg2be-firmware_ngwic_t1e1.17.15.03.SPA.pkg
/bootflash/c8kg2be-firmware_nim_async.17.15.03.SPA.pkg
/bootflash/c8kg2be-firmware_sm_nim_adpt.17.15.03.SPA.pkg
/bootflash/c8kg2be-firmware_nim_shdsl.17.15.03.SPA.pkg
/bootflash/c8kg2be-firmware_prince.17.15.03.SPA.pkg

This operation may require a reload of the system. Do you want to proceed? [y/n]
May  6 08:36:08.538: %INSTALL-5-INSTALL_START_INFO: R0/0: install_mgr: Started install
activate NONEy

--- Starting Activate ---
Performing Activate on all members
[1] Activate package(s) on  R0

May  6 08:37:37.284: %INSTALL-5-INSTALL_AUTO_ABORT_TIMER_PROGRESS: R0/0: rollback_timer:
Install auto abort timer will expire in 7200 seconds [1] Finished Activate on  R0
Checking status of Activate on [R0]
Activate: Passed on [R0]
Finished Activate

--- Starting Commit ---
Performing Commit on all members
[1] Commit package(s) on  R0
[1] Finished Commit on  R0
Checking status of Commit on [R0]
Commit: Passed on [R0]
Finished Commit operation

SUCCESS: install_add_activate_commit Tue May 06 08:37:59 UTC 2025

Router#
May  6 08:37:59.818: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_mgr: Completed install
 add_activate_commitMay  6 0


System integrity status: 0x32042000
Rom image verified correctly

System Bootstrap, Version v17.15(3.1r).s2.cp, RELEASE SOFTWARE
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Current image running: Boot ROM0

Last reset cause: LocalSoft
C8375-E-G2 platform with 33554432 Kbytes of main memory

........
boot: reading file c8kg2be-universalk9.17.15.03.SPA.bin
##########################################################################################


Performing Signature Verification of OS image...
Image validated
May  6 08:40:59.347: %SYS-4-ROUTER_RUNNING_BUNDLE_BOOT_MODE: R0/0: Warning: Booting with
bundle mode will be deprecated in the near future. Migration to install mode is required.
May  6 08:41:21.936: %BOOT-5-OPMODE_LOG: R0/0: binos: System booted in AUTONOMOUS mode

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```

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           170 West Tasman Drive
           San Jose, California 95134-1706



Cisco IOS Software [IOSXE], c8kg2be Software (ARMV8EL_LINUX_IOSD-UNIVERSALK9-M), Version
17.15.3, RELEASE SOFTWARE (fc1)
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Compiled Tue 25-Mar-25 23:37 by mcpre


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May  6 08:41:25.397: %FLASH_CHECK-3-DISK_QUOTA: R0/0: flash_check: bootflash quota exceeded
 [free space is 3172248 kB] - [recommended free space is 5929066 kB] - Please clean up files
 on bootflash.
cisco C8375-E-G2 (1RU) processor with 11906887K/6147K bytes of memory.
Processor board ID FDO2833M01A
Router operating mode: Autonomous
1 Virtual Ethernet interface
12 2.5 Gigabit Ethernet interfaces
2 Ten Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
33554432K bytes of physical memory.
20257791K bytes of flash memory at bootflash:.

Warning: When Cisco determines that a fault or defect can be traced to
the use of third-party transceivers installed by a customer or reseller,
then, at Cisco's discretion, Cisco may withhold support under warranty or
a Cisco support program. In the course of providing support for a Cisco
```

```
networking product Cisco may require that the end user install Cisco
transceivers if Cisco determines that removing third-party parts will
assist Cisco in diagnosing the cause of a support issue.

WARNING: Command has been added to the configuration using a type 0 password. However,
recommended to migrate to strong type-6 encryption

WARNING: ** NOTICE **  The H.323 protocol is no longer supported from IOS-XE release 17.6.1.
 Please consider using SIP for multimedia applications.



Press RETURN to get started!


*May  6 08:41:23.620: %CRYPTO-5-SELF_TEST_START: Crypto algorithms release (Rel5a), Entropy
 release (3.4.1)
       begin Crypto Module self-tests
*May  6 08:41:23.620: %CRYPTO-5-SELF_TEST_START: Crypto algorithms release (Rel5a), Entropy
 release (3.4.1)
       begin Crypto Module Integrity Test
*May  6 08:41:23.625: %CRYPTO-5-SELF_TEST_END: Crypto Integrity self-test completed
successfully
       All tests passed.
*May  6 08:41:23.808: %CRYPTO-5-SELF_TEST_END: Crypto Algorithm self-test completed
successfully
       All tests passed.
*May  6 08:41:24.426: %ISR_THROUGHPUT-6-LEVEL: Throughput level has been set to 3000000
kbps
*May  6 08:41:24.691: %SMART_LIC-6-AGENT_ENABLED: Smart Agent for Licensing is enabled
ESG-PM-ACL:[subsys-init] Init ESG-ACL subsystem starting

*May  6 08:41:27.684: ESG-PM-ACL:[subsys-init] Init ESG-ACL platform API reg

*May  6 08:41:27.684: ESG-PM-ACL:[subsys-init] Init ESG-ACL subsystem ended

*May  6 08:41:27.684: NGIOLite module C-NIM-8M success read extended attr from conf file

*May  6 08:41:29.186: %TLSCLIENT-5-TLSCLIENT_IOS: TLS Client is IOS based
*May  6 08:41:29.203: %SPANTREE-5-EXTENDED_SYSID: Extended SysId enabled for type vlan
*May  6 08:41:29.252: %CRYPTO_ENGINE-5-CSDL_COMPLIANCE_ENFORCED: Cisco PSB security compliance
 is being enforced
*May  6 08:41:29.267: %CUBE-3-LICENSING:  SIP trunking (CUBE) licensing is now based on
dynamic sessions counting, static license capacity configuration through 'mode border-element
 license capacity' would be ignored.
*May  6 08:41:29.268: %SIP-5-LICENSING: CUBE license reporting period has been set to the
minimum value of 8 hours.
*May  6 08:41:29.286: %VOICE_HA-7-STATUS: CUBE HA-supported platform detected.
*May  6 08:41:30.029: %CRYPTO_SL_TP_LEVELS-6-PLATFORM_BASED_LIC: Platform Based License
Support, throughput is un-throttled
*May  6 08:41:30.061: %LINK-3-UPDOWN: Interface EOBC0, changed state to up
*May  6 08:41:30.069: %LINK-3-UPDOWN: Interface Lsmpi0, changed state to up
*May  6 08:41:30.069: %LINEPROTO-5-UPDOWN: Line protocol on Interface LI-Null0, changed
state to up
*May  6 08:41:30.069: %LINEPROTO-5-UPDOWN: Line protocol on Interface VoIP-Null0, changed
state to up
*May  6 08:41:30.069: %LINK-3-UPDOWN: Interface LIIN0, changed state to up
*May  6 08:41:30.070: %LINK-3-UPDOWN: Interface GigabitEthernet0, changed state to down
*May  6 08:41:30.071: %IOSXE_RP_ALARM-6-INFO: ASSERT CRITICAL GigabitEthernet0 Physical
Port Link Down
*May  6 08:41:30.243: %PNP-6-PNP_DISCOVERY_STARTED: PnP Discovery started
*May  6 08:40:41.171: %IOSXE-3-PLATFORM: R0/0: /usr/sbin/updatepcr8d: MPCCE: Failed to read
 idprom cookie; error code: 100
*May  6 08:40:41.184: %IOSXE-3-PLATFORM: R0/0: /usr/sbin/updatepcr8d: Error logging in to
```

```
tam device, rc=0x64-TAM_LIB_ERR_MANDATORY_BUS_ENCRYPT_ENABLED
*May  6 08:40:41.184: %IOSXE-3-PLATFORM: R0/0: /usr/sbin/updatepcr8d: Error initializing
tam device. PCR8 will not be extended.
*May  6 08:40:46.480: %IOSXE-3-PLATFORM: R0/0: /usr/sbin/updatepcr8d: MPCCE: Failed to read
 idprom cookie; error code: 100
*May  6 08:40:46.493: %IOSXE-3-PLATFORM: R0/0: /usr/sbin/updatepcr8d: Error logging in to
tam device, rc=0x64-TAM_LIB_ERR_MANDATORY_BUS_ENCRYPT_ENABLED
*May  6 08:40:46.493: %IOSXE-3-PLATFORM: R0/0: /usr/sbin/updatepcr8d: Error initializing
tam device. PCR8 will not be extended.
*May  6 08:40:59.263: %SERVICES-2-NORESOLVE_ACTIVE: C0/0: cmcc: Error resolving active FRU:
 BINOS_FRU_RP
*May  6 08:40:59.346: %SYS-4-ROUTER_RUNNING_BUNDLE_BOOT_MODE: R0/0: Warning: Booting with
bundle mode will be deprecated in the near future. Migration to install mode is required.
*May  6 08:41:21.935: %BOOT-5-OPMODE_LOG: R0/0: binos: System booted in AUTONOMOUS mode
*May  6 08:41:25.396: %FLASH_CHECK-3-DISK_QUOTA: R0/0: flash_check: bootflash quota exceeded
 [free space is 3172248 kB] - [recommended free space is 5929066 kB] - Please clean up files
 on bootflash.
*May  6 08:41:25.952: %CMRP_PFU-6-PEM_INSERTED: R0/0: cmand: Power Supply in slot 0 not
operational.
*May  6 08:41:26.077: %CMRP_PFU-6-FANASSY_INSERTED: R0/0: cmand: Fan Assembly is inserted.
*May  6 08:41:30.313: %SYS-5-CONFIG_P: Configured programmatically by process MGMT VRF
Process from console as vty0
*May  6 08:41:30.519: %IOSXE_MGMTVRF-6-CREATE_SUCCESS_INFO: Management vrf Mgmt-intf created
 with ID 1, ipv4 table-id 0x1, ipv6 table-id 0x1E000001
*May  6 08:41:30.519: %SYS-5-CONFIG_P: Configured programmatically by process MGMT VRF
Process from console as vty0
*May  6 08:41:30.688: %IOSXE_RP_ALARM-2-PEM: ASSERT CRITICAL Power Supply Module 0 Power
Supply Failure
*May  6 08:41:30.688: %IOSXE_RP_ALARM-6-INFO: ASSERT CRITICAL POE Module 0 Power Supply
Failure
*May  6 08:41:30.714: %ONEP_BASE-6-SS_ENABLED: ONEP: Service set Base was enabled by Default
*May  6 08:41:31.046: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan1, changed state
 to down
*May  6 08:41:31.058: %LINEPROTO-5-UPDOWN: Line protocol on Interface EOBC0, changed state
 to up
*May  6 08:41:31.066: %LINEPROTO-5-UPDOWN: Line protocol on Interface Lsmpi0, changed state
 to up
*May  6 08:41:31.066: %LINEPROTO-5-UPDOWN: Line protocol on Interface LIIN0, changed state
 to up
*May  6 08:41:31.066: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0,
changed state to down
*May  6 08:41:31.262: %SMART_LIC-6-USAGE_NO_ACK: A Usage report acknowledgement has not
been received in the last 0 days.
*May  6 08:41:31.263: %SIP-5-LICENSING: smart license report is not acknowledged.
*May  6 08:41:31.773: %SYS-7-NVRAM_INIT_WAIT_TIME: Waited 0 seconds for NVRAM to be available
*May  6 08:41:31.944: %SYS-6-PRIVCFG_DECRYPT_SUCCESS: Successfully apply the private config
 file
*May  6 08:41:32.030: %PKI-6-TRUSTPOINT_CREATE: Trustpoint: TP-self-signed-2220840378 created
 succesfully
*May  6 08:41:32.031: %PKI-6-TRUSTPOINT_CREATE: Trustpoint: SLA-TrustPoint created succesfully
*May  6 08:41:32.034: %PKI-3-KEY_CMP_MISMATCH: Key in the certificate and stored key does
not match for Trustpoint-TP-self-signed-2220840378.
*May  6 08:41:32.041: %AAA-6-USERNAME_CONFIGURATION: user with username: admin configured
*May  6 08:41:32.041: %AAAA-4-CLI_DEPRECATED: WARNING: Command has been added to the
configuration using a type 0 password. However, recommended to migrate to strong type-6
encryption
*May  6 08:41:32.041: %AAA-6-USER_PRIVILEGE_UPDATE: username: admin privilege updated with
 priv-15
*May  6 08:41:32.259: %SYS-5-CONFIG_I: Configured from memory by console
*May  6 08:41:32.268: %IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/0, interfaces disabled
*May  6 08:41:32.268: %IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/1, interfaces disabled
*May  6 08:41:32.275: %SPA_OIR-6-OFFLINECARD: SPA (4M-2xSFP+) offline in subslot 0/0
*May  6 08:41:32.278: %SPA_OIR-6-OFFLINECARD: SPA (C-NIM-8M) offline in subslot 0/1
*May  6 08:41:32.306: %IOSXE_RP_ALARM-2-ESP: ASSERT CRITICAL module R0 No Working ESP
```

```
*May  6 08:41:32.309: %IOSXE_OIR-6-INSCARD: Card (fp) inserted in slot F0
*May  6 08:41:32.309: %IOSXE_OIR-6-INSCARD: Card (cc) inserted in slot 0
*May  6 08:41:32.309: %IOSXE_OIR-6-INSCARD: Card (cc) inserted in slot 1
*May  6 08:41:32.325: %CRYPTO-5-SELF_TEST_START: Crypto algorithms release (Rel5a), Entropy
 release (3.4.1)
       begin Crypto Module self-tests
*May  6 08:41:32.329: %CRYPTO-5-SELF_TEST_END: Crypto Algorithm self-test completed
successfully
       All tests passed.
*May  6 08:41:32.712: %UICFGEXP-6-SERVER_NOTIFIED_START: R0/0: psd: Server iox has been
notified to start
*May  6 08:41:33.077: %SYS-5-RESTART: System restarted --
Cisco IOS Software [IOSXE], c8kg2be Software (ARMV8EL_LINUX_IOSD-UNIVERSALK9-M), Version
17.15.3, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
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Compiled Tue 25-Mar-25 23:37 by mcpre
*May  6 08:41:33.084: %SNMP-5-COLDSTART: SNMP agent on host Router is undergoing a cold
start
*May  6 08:41:33.084: %SYS-5-CONFIG_I: Configured from console by console
*May  6 08:41:33.759: %IOSXE_OIR-6-ONLINECARD: Card (fp) online in slot F0
*May  6 08:41:34.091: %SYS-6-BOOTTIME: Time taken to reboot after reload =  215 seconds
*May  6 08:41:35.051: %LINEPROTO-5-UPDOWN: Line protocol on Interface VirtualPortGroup0,
changed state to up
*May  6 08:41:35.063: %LINEPROTO-5-UPDOWN: Line protocol on Interface VirtualPortGroup1,
changed state to up
*May  6 08:41:35.063: %LINEPROTO-5-UPDOWN: Line protocol on Interface VirtualPortGroup10,
changed state to up
*May  6 08:41:38.437: %PNP-6-PNP_BEST_UDI_UPDATE: Best UDI
[PID:C8375-E-G2,VID:V01,SN:FDO2833M01A] identified via (entity-mibs)
*May  6 08:41:38.437: %PNP-6-PNP_CDP_UPDATE: Device UDI
[PID:C8375-E-G2,VID:V01,SN:FDO2833M01A] identified for CDP
*May  6 08:41:38.437: %PNP-6-PNP_DISCOVERY_STOPPED: PnP Discovery stopped (Startup Config
Present)
*May  6 08:41:39.699: %LINK-3-UPDOWN: Interface GigabitEthernet0, changed state to up
*May  6 08:41:40.707: %LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0,
changed state to up
*May  6 08:41:42.333: %SYS-5-CONFIG_P: Configured programmatically by process EPM CREATE
DEFAULT CWA URL ACL from console as console
*May  6 08:41:46.197: %IOSXE_OIR-6-ONLINECARD: Card (cc) online in slot 0
*May  6 08:41:46.230: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/0
*May  6 08:41:46.587: %IOSXE_OIR-6-ONLINECARD: Card (cc) online in slot 1
*May  6 08:41:47.126: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is OFF
*May  6 08:41:47.126: %CRYPTO-6-GDOI_ON_OFF: GDOI is OFF
*May  6 08:41:48.779: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/1
*May  6 08:41:49.452: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is OFF
*May  6 08:41:49.452: %CRYPTO-6-GDOI_ON_OFF: GDOI is OFF
*May  6 08:41:49.571: %PKI-6-TRUSTPOINT_CREATE: Trustpoint: CISCO_IDEVID_SUDI created
succesfully
*May  6 08:41:49.573: %CRYPTO_ENGINE-5-KEY_ADDITION: A key named CISCO_IDEVID_SUDI has been
 generated or imported by pki-sudi
*May  6 08:41:49.609: %PKI-6-TRUSTPOINT_CREATE: Trustpoint: CISCO_IDEVID_SUDI0 created
succesfully
*May  6 08:41:49.610: %PKI-2-NON_AUTHORITATIVE_CLOCK: PKI functions can not be initialized
 until an authoritative time source, like NTP, can be obtained.
*May  6 08:41:53.146: %IOX-3-PD_PARTITION_CREATE: R0/0: run_ioxn_caf: IOX may take upto 3
mins to be ready. Wait for iox to be ready before installing the apps
*May  6 08:41:53.429: %IOX-3-PD_PARTITION_CREATE: R0/0: run_ioxn_caf: Successfully allocated
 4.0G in flash for hosting ApplicationsNGIOLite module C-NIM-8M success read extended attr
 from conf file

*May  6 08:42:15.679: %SPA_OIR-6-ONLINECARD: SPA (C-NIM-8M) online in subslot 0/1
*May  6 08:42:16.292: %ENVIRONMENTAL-6-NOTICE: V: PEM Out, Location: P0, State: Minor_Low,
 Reading: 0 mV
```

```
*May  6 08:42:20.701: %ONEP_BASE-3-AUTHEN_ERR: [Element]: Authentication/authorization
failed. Application (utd_snort-utd): Username (*INVALID*)
*May  6 08:42:22.179: %TRANSCEIVER-6-INSERTED: C0/0: iomd: transceiver module inserted in
Te0/0/4
*May  6 08:42:22.255: %TRANSCEIVER-6-INSERTED: C0/0: iomd: transceiver module inserted in
Te0/0/5
*May  6 08:42:22.643: %LINK-3-UPDOWN: Interface TwoGigabitEthernet0/1/6, changed state to
up
*May  6 08:42:23.345: %SPA_OIR-6-ONLINECARD: SPA (4M-2xSFP+) online in subslot 0/0
*May 6 08:42:23.644: %LINEPROTO-5-UPDOWN: Line protocol on Interface TwoGigabitEthernet0/1/6,
 changed state to up
*May  6 08:42:28.999: %LINK-3-UPDOWN: Interface TenGigabitEthernet0/0/4, changed state to
up
*May  6 08:42:29.011: %LINK-3-UPDOWN: Interface TenGigabitEthernet0/0/5, changed state to
up
*May  6 08:42:29.975: %LINK-3-UPDOWN: Interface TwoGigabitEthernet0/0/0, changed state to
up
*May 6 08:42:30.004: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet0/0/4,
 changed state to up
*May 6 08:42:30.010: %LINEPROTO-5-UPDOWN: Line protocol on Interface TenGigabitEthernet0/0/5,
 changed state to up
*May  6 08:42:29.901: %IM-6-IOX_INST_INFO: R0/0: ioxman: IOX SERVICE guestshell LOG:
Guestshell is up at 04/06/2025 08:42:29
*May  6 08:42:30.974: %LINK-3-UPDOWN: Interface TwoGigabitEthernet0/0/1, changed state to
up
*May 6 08:42:30.976: %LINEPROTO-5-UPDOWN: Line protocol on Interface TwoGigabitEthernet0/0/0,
 changed state to up
*May 6 08:42:31.975: %LINEPROTO-5-UPDOWN: Line protocol on Interface TwoGigabitEthernet0/0/1,
 changed state to up
*May  6 08:42:31.983: %LINK-3-UPDOWN: Interface TwoGigabitEthernet0/0/3, changed state to
up
*May  6 08:42:32.644: %LINK-3-UPDOWN: Interface TwoGigabitEthernet0/1/7, changed state to
up
*May  6 08:42:32.366: %CMRP-5-CHASSIS_MONITOR_BOOT_TIME_PRINT: R0/0: cmand: Card F0 took
59 secs to boot
*May  6 08:42:32.367: %CMRP-5-CHASSIS_MONITOR_BOOT_TIME_PRINT: R0/0: cmand: Card 0 took 54
 secs to boot
*May  6 08:42:32.367: %CMRP-5-CHASSIS_MONITOR_BOOT_TIME_PRINT: R0/0: cmand: Card 1 took 54
 secs to boot
*May 6 08:42:32.984: %LINEPROTO-5-UPDOWN: Line protocol on Interface TwoGigabitEthernet0/0/3,
 changed state to up
*May 6 08:42:33.642: %LINEPROTO-5-UPDOWN: Line protocol on Interface TwoGigabitEthernet0/1/7,
 changed state to up
*May  6 08:42:34.003: ALL modules are online!
*May  6 08:42:34.765: %IM-6-IOX_ENABLEMENT: R0/0: ioxman: IOX is ready.
*May  6 08:42:34.766: %IM-6-START_MSG: R0/0: ioxman: app-hosting: Start succeeded: utd is
started Current is in RUNNING
May  6 08:42:36.712: %PKI-6-AUTHORITATIVE_CLOCK: The system clock has been set.
May  6 08:42:38.080: %SMART_LIC-6-REPORTING_REQUIRED: A Usage report acknowledgement will
be required in 0 days.
May  6 08:42:38.081: ALL modules are online!
May  6 08:42:41.695: %SMART_LIC-6-REPORTING_REQUIRED: A Usage report acknowledgement will
be required in 0 days.
Router>
May  6 08:42:51.407: %ONEP_BASE-6-CONNECT: [Element]: ONEP session Application:utd_snort
Host:utd ID:3545 User: has connected.
```

This is an example of the three-step installation:

```
Router#install add file bootflash:c8kg2be-universalk9.17.15.03a.SPA.bin
install_add: START Wed May 21 09:03:39 UTC 2025
install_add: Adding IMG
```

```
% UTD: Received appnav notification from LXC for   (src 192.0.2.5, dst 192.0.2.6)
% UTD successfully registered with Appnav (src 192.0.2.5, dst 192.0.2.6)
% UTD redirect interface set to VirtualPortGroup1 internally
--- Starting initial file syncing ---
Copying bootflash:c8kg2be-universalk9.17.15.03a.SPA.bin from  R0 to  R0
Info: Finished copying to the selected
Finished initial file syncing

--- Starting Add ---
Performing Add on all members
Checking status of Add on [R0]
Add: Passed on [R0]
Image added. Version: 17.15.03a.0.176

Finished Add

SUCCESS: install_add /bootflash/c8kg2be-universalk9.17.15.03a.SPA.bin Wed May 21 09:04:43
UTC 2025

Router#show install log
[0|install_op_boot]: START Wed May 21 09:02:03 Universal 2025
[0|install_op_boot(INFO, )]: Mount IMG INI state base image
[0|install_op_boot]: END SUCCESS  Wed May 21 09:02:03 Universal 2025
[0|install_op_boot(INFO, )]: cleanup_trap  remote_invocation 0 operation install_op_boot
.. 0 .. 0
[remote|COMP_CHECK]: START Wed May 21 09:04:42 UTC 2025
[remote|COMP_CHECK]: END FAILED exit(1)  Wed May 21 09:04:43 UTC 2025

Router#
Router#install activate
install_activate: START Wed May 21 09:07:21 UTC 2025
install_activate: Activating IMG
Following packages shall be activated:
/bootflash/c8kg2be-rpboot.17.15.03a.SPA.pkg
/bootflash/c8kg2be-firmware_sm_nim_adpt.17.15.03a.SPA.pkg
/bootflash/c8kg2be-firmware_nim_async.17.15.03a.SPA.pkg
/bootflash/c8kg2be-firmware_sm_async.17.15.03a.SPA.pkg
/bootflash/c8kg2be-firmware_prince.17.15.03a.SPA.pkg
/bootflash/c8kg2be-mono-universalk9.17.15.03a.SPA.pkg
/bootflash/c8kg2be-firmware_nim_shdsl.17.15.03a.SPA.pkg
/bootflash/c8kg2be-firmware_ngwic_t1e1.17.15.03a.SPA.pkg
/bootflash/c8kg2be-firmware_sm_1t3e3.17.15.03a.SPA.pkg
/bootflash/c8kg2be-firmware_nim_xdsl.17.15.03a.SPA.pkg

This operation may require a reload of the system. Do you want to proceed? [y/n]y

--- Starting Activate ---
Performing Activate on all members
 [1] Activate package(s) on  R0

 [1] Finished Activate on  R0
Checking status of Activate on [R0]
Activate: Passed on [R0]
Finished Activate

SUCCESS: install_activate Wed May 21 09:09:31 UTC 2025
Router#May 21 09:

System integrity status: 0x32042000
Rom image verified correctly

System Bootstrap, Version v17.15(3.1r).s2.cp, RELEASE SOFTWARE
Copyright (c) 1994-2025 by cisco Systems, Inc.
```

```
Current image running: Boot ROM0

Last reset cause: LocalSoft
C8375-E-G2 platform with 33554432 Kbytes of main memory


........

boot: reading file packages.conf
#

##########################################################

Performing Signature Verification of OS image...
Image validated

May 21 09:11:47.581: %BOOT-5-OPMODE_LOG: R0/0: binos: System booted in AUTONOMOUS mode

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Cisco IOS Software [IOSXE], c8kg2be Software (ARMV8EL_LINUX_IOSD-UNIVERSALK9-M), Version
17.15.3a, RELEASE SOFTWARE (fc4)
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May 21 09:11:51.161: %FLASH_CHECK-3-DISK_QUOTA: R0/0: flash_check: bootflash quota exceeded
 [free space is 1111072 kB] - [recommended free space is 5929066 kB] - Please clean up files
 on bootflash.
cisco C8375-E-G2 (1RU) processor with 11906881K/6147K bytes of memory.
Processor board ID FDO2833M01A
Router operating mode: Autonomous
1 Virtual Ethernet interface
12 2.5 Gigabit Ethernet interfaces
2 Ten Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
33554432K bytes of physical memory.
20257791K bytes of flash memory at bootflash:.

Warning: When Cisco determines that a fault or defect can be traced to
the use of third-party transceivers installed by a customer or reseller,
then, at Cisco's discretion, Cisco may withhold support under warranty or
a Cisco support program. In the course of providing support for a Cisco
networking product Cisco may require that the end user install Cisco
transceivers if Cisco determines that removing third-party parts will
assist Cisco in diagnosing the cause of a support issue.
The process for the command is not responding or is otherwise unavailable

 WARNING: Command has been added to the configuration using a type 0 password. However,
recommended to migrate to strong type-6 encryption

 WARNING: ** NOTICE **  The H.323 protocol is no longer supported from IOS-XE release 17.6.1.
 Please consider using SIP for multimedia applications.



Press RETURN to get started!

% UTD: Received appnav notification from LXC for   (src 192.0.2.5, dst 192.0.2.6)
% UTD successfully registered with Appnav (src 192.0.2.5, dst 192.0.2.6)
% UTD redirect interface set to VirtualPortGroup1 internally

Router>
Router>en
Router#
Router#install commit
install_commit: START Wed May 21 09:22:28 UTC 2025
--- Starting Commit ---
Performing Commit on all members
 [1] Commit packages(s) on  R0
 [1] Finished Commit packages(s) on  R0
Checking status of Commit on [R0]
Commit: Passed on [R0]
Finished Commit operation

SUCCESS: install_commit Wed May 21 09:22:31 UTC 2025
```

These are sample outputs for show commands:

### show install log

```
Device# show install log
[0|install_op_boot]: START Thu Oct 28 22:09:29 Universal 2021
```

```
[0|install_op_boot(INFO, )]: Mount IMG INI state base image
[0|install_op_boot]: END SUCCESS  Thu Oct 28 22:09:30 Universal 2021
```

### show install summary

```
Device# show install summary
[ R0 ] Installed Package(s) Information:

State (St): I - Inactive, U - Activated & Uncommitted,

C - Activated & Committed, D - Deactivated & Uncommitted

--------------------------------------------------------------------------------

Type  St   Filename/Version

--------------------------------------------------------------------------------

IMG   C    17.15.03a.0.176


--------------------------------------------------------------------------------

Auto abort timer: inactive

--------------------------------------------------------------------------------
```

### show install package *filesystem: filename*

```
Device# show install package bootflash:c8kg2be-universalk9.17.15.03a.SPA.bin
  Package: c8kg2be-universalk9.17.15.03a.SPA.bin
    Size: 953231736
    Timestamp:
  Canonical path: /bootflash/c8kg2be-universalk9.17.15.03a.SPA.bin

    Raw disk-file SHA1sum:
      d358592ccd2dd626889ef091401d06fae5458ff1
  Header size:     1084 bytes
  Package type:    30000
  Package flags:   0
  Header version:  3

  Internal package information:
    Name: rp_super
    BuildTime: 2025-05-02_11.57
    ReleaseDate: 2025-05-02_16.50
    BootArchitecture: arm64
    RouteProcessor: mirabile
    Platform: C8KG2BE
    User: mcpre
    PackageName: universalk9
    Build: 17.15.03a
    CardTypes:

  Package is bootable from media and tftp.
  Package contents:

  Package: c8kg2be-firmware_prince.17.15.03a.SPA.pkg
    Size: 10444800
    Timestamp:

    Raw disk-file SHA1sum:
      fa82bed30d349686d1d9700892076a3d66375698
    Header size:     4096 bytes
    Package type:    40000
    Package flags:   0
    Header version:  3

    Internal package information:
      Name: firmware_prince
      BuildTime: 2025-05-02_11.57
      ReleaseDate: 2025-05-02_16.50
      BootArchitecture: none
      RouteProcessor: mirabile
      Platform: C8KG2BE
      User: mcpre
      PackageName: firmware_prince
      Build: 17.15.03a
      CardTypes:

    Package is not bootable.
  Package: c8kg2be-mono-universalk9.17.15.03a.SPA.pkg
    Size: 891244544
    Timestamp:

    Raw disk-file SHA1sum:
      af7ba58491731d788d9f4528d74b5bfef9dfc7f2
    Header size:     4096 bytes
    Package type:    30000
    Package flags:   0
    Header version:  3

    Internal package information:
      Name: mono
      BuildTime: 2025-05-02_11.57
      ReleaseDate: 2025-05-02_16.50
      BootArchitecture: arm64
      RouteProcessor: mirabile
      Platform: C8KG2BE
      User: mcpre
      PackageName: mono-universalk9
      Build: 17.15.03a
      CardTypes:

    Package is bootable from media and tftp.
    Package contents:

  Package: c8kg2be-firmware_nim_xdsl.17.15.03a.SPA.pkg
    Size: 5677056
    Timestamp:

    Raw disk-file SHA1sum:
      4af7a8764651253c73c7fadebeba6f3a8f0a133d
    Header size:     4096 bytes
    Package type:    40000
    Package flags:   0
    Header version:  3

    Internal package information:
      Name: firmware_nim_xdsl
      BuildTime: 2025-05-02_11.57
      ReleaseDate: 2025-05-02_16.50
      BootArchitecture: none
      RouteProcessor: mirabile
      Platform: C8KG2BE
      User: mcpre
      PackageName: firmware_nim_xdsl
      Build: 17.15.03a
      CardTypes:
```

```
  Package is not bootable.
Package: c8kg2be-firmware_sm_1t3e3.17.15.03a.SPA.pkg
  Size: 13889536
  Timestamp:

  Raw disk-file SHA1sum:
    526aa41ccd8398e7691d316ca24289801e0417a8
  Header size:     4096 bytes
  Package type:    40000
  Package flags:   0
  Header version:  3

  Internal package information:
    Name: firmware_sm_1t3e3
    BuildTime: 2025-05-02_11.57
    ReleaseDate: 2025-05-02_16.50
    BootArchitecture: none
    RouteProcessor: mirabile
    Platform: C8KG2BE
    User: mcpre
    PackageName: firmware_sm_1t3e3
    Build: 17.15.03a
    CardTypes:

  Package is not bootable.
Package: c8kg2be-firmware_sm_async.17.15.03a.SPA.pkg
  Size: 14671872
  Timestamp:

  Raw disk-file SHA1sum:
    7c7f4c06da5b3b0e1db879e074998130db22298f
  Header size:     4096 bytes
  Package type:    40000
  Package flags:   0
  Header version:  3

  Internal package information:
    Name: firmware_sm_async
    BuildTime: 2025-05-02_11.57
    ReleaseDate: 2025-05-02_16.50
    BootArchitecture: none
    RouteProcessor: mirabile
    Platform: C8KG2BE
    User: mcpre
    PackageName: firmware_sm_async
    Build: 17.15.03a
    CardTypes:

  Package is not bootable.
Package: c8kg2be-firmware_nim_async.17.15.03a.SPA.pkg
  Size: 13254656
  Timestamp:

  Raw disk-file SHA1sum:
    27132c3a41c79991d1f71488ad325ad05cc7b0bb
  Header size:     4096 bytes
  Package type:    40000
  Package flags:   0
  Header version:  3

  Internal package information:
    Name: firmware_nim_async
    BuildTime: 2025-05-02_11.57
    ReleaseDate: 2025-05-02_16.50
    BootArchitecture: none
    RouteProcessor: mirabile
    Platform: C8KG2BE
    User: mcpre
    PackageName: firmware_nim_async
    Build: 17.15.03a
    CardTypes:

  Package is not bootable.
Package: c8kg2be-firmware_nim_shdsl.17.15.03a.SPA.pkg
  Size: 11804672
  Timestamp:

  Raw disk-file SHA1sum:
    51da21dffb39d2ef6b266b7ffab083b3fb339651
  Header size:     4096 bytes
  Package type:    40000
  Package flags:   0
  Header version:  3

  Internal package information:
    Name: firmware_nim_shdsl
    BuildTime: 2025-05-02_11.57
    ReleaseDate: 2025-05-02_16.50
    BootArchitecture: none
    RouteProcessor: mirabile
    Platform: C8KG2BE
    User: mcpre
    PackageName: firmware_nim_shdsl
    Build: 17.15.03a
    CardTypes:

  Package is not bootable.
Package: c8kg2be-firmware_ngwic_t1e1.17.15.03a.SPA.pkg
  Size: 11956224
  Timestamp:

  Raw disk-file SHA1sum:
    19376efa2ed616672c0d488b628a768e262bd8e6
  Header size:     4096 bytes
  Package type:    40000
  Package flags:   0
  Header version:  3

  Internal package information:
    Name: firmware_ngwic_t1e1
    BuildTime: 2025-05-02_11.57
    ReleaseDate: 2025-05-02_16.50
    BootArchitecture: none
    RouteProcessor: mirabile
    Platform: C8KG2BE
    User: mcpre
    PackageName: firmware_ngwic_t1e1
    Build: 17.15.03a
    CardTypes:

  Package is not bootable.
Package: c8kg2be-firmware_sm_nim_adpt.17.15.03a.SPA.pkg
  Size: 204800
  Timestamp:

  Raw disk-file SHA1sum:
    b3a7ddd80df900d6217bb8db36ff8bdbc6241fa3
  Header size:     4096 bytes
  Package type:    40000
  Package flags:   0
  Header version:  3

  Internal package information:
    Name: firmware_sm_nim_adpt
    BuildTime: 2025-05-02_11.57
    ReleaseDate: 2025-05-02_16.50
    BootArchitecture: none
    RouteProcessor: mirabile
    Platform: C8KG2BE
    User: mcpre
    PackageName: firmware_sm_nim_adpt
    Build: 17.15.03a
    CardTypes:

  Package is not bootable.
```

### show install active

```
Device# show install active
[ R0 ] Active Package(s) Information:
State (St): I - Inactive, U - Activated & Uncommitted,
C - Activated & Committed, D - Deactivated & Uncommitted
--------------------------------------------------------------------------------
Type  St   Filename/Version
--------------------------------------------------------------------------------
IMG   C  17.15.03a.0.158
--------------------------------------------------------------------------------
Auto abort timer: inactive
--------------------------------------------------------------------------------
```

### show install inactive

```
Device# show install inactive
[ R0 ] Inactive Package(s) Information:
State (St): I - Inactive, U - Activated & Uncommitted,
C - Activated & Committed, D - Deactivated & Uncommitted
-------------------------------------------------------------------------------
Type  St   Filename/Version
-------------------------------------------------------------------------------
No Inactive Packages
```

### show install committed

```
Device# show install committed
[ R0 ] Committed Package(s) Information:
State (St): I - Inactive, U - Activated & Uncommitted,
C - Activated & Committed, D - Deactivated & Uncommitted
--------------------------------------------------------------------------------
Type  St   Filename/Version
--------------------------------------------------------------------------------
IMG    C   17.15.03a.0.158
--------------------------------------------------------------------------------



--------------------------------------------------------------------------------

Auto abort timer: inactive

--------------------------------------------------------------------------------
```

### show install uncommitted

```
Device# show install uncommitted
[ R0 ] Uncommitted Package(s) Information:
State (St): I - Inactive, U - Activated & Uncommitted,
            C - Activated & Committed, D - Deactivated & Uncommitted
--------------------------------------------------------------------
Type  St   Filename/Version
--------------------------------------------------------------------
No Uncommitted Packages
```

# Troubleshoot software installation using install commands

**Problem** Troubleshooting the software installation

**Solution** Use these show commands to view installation summary, logs, and software versions.

- **show install summary**
- **show install log**
- **show version**
- **show version running**

**Problem** Other installation issues

**Solution** Use these commands to resolve installation issue:

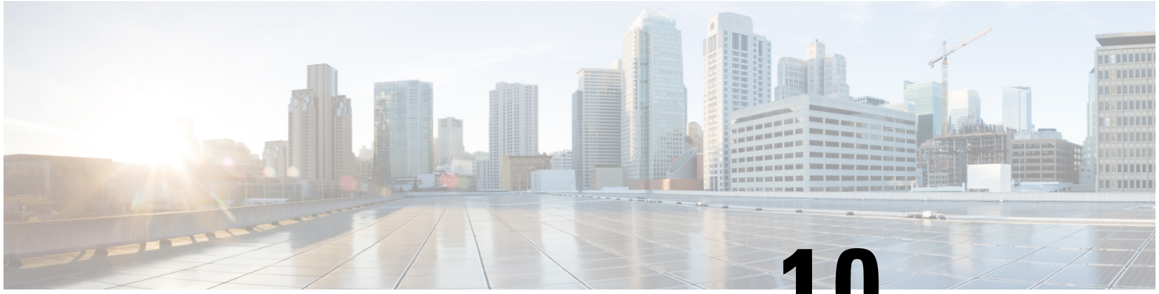
- **dir** <*install directory*>
- **more location:***packages.conf*
- **show tech-support install**: this command automatically runs the **show** commands that display information specific to installation.
- **request platform software trace archive target bootflash** <*location*>: this command archives all the trace logs relevant to all the processes running on the system since the last reload, and saves this information in the specified location.

CHAPTER 9

# Software Upgrade Processes

If you want to upgrade the ROMMON and IOS at the same time, perform the steps given below:

- Copy the XE image to the router and configure the boot system to point to the new image.
- Copy the ROMMON package to the router and perform the ROMMON upgrade.
- Reload the router and verify that it boots to the IOS prompt on the new XE image.
- Verify that the new ROMMON image was successfully installed using a show platform.



CHAPTER 10

# Factory reset

Factory Reset is a process of clearing the current running and start-up configuration information on a device, and resetting the device to an earlier, fully-functional state.

The factory reset process uses the **factory-reset all** command to take backup of existing configuration, and then reset the router to an earlier, fully functional state. The duration of the factory reset process is dependent on the storage size of the router. It can vary between 30 minutes to 3 hours on a high availability setup.

*Table 11: Data erased or retained during factory reset*

| Command name | Data erased | Data retained |
|---|---|---|
| **factory-reset all secure** | Non-volatile random-access memory (NVRAM) data | Data from remote field-replaceable units (FRUs). |
| | OBFL (Onboard Failure Logging) logs | Value of configuration register<br>**Important**<br>From Cisco IOS XE 17.14.1a, the value of the configuration register can be erased using the **factory-reset all secure** command on C8475-G2 and C8455-G2. |
| | Licenses | Contents of USB |
| | User data, startup, and running configuration | Credentials (Secure Unique Device Identifier [SUDI] certificates, public key infrastructure (PKI) keys, and FIPS-related keys) |
| | ROMMON variables | |
| | All writeable file systems and personal data.<br>**Note**<br>If the current boot image is a remote image or stored on a USB, NIM-SSD, or such, ensure that you take a backup of the image before performing factory reset. | |

| Command name | Data erased | Data retained |
|---|---|---|
| **factory-reset keep-licensing-info** | • License Boot level configuration<br>• Throughput level configuration<br>• Smart license transport type<br>• Smart license URL data | • Real User Monitoring (RUM) Reports (open/unacknowledged license usage report)<br>• Usage reporting details (last ACK received, next ACK scheduled, last/next report push)<br>• Unique Device Identification (UDI) trust codes<br>• Customer policy received from CSSM<br>• SLAC, SLR authorization codes return codes<br>• Factory installed purchase information |

After the factory reset process is complete, the router reboots to ROMMON mode. If you have the zero-touch provisioning (ZTP) capability setup, after the router completes the factory reset procedure, the router reboots with ZTP configuration.

# Prerequisites

- Ensure that all the software images, configurations and personal data is backed up before performing factory reset.
- Ensure that there is uninterrupted power supply when factory reset is in progress.
- The factory reset process takes a backup of the boot image if the system is booted from an image stored locally (bootflash or hard disk). If the current boot image is a remote image or stored on an USB, NIM-SSD or such, ensure that you take a backup of the image before performing factory reset.
- The **factory-reset all secure** command erases all files, including the boot image, even if the image is stored locally. If the current boot image is a remote image or stored on a USB, NIM-SSD, or such, ensure that you take a backup of the image before performing secure factory reset.
- Ensure that ISSU/ISSD (In- Service Software Upgrade or Downgrade) is not in progress before performing factory reset.

# Restrictions

- Any software patches that are installed on the router are not restored after the factory reset operation.
- If the factory reset command is issued through a Virtual Teletype (VTY) session, the session is not restored after the completion of the factory reset process.

# When to perform factory reset

- Return Material Authorization (RMA): If a router is returned back to Cisco for RMA, it is important that all sensitive information is removed.
- Router is compromised: If the router data is compromised due to a malicious attack, the router must be reset to factory configuration and then reconfigured once again for further use.
- Repurposing: The router needs to be moved to a new topology or market from the existing site to a different site.

# How to perform a factory reset

### Procedure

**Step 1** Log in to the device.

**Important**
If the current boot image is a remote image or is stored in a USB or a NIM-SSD, ensure that you take a backup of the image before starting the factory reset process.

**Step 2** This step is divided into two parts (a and b). If you need to retain the licensing information while performing the **factory-reset** command, follow step 2. a. If you do not need to retain the licensing information and want all the data to be erased, perform step 2. b.

a) Execute **factory-reset keep-licensing-info** command to retain the licensing data.

The system displays the following message when you use the **factory-reset keep-licensing-info** command:

```
Router# factory-reset keep-licensing-info

The factory reset operation is irreversible for Keeping license usage. Are you sure? [confirm]
This operation may take 20 minutes or more. Please do not power cycle.

Dec 1 20:58:38.205: %PMAN-5-EXITACTION: R0/0: pvp: Process manager is exiting: process exit with
reload chassis code
/bootflash failed to mount
Dec 01 20:59:44.264: Factory reset operation completed.
Initializing Hardware ...

Current image running: Boot ROM1
```

```
Last reset cause: LocalSoft

ISR4331/K9 platform with 4194304 Kbytes of main memory
rommon 1
```

b) Execute the **factory-reset all secure 3-pass** command to securely erase all data.

The system displays the following message when you use the **factory-reset all secure 3-pass** command:

```
Router# factory-reset all secure 3-pass

The factory reset operation is irreversible for securely reset all. Are you sure? [confirm]
This operation may take hours. Please do not power cycle.

*Jun 19 00:53:33.385: %SYS-5-RELOAD: Reload requested by Exec. Reload Reason: Factory Reset.Jun
19 00:53:42.856: %PMAN-5-EXITACTION:

Enabling factory reset for this reload cycle
  Jun 19 00:54:06.914: Factory reset secure operation. Write 0s. Please do not power cycle.
  Jun 19 01:18:36.040: Factory reset secure operation. Write 1s. Please do not power cycle.
  Jun 19 01:43:49.263: Factory reset secure operation. Write random. Please do not power cycle.
  Jun 19 02:40:29.770: Factory reset secure operation completed.
Initializing Hardware ....
```

**Step 3** Enter **confirm** to proceed with the factory reset.

**Note**
The duration of the factory reset process depends on the storage size of the router. It can extend between 30 minutes and up to 3 hours on a high availability setup. If you want to quit the factory reset process, press the **Escape** key.

# What happens after a factory reset

After the factory reset is successfully completed, the router boots up. However, before the factory reset process started, if the configuration register was set to manually boot from ROMMON, the router stops at ROMMON.

After you configure Smart Licensing, execute the **#show license status** command, to check whether Smart Licensing is enabled for your instance.

**Note** If you had Specific License Reservation enabled before you performed the factory reset, use the same license and enter the same license key that you received from the smart agent.

CHAPTER 11

# Support for Security-Enhanced Linux

This chapter describes the SELinux feature, and includes the following sections:

## Overview

Security-Enhanced Linux (SELinux) is a solution composed of Linux kernel security module and system utilities to incorporate a strong, flexible Mandatory Access Control (MAC) architecture into Cisco IOS-XE platforms.

SELinux provides an enhanced mechanism to enforce the separation of information, based on confidentiality and integrity requirements, which addresses threats of tampering and bypassing of application security mechanisms and enables the confinement of damage that malicious or flawed applications can cause.

## Prerequisites for SELinux

There are no specific prerequisites for this feature.

## Restrictions for SELinux

There are no specific restrictions for this feature.

## Information About SELinux

SELinux enforces mandatory access control policies that confine user programs and system services to the minimum privilege required to perform their assigned functionality. This reduces or eliminates the ability of these programs and daemons to cause harm when compromised (for example, through buffer overflows or misconfigurations). This is a practical implementation of principle of least privilege by enforcing MAC on Cisco IOS-XE platforms. This confinement mechanism works independently of the traditional Linux access control mechanisms. SELinux provides the capability to define policies to control the access from an application process to any resource object, thereby allowing for the clear definition and confinement of process behavior.

SELinux can operate either in **Permissive mode** or **Enforcing mode** when enabled on a system.

- In Permissive mode, SELinux does not enforce the policy, and only generates system logs for any denials caused by violation of the resource access policy. The operation is not denied, but only logged for resource access policy violation.
- In Enforcing mode, the SELinux policy is enabled and enforced. It denies resource access based on the access policy rules, and generates system logs.

SELinux is enabled in Enforcing mode by default on supported Cisco IOS XE platforms. In the Enforcing mode, any system resource access that does not have the necessary allow policy is treated as a violation, and the operation is denied. The violating operation fails when a denial occurs, and system logs are generated. In Enforcing mode, the solution works in access-violation prevention mode.

# Configuring SELinux

The are no additional requirements or configuration steps needed to enable or use the SELinux feature in Enforcing mode.

The following commands are introduced as part of the SELinux feature:

```
set platform software selinux {default | enforcing | permissive}
```

```
platform security selinux {enforcing | permissive}
```

```
show platform software selinux
```

**Note** These new commands are implemented as **service internal** commands.

## Configuring SELinux (EXEC Mode)

Use the **set platform software selinux** command to configure SELinux in EXEC mode.

The following example shows SELinux configuration in EXEC mode:

```
Device# set platform software selinux ?

default  Set SELinux mode to default
enforcing  Set SELinux mode to enforcing
permissive  Set SELinux mode to permissive
```

## Configuring SELinux (CONFIG Mode)

Use the **platform security selinux** command to configure SELinux in configuration mode.

The following example shows SELinux configuration in CONFIG mode:

```
Device(config)# platform security selinux

enforcing  Set SELinux policy to Enforcing mode
permissive  Set SELinux policy to Permissive mode

Device(config)# platform security selinux permissive

Device(config)#
*Oct 20 21:52:45.155: %IOSXE-1-PLATFORM: R0/0:
SELINUX_MODE_PROG: Platform Selinux confinement mode downgraded to permissive!

Device(config)#
```

# Examples for SELinux

The following example shows the output for changing the mode from Enforcing to Permissive:

```
“*Oct 20 21:44:03.609: %IOSXE-1-PLATFORM: R0/0:
SELINUX_MODE_PROG: Platform Selinux confinement mode downgraded to permissive!”
```

The following example shows the output for changing the mode from Permissive to Enforcing:

```
“*Oct 20 21:44:34.160: %IOSXE-1-PLATFORM: R0/0:
SELINUX_MODE_PROG: Platform Selinux confinement mode upgraded to enforcing!”
```

**Note** If the SELinux mode is changed, this change is considered a system security event, and a system log message is generated.

# SysLog Message Reference

| **Facility-Severity-Mnemonic** | **%SELINUX-1-VIOLATION** |
|---|---|
| Severity-Meaning | Alert Level Log |
| Message | N/A |
| Message Explanation | Resource access was made by the process for which a resource access policy does not exist. The operation was flagged, and resource access was denied. A system log was generated with information that process resource access has been denied. |
| Component | SELINUX |

| Facility-Severity-Mnemonic | %SELINUX-1-VIOLATION |
|---|---|
| Recommended Action | Contact Cisco TAC with the following relevant information as attachments:<br>• The exact message as it appears on the console or in the system<br>• Output of the **show tech-support** command (text file)<br>• Archive of Btrace files from the box using the following command:<br>**request platform software trace archive target <URL>**<br>• Output of the **show platform software selinux** command |

The following examples demonstrate sample syslog messages:

Example 1:

```
*Nov 14 00:09:04.943: %SELINUX-1-VIOLATION: R0/0: audispd: type=AVC
msg=audit(1699927057.934:129): avc: denied { getattr } for pid=5899 comm="ls"
path="/root/test" dev="rootfs" ino=25839
scontext=system_u:system_r:polaris_iosd_t:s0
tcontext=system_u:object_r:admin_home_t:s0 tclass=file permissive=0
```

Example 2:

```
*Nov 14 00:09:04.947: %SELINUX-1-VIOLATION: R0/0: audispd: t type=AVC
msg=audit(1699927198.486:130): avc: denied { write } for pid=6012 comm="echo"
path="/root/test" dev="rootfs" ino=25839
scontext=system_u:system_r:polaris_iosd_t:s0
tcontext=system_u:object_r:admin_home_t:s0 tclass=file permissive= 0
```

# Verifying SELinux Enablement

Use the **show platform software selinux** command to view the SELinux configuration mode:

```
Device# show platform software selinux
=========================================
IOS-XE SELINUX STATUS
=========================================
SElinux Status :    Enabled
Current Mode :      Enforcing
Config file Mode :  Enforcing
```

# Troubleshooting SELinux

If there is an instance of an SELinux violation on your device or network, please reach out to Cisco TAC with the following details:

- The message exactly as it appears on the console or in the system log. For example:

```
device#request platform software trace archive target
    flash:selinux_btrace_logs
```

- Output of the **show tech-support** command (text file)
- Archive of Btrace files from the box using the following command:

  **request platform software trace archive target <URL>**
- Output of the **show platform software selinux** command

CHAPTER 12

# High availability

Cisco High Availability (HA) enables network-wide protection by providing fast recovery from faults that may occur in any part of the network. With Cisco High Availability, network hardware and software work together and enable rapid recovery from disruptions to ensure fault transparency to users and network applications.

The unique hardware and software architecture is designed to maximize router uptime during any network event, and thereby provide maximum uptime and resilience within any network scenario.

## Software Redundancy Overview

IOS runs as one of many processes within the operating system. This is different than on traditional Cisco IOS, where all processes are run within Cisco IOS. See the "IOS as a Process" section on page 2-7  for more information regarding IOS as a process.

This architecture allows for software redundancy opportunities that are not available on other platforms that run Cisco IOS software. Specifically, a standby IOS process can be available on the same Route Processor as the active IOS process. This standby IOS process can be switched to in the event of an IOS failure.

On the C84xx Series Platforms, the second IOS process can run only on the standby Route Processor.

## Configuring two Cisco IOS processes

Cisco IOS runs as one of the many processes. This architecture supports software redundancy opportunities. Specifically, a standby Cisco IOS process is available on the same Route Processor as the active Cisco IOS process. In the event of a Cisco IOS failure, the system switches to the standby Cisco IOS process.

### SUMMARY STEPS

1. enable
2. **configure terminal**

3. redundancy
4. mode SSO
5. **exit**
6. reload

### DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | enable<br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | redundancy<br>**Example:**<br>`Router(config)# redundancy` | Enters redundancy configuration mode. |
| **Step 4** | mode SSO<br>**Example:**<br>`Router(config)# mode SSO` | Configures SSO. When this command is entered, the redundant supervisor engine is reloaded and begins to work in SSO mode. |
| **Step 5** | **exit**<br>**Example:**<br>`Router(config)# exit`<br>**Example:**<br>`Router #` | Exits configuration mode and returns to global configuration mode. |
| **Step 6** | reload<br>**Example:**<br>`Router # reload` | Reloads IOS.<br>**Example:**<br>`Router# configure terminal`<br>`Router(config)# redundancy`<br>`Router(config)# mode SSO`<br>`Router(config)# exit`<br>`Router# reload` |

# Stateful switchover

Stateful Switchover (SSO) can be used to enable a second IOS process.

Stateful Switchover is particularly useful in conjunction with Nonstop Forwarding. SSO allows the dual IOS processes to maintain state at all times, and Nonstop Forwarding lets a switchover happen seamlessly when a switchover occurs

For additional information on NSF/SSO, see the Cisco Nonstop Forwarding document.

## SSO-Aware Protocol and Applications

SSO-supported line protocols and applications must be SSO-aware. A feature or protocol is SSO-aware if it maintains, either partially or completely, undisturbed operation through an RP switchover. State information for SSO-aware protocols and applications is synchronized from active to standby to achieve stateful switchover for those protocols and applications.

The dynamically created state of SSO-unaware protocols and applications is lost on switchover and must be reinitialized and restarted on switchover.

To see which protocols are SSO-aware on your router, use the following commands **show redundancy client** or **show redundancy history**.

# IPsec Failover

IPSec failover is a feature that increases the total uptime (or availability) of a customer's IPSec network. Traditionally, this is accomplished by employing a redundant (standby) router in addition to the original (active) router. If the active router becomes unavailable for any reason, the standby router takes over the processing of IKE and IPSec. IPSec failover falls into two categories: stateless failover and stateful failover.

IPsec supports only stateless failover. Stateless failover uses protocols such as the Hot Standby Router Protocol (HSRP) to provide primary to secondary cutover and also allows the active and standby VPN gateways to share a common virtual IP address.

# Bidirectional forwarding detection

Bidirectional Forwarding Detection (BFD) is a detection protocol designed to provide fast forwarding path failure detection times for all media types, encapsulations, topologies, and routing protocols. In addition to fast forwarding path failure detection, BFD provides a consistent failure detection method for network administrators. Because the network administrator can use BFD to detect forwarding path failures at a uniform rate rather than the variable rates for different routing protocol hello mechanisms, network profiling and planning is easier, and reconvergence time is consistent and predictable.

For more information on BFD, see the Bidirectional Forwarding Detection document.

CHAPTER 13

# Using the Management Ethernet Interface

The Cisco C84xx Series Platform have one Gigabit Ethernet Management Ethernet interface.

## Gigabit ethernet management interface

The purpose of this interface is to allow users to perform management tasks on the router; it is basically an interface that should not and often cannot forward network traffic but can otherwise access the router, often via Telnet and SSH, and perform most management tasks on the router. The interface is most useful before a router has begun routing, or in troubleshooting scenarios when the SPA interfaces are inactive.

The following aspects of the Management Ethernet interface should be noted:

- IPv4, IPv6, and ARP are the only routed protocols supported for the interface.
- The Ethernet Management Interface cannot be used as a Lawful Intercept MD source interface.
- The Management Ethernet interface is part of its own VRF. This is discussed in more detail in the Gigabit ethernet management interface VRF, on page 74

.

## Gigabit ethernet port numbering

The Gigabit Ethernet Management port is always GigabitEthernet0.

The port can be accessed in configuration mode like any other port on the Cisco C8400 Series Secure Router:

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#interface gigabitethernet0
Router(config-if)#
```

# IP address handling in ROMmon and the management ethernet port

IP addresses can be configured in ROMmon (the **IP_ADDRESS=** and **IP_SUBNET_MASK=** commands) and through the use of the IOS command-line interface (the **ip address** command in interface configuration mode).

Assuming the IOS process has not begun running , the IP address that was set in ROMmon acts as the IP address of the Management Ethernet interface. In cases where the IOS process is running and has taken control of the Management Ethernet interface, the IP address specified when configuring the Gigabit Ethernet 0 interface in the IOS CLI becomes the IP address of the Management Ethernet interface. The ROMmon-defined IP address is only used as the interface address when the IOS process is inactive.

For this reason, the IP addresses specified in ROMmon and in the IOS CLI can be identical and the Management Ethernet interface will function properly in single RP configurations.

# Gigabit ethernet management interface VRF

The Gigabit Ethernet Management interface is automatically part of its own VRF. This VRF, which is named “Mgmt-intf,” is automatically configured and is dedicated to the Management Ethernet interface; no other interfaces can join this VRF. Therefore, this VRF does not participate in the MPLS VPN VRF or any other network-wide VRF. The Mgmt-intf VRF supports loopback interface.

Placing the management ethernet interface in its own VRF has the following effects on the Management Ethernet interface:

- Many features must be configured or used inside the VRF, so the CLI may be different for certain management ethernet functions than on management ethernet interfaces on other routers.
- Prevents transit traffic from traversing the router. Because all built-in portd and the Management Ethernet interface are automatically in different VRFs, no transit traffic can enter the Management Ethernet interface and leave a built-in port, or vice versa.
- Improved security of the interface. Because the Mgmt-intf VRF has its own routing table as a result of being in its own VRF, routes can only be added to the routing table of the Management Ethernet interface if explicitly entered by a user.

The Management Ethernet interface VRF supports both IPv4 and IPv6 address families.

# Common ethernet management tasks

Because users can perform most tasks on a router through the Management Ethernet interface, many tasks can be done by accessing the router through the Management Ethernet interface.

This list is not intended as a comprehensive list of all tasks that can be done using the Management Ethernet interface.

This section covers the following processes:

# View the VRF configuration

The VRF configuration for the Management Ethernet interface is viewable using the **show running-config vrf** command.

This example shows the default VRF configuration:

```
Router# show running-config vrf
Building configuration...
Current configuration : 351 bytes
vrf definition Mgmt-intf
 !
 address-family ipv4
 exit-address-family
 !
 address-family ipv6
 exit-address-family
!
(some output removed for brevity)
```

# View VRF information for the management ethernet VRF

To see detailed information about the Management Ethernet VRF, enter the **show vrf detail Mgmt-intf** command:

```
Router# show vrf detail Mgmt-intf
```

# Set a default route in the management ethernet interface VRF

To set a default route in the Management Ethernet Interface VRF, enter the following command

**ip route vrf Mgmt-intf 0.0.0.0 0.0.0.0** *next-hop-IP-address*

# Set the management ethernet IP address

The IP address of the Management Ethernet port is set like the IP address on any other interface.

Below are two simple examples of configuring an IPv4 adress and an IPv6 address on the Management Ethernet interface.

### IPv4 Example

```
Router(config)# interface GigabitEthernet 0
Router(config-if)# ip address
 A.B.C.D A.B.C.D
```

### IPv6 Example

```
Router(config)# interface GigabitEthernet 0
```

Router(config-if)# **ipv6 address** *X:X:X:X::X*

# Telnetting over the Management Ethernet Interface

Telnetting can be done through the VRF using the Management Ethernet interface.

In the following example, the router telnets to 172.17.1.1 through the Management Ethernet interface VRF:

```
Router# telnet 172.17.1.1 /vrf Mgmt-intf
```

# Pinging over the management ethernet interface

Pinging other interfaces using the Management Ethernet interface is done through the VRF.

In the following example, the router pings the interface with the IP address of 172.17.1.1 through the Management Ethernet interface:

```
Router# ping vrf Mgmt-intf 172.17.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.17.1.1, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 1/1/1 ms
```

# Copy using TFTP or FTP

To copy a file using TFTP through the Management Ethernet interface, the **ip tftp source-interface GigabitEthernet 0** command must be entered before entering the **copy tftp** command because the **copy tftp** command has no option of specifying a VRF name.

Similarly, to copy a file using FTP through the Management Ethernet interface, the **ip ftp source-interface GigabitEthernet 0** command must be entered before entering the **copy ftp** command because the **copy ftp** command has no option of specifying a VRF name.

### TFTP Example

```
Router(config)# ip tftp source-interface gigabitethernet 0
```

### FTP Example

```
Router(config)# ip ftp source-interface gigabitethernet 0
```

# NTP Server

To allow the software clock to be synchronized by a Network Time Protocol (NTP) time server over the Management Ethernet interface, enter the **ntp server vrf Mgmt-intf** command and specify the IP address of the device providing the update.

The following CLI provides an example of this procedure.

```
Router(config)# ntp server vrf Mgmt-intf 172.17.1.1
```

# SYSLOG server

To specify the Management Ethernet interface as the source IP or IPv6 address for logging purposes, enter the **logging host <ip-address> vrf Mgmt-intf** command.

The following CLI provides an example of this procedure.

```
Router(config)# logging host <ip-address> vrf Mgmt-intf
```

# SNMP-related services

To specify the Management Ethernet interface as the source of all SNMP trap messages, enter the **snmp-server source-interface traps gigabitEthernet 0** command.

The following CLI provides an example of this procedure:

```
Router(config)# snmp-server source-interface traps gigabitEthernet 0
```

# Domain name assignment

The IP domain name assignment for the Management Ethernet interface is done through the VRF.

To define the default domain name as the Management Ethernet VRF interface, enter the **ip domain-name vrf Mgmt-intf** *domain* command.

```
Router(config)# ip domain-name vrf Mgmt-intf cisco.com
```

# DNS service

To specify the Management Ethernet interface VRF as a name server, enter the **ip name-server vrf Mgmt-intf** *IPv4-or-IPv6-address* command.

```
Router(config)# ip name-server vrf Mgmt-intf
 IPv4-or-IPv6-address
```

# RADIUS or TACACS+ Server

To group the Management VRF as part of a AAA server group, enter the **ip vrf forward Mgmt-intf** command when configuring the AAA server group.

The same concept is true for configuring a TACACS+ server group. To group the Management VRF as part of a TACACS+ server group, enter the **ip vrf forwarding Mgmt-intf** command when configuring the TACACS+ server group.

### RADIUS Server Group Configuration

```
Router(config)# aaa group server radius hello
Router(config-sg-radius)# ip vrf forwarding Mgmt-intf
```

### TACACS+ Server Group Example

```
outer(config)# aaa group server tacacs+ hello
Router(config-sg-tacacs+)# ip vrf forwarding Mgmt-intf
```

# VTY lines with ACL

To ensure an access control list (ACL) is attached to vty lines that are and are not using VRF, use the **vrf-also** option when attaching the ACL to the vty lines.

```
Router(config)# line vty 0 4
Router(config-line)# access-class 90 in vrf-also
```

CHAPTER 14

# Bridge domain interface

Bridge domain interface is a logical interface that allows bidirectional flow of traffic between a Layer 2 bridged network and a Layer 3 routed network traffic. Bridge domain interfaces are identified by the same index as the bridge domain. Each bridge domain represents a Layer 2 broadcast domain. Only one bridge domain interface can be associated with a bridge domain.

Bridge domain interface supports the following features:

- IP termination
- Layer 3 VPN termination
- Address Resolution Protocol (ARP), G-ARP, and P-ARP handling
- MAC address assignment

Prior to configuring a bridge domain interface, you must understand the following concepts:

- Ethernet Virtual Circuit Overview
- Bridge Domain Interface Encapsulation
- Assigning a MAC Address
- Support for IP Protocols
- Support for IP Forwarding
- Packet Forwarding
- Bridge Domain Interface Statistics

# Restrictions

The following are the restrictions pertaining to bridge domain interfaces:

- Only 4096 bridge domain interfaces are supported per system.
- For a bridge domain interface, the maximum transmission unit (MTU) size can be configured between 1500 and 9216 bytes.
- Bridge domain interfaces support only the following features:
  - IPv4 Multicast
  - QoS marking and policing. Shaping and queuing are not supported
  - IPv4 VRF
  - IPv6 unicast forwarding
  - Dynamic routing such as BGP, OSPF, EIGRP, RIP, IS-IS, and STATIC
  - Hot Standby Router Protocol (HSRP)
  - Virtual Router Redundancy Protocol (VRRP) from IOS XE 3.8.0 onwards.
- Bridge domain interfaces do not support the following features:
  - PPP over Ethernet (PPPoE)
  - Bidirectional Forwarding Detection (BFD) protocol
  - QoS
  - Network-Based Application Recognition (NBAR) or Advanced Video Coding (AVC)

# Ethernet virtual circuit

An Ethernet Virtual Circuit (EVC) is an end-to-end representation of a single instance of a Layer 2 service that is offered by a provider. It embodies the different parameters on which the service is being offered. In the Cisco EVC Framework, the bridge domains are made up of one or more Layer 2 interfaces known as service instances. A service instance is the instantiation of an EVC on a given port on a given router. Service instance is associated with a bridge domain based on the configuration.

An incoming frame can be classified as service instance based on the following criteria:

- Single 802.1Q VLAN tag, priority-tagged, or 802.1ad VLAN tag
- Both QinQ (inner and outer) VLAN tags, or both 802.1ad S-VLAN and C-VLAN tags
- Outer 802.1p CoS bits, inner 802.1p CoS bits, or both

- Payload Ethernet type (five choices are supported: IPv4, IPv6, PPPoE-all, PPoE-discovery, and PPPoE-session)

Service instance also supports alternative mapping criteria:

- Untagged—Mapping to all the frames lacking a 802.1Q or 802.1ad header
- Default—Mapping to all the frames

# Bridge domain interface encapsulation

Security Group classification includes both Source and Destination Group, which is specified by source SGT and DGT. SGT Based PBR feature provides the PBR route-map match clause for SGT/DGT based packet classification. SGT Based PBR feature supports configuration of unlimited number of tags, but it is recommended to configure the tags based on memory available in the platform.

An EVC provides the ability to employ different encapsulations on each Ethernet flow point (EFP) present in a bridge domain. A BDI egress point may not be aware of the encapsulation of an egress packet because the packet may have egressed from one or more EFPs with different encapsulations.

In a bridge domain, if all the EFPs have different encapsulations, the BDI must be untagged (using the no 802.1Q tag). Encapsulate all the traffic in the bridge domain (popped or pushed) at the EFPs. Configure rewrite at each EFP to enable encapsulation of the traffic on the bridge domain.

In a bridge domain, if all the EFPs have the same encapsulation, configure the encapsulations on the BDI using the encapsulation command. Enabling encapsulation at the BDI ensures effective pushing or popping of tags, thereby eliminating the need for configuring the rewrite command at the EFPs. For more information on configuring the encapsulations on the BDI, see the How to Configure a Bridge Domain Interface.

# Assign a MAC address

All the bridge domain interfaces on the Cisco C8400 Series Routers share a common MAC address. The first bridge domain interface on a bridge domain is allocated a MAC address. Thereafter, the same MAC address is assigned to all the bridge domain interfaces that are created in that bridge domain.

**Note** You can configure a static MAC address on a bridge domain interface using the **mac-address** command.

# Support for IP protocols

Brigde domain interfaces enable the Cisco C8400 Series Secure Routers to act as a Layer 3 endpoint on the Layer 2 bridge domain for the following IP-related protocols:

- ARP
- DHCP
- HTTP

- ICMP
- NTP
- RARP
- SNMP
- TCP
- Telnet
- TFTP
- UDP

# Support for IP Forwarding

Bridge domain interface supports the following IP forwarding features:

- IPv4 input and output access control lists (ACL)
- IPv4 input and output QoS policies. The operations supported for the input and output service policies on a bridge domain interface are:
    - Classification
    - Marking
    - Policing
- IPv4 L3 VRFs

# Packet forwarding

A bridge domain interface provides bridging and forwarding services between the Layer 2 and Layer 3 network infrastructure.

## Layer 2 to Layer 3

During a packet flow from a Layer 2 network to a Layer 3 network, if the destination MAC address of the incoming packet matches the bridge domain interface MAC address, or if the destination MAC address is a multicast address, the packet or a copy of the packet is forwarded to the bridge domain interface.

**Note** MAC address learning cannot not be performed on the bridge domain interface.

## Layer 3 to Layer 2

When a packet arrives at a Layer 3 physical interface of a router, a route lookup action is performed. If route lookup points to a bridge domain interface, then the bridge domain interface adds the layer 2 encapsulation and forwards the frame to the corresponding bridge domain. The byte counters are updated.

During a Layer 2 lookup on a bridge domain to which the bridge domain interface belongs, the bridge domain forwards the packets to the correct service instance based on the destination MAC address.

# Link states of a bridge domain and a bridge domain interface

Bridge domain interface acts as a routable IOS interface on Layer 3 and as a port on a bridge domain. Both bridge domain interfaces and bridge domains operate with individual administrative states.

Shutting down a bridge domain interface stops the Layer 3 data service, but does not override or impact the state of the associated bridge domain.

Shutting down a bridge domain stops Layer 2 forwarding across all the associated members including service instances and bridge domain interfaces. The associated service instances influnence operational state of a bridge domain. Bridge domain interface cannot be operational unless one of the associated service instances is up.

**Note** Because a bridge domain interface is an internal interface, the operational state of bridge domain interface does not affect the bridge domain operational state.

## BDI initial state

The initial administrative state of a BDI depends on how the BDI is created. When you create a BDI at boot time in the startup configuration, the default administrative state for the BDI is up. It will remain in this state unless the startup configuration includes the shutdown command. This behavior is consistent with all the other interfaces. When you create a BDI dynamically at command prompt, the default administrative state is down.

## BDI link state

A BDI maintains a link state that comprises of three states: administratively down, operationally down, and up. The link state of a BDI is derived from two independent inputs: the BDI administrative state set by the corresponding users and the fault indication state from the lower levels of the interface states. It defines a BDI link state based on the state of the two inputs.

| Fault Indication State | BDI Admin{start straddle 2 columns}{end straddle 2 columns} | |
|---|---|---|
| {start emdash} {end emdash} | **Shutdown** | **No Shutdown** |
| **No faults asserted** | Admin-down | Up |
| **At least one fault asserted** | Admin-down | Operationally-Down |

# Bridge domain interface statistics

For virtual interfaces, such as the bridge domain interface, protocol counters are periodically queried from the QFP.

When packets flow from a Layer 2 bridge domain network to a Layer 3 routing network through the bridge domain interface, the packets are treated as bridge domain interface input packets and bytes. When packets arrive at a Layer 3 interface and are forwarded through the bridge domain interface to a Layer 2 bridge domain, the packets are treated as output packets and bytes, and the counters are updated accordingly.

A BDI maintains a standard set of Layer 3 packet counters as the case with all Cisco IOS interfaces. Use the show interface command to view the Layer 3 packet counters.

The convention of the counters is relative to the Layer 3 cloud. For example, input refers to the traffic entry to the Layer 3 cloud from the Layer 2 BD, while output refers to the traffic exit from the Layer 3 cloud to the Layer 2 BD.

Use the **show interfaces accounting** command to display the statistics for the BDI status. Use the **show interface** <*if-name*> command to display the overall count of the packets and bytes that are transmitted and received.

# Create or delete a bridge domain interface

When you define an interface or subinterface for a Cisco IOS router, you name it and specify how it is assigned an IP address.You can create a bridge domain interface before adding a bridge domain to the system. This new bridge domain interface will be activated after the associated bridge domain is configured.

**Note** When a bridge domain interface is created, a bridge domain is automatically created.

When you create the bridge domain interface and the bridge domain, the system maintains the required associations for mapping the bridge domain-bridge domain interface pair.

The mapping of bridge domain and bridge domain interface is maintained in the system. The bridge domain interface uses the index of the associated bridge domain to show the association.

# Bridge domain virtual IP interface

The Virtual IP Interface (VIF) feature helps to associate multiple BDI interfaces with a BD instance. The BD-VIF interface inherits all the existing L3 features of IOS logical IP interface.

**Note** You must configure every BD-VIF interface with a unique MAC address and it should belong to a different VRF.

The Virtual IP Interface (VIF) feature has the following limitations:

- BD-VIF interface does not support IP multicast.

- Number of BD-VIF interfaces with automatically generated MAC address varies on the basis of platforms.
- BD-VIF Interface does not support MPLS.
- The maximum number of BD-VIF interfaces per bridge-domain and the total number of BD-VIF interface for per system vary based on the type of platforms.

# Configure bridge domain virtual IP interface

```
enable
configure terminal
[no] interface BD-VIF interface-number
  [[no] vrf forwarding vrf-name]
  [[no] mac address mac-address]
  [[no] ip address ip-address mask]
  [[no] ipv6 address {X:X:X:X::X link-local| X:X:X:X::X/prefix [anycast | eui-64] | autoconfig
 [default]}]

exit
```

To delete BD-VIF interface, use the 'no' form of the command.

## Associate VIF interface with a bridge domain

```
enable
configure terminal
bridge-domain bridge-domain number
[no] member BD-VIF interface-number
exit
```

## Verify bridge domain virtual IP interface

All existing show commands for interface and IP interface can be used for the BD-VIF interface.

show interface bd-vif *bd-vif-id*

show ip interface bd-vif *bd-vif-id*

show bd-vif interfaces in fman-fp

show pla sof inter fp ac brief | i BD_VIF

## Example: Configure bridge domain virtual IP interface

```
Detail sample:

interface Port-channel1
mtu 9000
no ip address
 !Ethernet service endpoint one per neutron network
service instance 1756 ethernet
  description 4e8e5957-649f-477b-9e5b-f1f75b21c03c
  encapsulation dot1q 1756
  rewrite ingress tag pop 1 symmetric
  bridge-domain 1756
!
```

```
interface BD-VIF5001
no shutdown
vrf forwarding vrf5001
ip address 10.0.0.1 255.255.255.0
interface BD-VIF5002
no shutdown
vrf forwarding vrf5002
ip address 10.0.0.2 255.255.255.0

bridge-domain 1756
member Port-channel1 service-instance 1756
member bd-vif5001
member bd-vif5002
```

# Configure a bridge domain interface

To configure a bridge domain interface, perform the following steps:

### Procedure

**Step 1** **enable**

**Example:**

```
Router> enable
```

Enables privileged EXEC mode. Enter your password if prompted.

**Step 2** **configure terminal**

**Example:**

```
Router# configure terminal
```

Enters global configuration mode.

**Step 3** **interface BDI** *{interface number}*

**Example:**

```
Router(config-if)# interface BDI3
```

Specifies a bridge domain interface on a Cisco 8500 Series Catalyst Edge Platform.

**Step 4** **encapsulation** *encapsulation dot1q <first-tag> [second-dot1q <second-tag>]*

**Example:**

```
Router(config-if)# encapsulation dot1Q 1 second-dot1q 2
```

Defines the encapsulation type.

The example shows how to define dot1q as the encapsulation type.

**Step 5** Do one of the following:

**Example:**

**ip address** *ip-address mask*

**Example:**

**Example:**

**ipv6 address** *{X:X:X:X::X* **link-local***| X:X:X:X::X/prefix [***anycast** *|* **eui-64***] |* **autoconfig** *[***default***]}*

**Example:**

```
Router(config-if)# ip address 2.2.2.1 255.255.255.0
```

**Example:**

**Example:**

```
Router(config-if)# ipv6 address AB01:CD1:123:C::/64 eui-64
```

Specifies either the IPv4 or IPv6 address for the bridge domain interface.

**Step 6** **match security-group destination tag** *sgt-number*

**Example:**

```
Router(config-route-map)# match security-group destination tag 150
```

Configures the value for security-group destination security tag.

**Step 7** **mac address** *{mac-address}*

**Example:**

```
Router(config-if)# mac-address 1.1.3
```

Specifies the MAC address for the bridge domain interface.

**Step 8** **no shut**

**Example:**

```
Router(config-if)# no shut
```

Enables the bridge domain interface.

**Step 9** **shut**

**Example:**

```
Router(config-if)# shut
```

Disables the bridge domain interface .

The following example shows the configuration of a bridge domain interface at IP address 2.2.2.1 255.255.255.0:

```
Router# configure terminal
Router(config)# interface BDI3
Router(config-if)# encapsulation dot1Q 1 second-dot1q 2
Router(config-if)# ip address 2.2.2.1 255.255.255.0
Router(config-if)# mac-address 1.1.3
Router(config-if)# no shut
Router(config-if)# exit
```

# Display and verify bridge domain interface

### SUMMARY STEPS

1. **enable**
2. **show interfaces bdi**
3. **show platform software interface fp active name**
4. **show platform hardware qfp active interface if-name**
5. **debug platform hardware qfp feature**
6. **platform trace runtime process forwarding-manager module**
7. **platform trace boottime process forwarding-manager module interfaces**

### DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router> enable` | Enables privileged EXEC mode. Enter your password if prompted. |
| **Step 2** | **show interfaces bdi**<br>**Example:**<br>`Router# show interfaces BDI3` | Displays the configuration summary of the corresponding BDI. |
| **Step 3** | **show platform software interface fp active name**<br>**Example:**<br>`Router# show platform software interface fp active name BDI4` | Displays the bridge domain interface configuration in a Forwarding Processor. |
| **Step 4** | **show platform hardware qfp active interface if-name**<br>**Example:**<br>`Router# show platform hardware qfp active interface if-name BDI4` | Displays the bridge domain interface configuration in a data path. |

| | Command or Action | Purpose |
|---|---|---|
| **Step 5** | **debug platform hardware qfp feature**<br>**Example:**<br>`Router# debug platform hardware qfp active feature l2bd client all` | The selected CPP L2BD Client debugging is on. |
| **Step 6** | **platform trace runtime process forwarding-manager module**<br>**Example:**<br>`Router(config)# platform trace runtime slot F0 bay 0 process forwarding-manager module interfaces level info` | Enables the Forwarding Manager Route Processor and Embedded Service Processor trace messages for the Forwarding Manager process. |
| **Step 7** | **platform trace boottime process forwarding-manager module interfaces**<br>**Example:**<br>`Router(config)# platform trace boottime slot R0 bay 1 process forwarding-manager forwarding-manager level max` | Enables the Forwarding Manager Route Processor and Embedded Service Processor trace messages for the Route Processor Forwarding Manager process during bootup. |

CHAPTER 15

# Packet Trace

The Packet-Trace feature provides a detailed understanding of how data packets are processed by the Cisco IOS XE platform, and thus helps customers to diagnose issues and troubleshoot them more efficiently. This module provides information about how to use the Packet-Trace feature.

# Information About Packet Trace

The Packet-Trace feature provides three levels of inspection for packets: accounting, summary, and path data. Each level provides a detailed view of packet processing at the cost of some packet processing capability. However, Packet Trace limits inspection to packets that match the debug platform condition statements, and is a viable option even under heavy-traffic situations in customer environments.

The following table explains the three levels of inspection provided by packet trace.

*Table 12: Packet-Trace Level*

| Packet-Trace Level | Description |
|---|---|
| Accounting | Packet-Trace accounting provides a count of packets that enter and leave the network processor. Packet-Trace accounting is a lightweight performance activity, and runs continuously until it is disabled. |
| Summary | At the summary level of packet trace, data is collected for a finite number of packets. Packet-Trace summary tracks the input and output interfaces, the final packet state, and punt, drop, or inject packets, if any. Collecting summary data adds to additional performance compared to normal packet processing, and can help to isolate a troublesome interface. |

| Packet-Trace Level | Description |
|---|---|
| Path data | The packet-trace path data level provides the greatest level of detail in packet trace. Data is collected for a finite number of packets. Packet-Trace path data captures data, including a conditional debugging ID that is useful to correlate with feature debugs, a timestamp, and also feature-specific path-trace data.<br>Path data also has two optional capabilities: packet copy and Feature Invocation Array (FIA) trace. The packet-copy option enables you to copy input and output packets at various layers of the packet (layer 2, layer 3 or layer 4). The FIA- trace option tracks every feature entry invoked during packet processing and helps you to know what is happening during packet processing.<br>**Note**<br>Collecting path data consumes more packet-processing resources, and the optional capabilities incrementally affect packet performance. Therefore, path-data level should be used in limited capacity or in situations where packet performance change is acceptable. |

# Usage Guidelines for Configuring Packet Trace

Consider the following best practices while configuring the Packet-Trace feature:

- Use of ingress conditions when using the Packet-Trace feature is recommended for a more comprehensive view of packets.
- Packet-trace configuration requires data-plane memory. On systems where data-plane memory is constrained, carefully consider how you will select the packet-trace values. A close approximation of the amount of memory consumed by packet trace is provided by the following equation:

memory required = (statistics overhead) + number of packets * (summary size + data size + packet copy size).

When the Packet-Trace feature is enabled, a small, fixed amount of memory is allocated for statistics. Similarly, when per-packet data is captured, a small, fixed amount of memory is required for each packet for summary data. However, as shown by the equation, you can significantly influence the amount of memory consumed by the number of packets you select to trace, and whether you collect path data and copies of packets.

# Configuring Packet Trace

Perform the following steps to configure the Packet Trace feature.

**Note** The amount of memory consumed by the Packet-Trace feature is affected by the packet-trace configuration. You should carefully select the size of per-packet path data and copy buffers and the number of packets to be traced in order to avoid interrupting normal services. You can check the current data-plane DRAM memory consumption by using the **show platform hardware qfp active infrastructure exmem statistics** command.

## SUMMARY STEPS

1. **enable**
2. **debug platform packet-trace packet** *pkt-num* **[fia-trace | summary-only] [circular] [data-size** *data-size***]**
3. **debug platform packet-trace {punt |inject|copy|drop|packet|statistics}**
4. **debug platform condition [ipv4 | ipv6] [interface** *interface***][access-list** *access-list -name* | *ipv4-address* / *subnet-mask* | *ipv6-address* / *subnet-mask***] [ingress | egress |both]**
5. **debug platform condition start**
6. **debug platform condition stop**
7. **show platform packet-trace {configuration | statistics | summary | packet {all |** *pkt-num***}}**
8. **clear platform condition all**
9. **exit**

## DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router> enable` | Enables the privileged EXEC mode. Enter your password if prompted. |
| **Step 2** | **debug platform packet-trace packet** *pkt-num* **[fia-trace \| summary-only] [circular] [data-size** *data-size***]**<br>**Example:**<br>`Router# debug platform packet-trace packets 2048 summary-only` | Collects summary data for a specified number of packets. Captures feature path data by default, and optionally performs FIA trace.<br>*pkt-num*—Specifies the maximum number of packets maintained at a given time.<br>**fia-trace**—Provides detailed level of data capture, including summary data, feature-specific data. Also displays each feature entry visited during packet processing.<br>**summary-only**—Enables the capture of summary data with minimal details.<br>**circular**—Saves the data of the most recently traced packets.<br>*data-size*—Specifies the size of data buffers for storing feature and FIA trace data for each packet in bytes. When very heavy packet processing is performed on packets, users can increase the size of the data buffers if necessary. The default value is 2048. |
| **Step 3** | **debug platform packet-trace {punt \|inject\|copy\|drop\|packet\|statistics}**<br>**Example:**<br>`Router# debug platform packet-trace punt` | Enables tracing of punted packets from data to control plane. |

| | Command or Action | Purpose |
|---|---|---|
| Step 4 | **debug platform condition [ipv4 \| ipv6] [interface** *interface***][access-list** *access-list -name* \| *ipv4-address* / *subnet-mask* \| *ipv6-address* / *subnet-mask***] [ingress \| egress \|both]**<br>**Example:**<br>`Router# debug platform condition interface g0/0/0 ingress` | Specifies the matching criteria for tracing packets. Provides the ability to filter by protocol, IP address and subnet mask, access control list (ACL), interface, and direction. |
| Step 5 | **debug platform condition start**<br>**Example:**<br>`Router# debug platform condition start` | Enables the specified matching criteria and starts packet tracing. |
| Step 6 | **debug platform condition stop**<br>**Example:**<br>`Router# debug platform condition start` | Deactivates the condition and stops packet tracing. |
| Step 7 | **show platform packet-trace {configuration \| statistics \| summary \| packet {all \|** *pkt-num***}}**<br>**Example:**<br>`Router# show platform packet-trace 14` | Displays packet-trace data according to the specified option. See {start cross reference} Table 21-1 {end cross reference} for detailed information about the **show** command options. |
| Step 8 | **clear platform condition all**<br>**Example:**<br>`Router(config)# clear platform condition all` | Removes the configurations provided by the **debug platform condition** and **debug platform packet-trace** commands. |
| Step 9 | **exit**<br>**Example:**<br>`Router# exit` | Exits the privileged EXEC mode. |

# Configuring Packet Tracer with UDF Offset

Perform the following steps to configure the Packet-Trace UDF with offset:

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **udf** *udf name* **header** {**inner | outer**} {**13|14**} **offset** *offset-in-bytes* **length** *length-in-bytes*
4. **udf** *udf name* {**header | packet-start**} *offset-base offset length*
5. **ip access-list extended** {*acl-name* |*acl-num*}

6. **ip access-list extended { deny | permit } udf udf-name value mask**
7. **debug platform condition [ipv4 | ipv6] [ interface** *interface***] [access-list** *access-list -name* | *ipv4-address / subnet-mask* | *ipv6-address / subnet-mask***] [ ingress | egress |both ]**
8. **debug platform condition start**
9. **debug platform packet-trace packet** *pkt-num* **[ fia-trace | summary-only] [ circular ] [ data-size** *data-size***]**
10. **debug platform packet-trace {punt | inject|copy | drop |packet | statistics}**
11. **debug platform condition stop**
12. **exit**

## DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| Step 1 | **enable**<br>**Example:**<br>`Device> enable` | Enables privileged EXEC mode.<br>• Enter your password if prompted. |
| Step 2 | **configure terminal**<br>**Example:**<br>`Device# configure terminal` | Enters global configuration mode. |
| Step 3 | **udf** *udf name* **header** {**inner** \| **outer**} {**13**\|**14**} **offset** *offset-in-bytes* **length** *length-in-bytes*<br>**Example:**<br>`Router(config)# udf TEST_UDF_NAME_1 header  inner 13 64 1`<br>`Router(config)# udf TEST_UDF_NAME_2 header  inner 14 77 2`<br>`Router(config)# udf TEST_UDF_NAME_3 header outer 13 65 1`<br>`Router(config)# udf TEST_UDF_NAME_4 header outer 14 67 1` | Configures individual UDF definitions. You can specify the name of the UDF, the networking header from which offset, and the length of data to be extracted.<br>The **inner** or **outer** keywords indicate the start of the offset from the unencapsulated Layer 3 or Layer 4 headers, or if there is an encapsulated packet, they indicate the start of offset from the inner L3/L4.<br>The **length** keyword specifies, in bytes, the length from the offset. The range is from 1 to 2.<br>. |
| Step 4 | **udf** *udf name* {**header** \| **packet-start**} *offset-base offset length*<br>**Example:**<br>`Router(config)# udf TEST_UDF_NAME_5 packet-start 120 1` | • header—Specifies the offset base configuration.<br>• packet-start—Specifies the offset base from packet-start. packet-start" can vary depending on if packet-trace is for an inbound packet or outbound packet. If the packet-trace is for an inbound packet then the packet-start will be layer2. For outbound, he packet-start will be layer3. |

| | Command or Action | Purpose |
|---|---|---|
| | | • offset—Specifies the number of bytes offset from the offset base. To match the first byte from the offset base (Layer 3/Layer 4 header), configure the offset as 0.<br>• length—Specifies the number of bytes from the offset. Only 1 or 2 bytes are supported. To match additional bytes, you must define multiple UDFs. |
| **Step 5** | **ip access-list extended** {*acl-name* \|*acl-num*}<br>**Example:**<br>`Router(config)# ip access-list extended acl2` | Enables extended ACL configuration mode. The CLI enters the extended ACL configuration mode in which all subsequent commands apply to the current extended access list. Extended ACLs control traffic by the comparison of the source and destination addresses of the IP packets to the addresses configured in the ACL. |
| **Step 6** | **ip access-list extended { deny \| permit } udf udf-name value mask**<br>**Example:**<br>`Router(config-acl)# permit ip any any udf TEST_UDF_NAME_5 0xD3 0xFF` | Configures the ACL to match on UDFs along with the current access control entries (ACEs) . The bytes defined in ACL is 0xD3. Masks are used with IP addresses in IP ACLs to specify what should be permitted and denied. |
| **Step 7** | **debug platform condition [ipv4 \| ipv6] [ interface** *interface***] [access-list** *access-list -name* \| *ipv4-address* / *subnet-mask* \| *ipv6-address* / *subnet-mask***] [ ingress \| egress \|both ]**<br>**Example:**<br>`Router# debug platform condition interface gi0/0/0 ipv4 access-list acl2 both` | Specifies the matching criteria for tracing packets. Provides the ability to filter by protocol, IP address and subnet mask, access control list (ACL), interface, and direction. |
| **Step 8** | **debug platform condition start**<br>**Example:**<br>`Router# debug platform condition start` | Enables the specified matching criteria and starts packet tracing. |
| **Step 9** | **debug platform packet-trace packet** *pkt-num* **[ fia-trace \| summary-only] [ circular ] [ data-size** *data-size***]**<br>**Example:**<br>`Router# debug platform packet-trace packet 1024 fia-trace data-size 2048` | Collects summary data for a specified number of packets. Captures feature path data by default, and optionally performs FIA trace.<br>*pkt-num*—Specifies the maximum number of packets maintained at a given time.<br>**fia-trace**—Provides detailed level of data capture, including summary data, feature-specific data. Also displays each feature entry visited during packet processing.<br>**summary-only**—Enables the capture of summary data with minimal details. |

| | Command or Action | Purpose |
|---|---|---|
| | | **circular**—Saves the data of the most recently traced packets.<br>*data-size*—Specifies the size of data buffers for storing feature and FIA trace data for each packet in bytes. When very heavy packet processing is performed on packets, users can increase the size of the data buffers if necessary. The default value is 2048. |
| **Step 10** | **debug platform packet-trace {punt \| inject\|copy \| drop \|packet \| statistics}**<br>**Example:**<br>`Router# debug platform packet-trace punt` | Enables tracing of punted packets from data to control plane. |
| **Step 11** | **debug platform condition stop**<br>**Example:**<br>`Router# debug platform condition start` | Deactivates the condition and stops packet tracing. |
| **Step 12** | **exit**<br>**Example:**<br>`Router# exit` | Exits the privileged EXEC mode. |

# Displaying Packet-Trace Information

Use these **show** commands to display packet-trace information.

*Table 13: show Commands*

| Command | Description |
|---|---|
| **show platform packet-trace configuration** | Displays packet trace configuration, including any defaults. |
| **show platform packet-trace statistics** | Displays accounting data for all the traced packets. |
| **show platform packet-trace summary** | Displays summary data for the number of packets specified. |
| **show platform packet-trace {all \|** *pkt-num***} [decode]** | Displays the path data for all the packets or the packet specified. The **decode** option attempts to decode the binary packet into a more human- readable form. |

# Removing Packet Trace Data

Use these commands to clear packet-trace data.

*Table 14: clear Commands*

| Command | Description |
|---|---|
| **clear platform packet-trace statistics** | Clears the collected packet-trace data and statistics. |
| **clear platform packet-trace configuration** | Clears the packet-trace configuration and the statistics. |

# Configuration Examples for Packet Trace

This section provides the following configuration examples:

## Example: Configuring Packet Trace

This example describes how to configure packet trace and display the results. In this example, incoming packets to Gigabit Ethernet interface 0/0/1 are traced, and FIA-trace data is captured for the first 128 packets. Also, the input packets are copied. The **show platform packet-trace packet 0** command displays the summary data and each feature entry visited during packet processing for packet 0.

```
Router>
enable
Router# debug platform packet-trace packet 128 fia-trace
Router# debug platform packet-trace punt
Router# debug platform condition interface g0/0/1 ingress
Router# debug platform condition start
Router#! ping to UUT
Router# debug platform condition stop
Router# show platform packet-trace packet 0
Packet: 0           CBUG ID: 9
Summary
  Input     : GigabitEthernet0/0/1
  Output    : GigabitEthernet0/0/0
  State     : FWD
  Timestamp
    Start   : 1819281992118 ns (05/17/2014 06:42:01.207240 UTC)
    Stop    : 1819282095121 ns (05/17/2014 06:42:01.207343 UTC)
Path Trace
  Feature: IPV4
    Source      : 198.51.100.2
    Destination : 198.51.100.2
    Protocol    : 1 (ICMP)
  Feature: FIA_TRACE
    Entry     : 0x8059dbe8 - DEBUG_COND_INPUT_PKT
    Timestamp : 3685243309297
  Feature: FIA_TRACE
    Entry     : 0x82011a00 - IPV4_INPUT_DST_LOOKUP_CONSUME
    Timestamp : 3685243311450
  Feature: FIA_TRACE
    Entry     : 0x82000170 - IPV4_INPUT_FOR_US_MARTIAN
    Timestamp : 3685243312427
  Feature: FIA_TRACE
    Entry     : 0x82004b68 - IPV4_OUTPUT_LOOKUP_PROCESS
    Timestamp : 3685243313230
  Feature: FIA_TRACE
    Entry     : 0x8034f210 - IPV4_INPUT_IPOPTIONS_PROCESS
    Timestamp : 3685243315033
  Feature: FIA_TRACE
    Entry     : 0x82013200 - IPV4_OUTPUT_GOTO_OUTPUT_FEATURE
    Timestamp : 3685243315787
  Feature: FIA_TRACE
    Entry     : 0x80321450 - IPV4_VFR_REFRAG
    Timestamp : 3685243316980
  Feature: FIA_TRACE
    Entry     : 0x82014700 - IPV6_INPUT_L2_REWRITE
    Timestamp : 3685243317713
  Feature: FIA_TRACE
    Entry     : 0x82000080 - IPV4_OUTPUT_FRAG
    Timestamp : 3685243319223
  Feature: FIA_TRACE
    Entry     : 0x8200e500 - IPV4_OUTPUT_DROP_POLICY
    Timestamp : 3685243319950
  Feature: FIA_TRACE
    Entry     : 0x8059aff4 - PACTRAC_OUTPUT_STATS
    Timestamp : 3685243323603
  Feature: FIA_TRACE
    Entry     : 0x82016100 - MARMOT_SPA_D_TRANSMIT_PKT
    Timestamp : 3685243326183

Router# clear platform condition all
Router# exit
```

Linux Forwarding Transport Service (LFTS) is a transport mechanism to forward packets punted from the CPP into applications other than IOSd. This example displays the LFTS-based intercepted packet destined for binos application.

```
Router# show platform packet-trace packet 10
Packet: 10     CBUG ID: 52
Summary
  Input  : GigabitEthernet0/0/0
  Output : internal0/0/rp:1
  State  : PUNT 55 (For-us control)
  Timestamp
    Start : 597718358383 ns (06/06/2016 09:00:13.643341 UTC)
    Stop : 597718409650 ns (06/06/2016 09:00:13.643392 UTC)
Path Trace
  Feature: IPV4
    Input  : GigabitEthernet0/0/0
    Output : <unknown>
    Source : 10.64.68.2
    Destination : 224.0.0.102
    Protocol : 17 (UDP)
      SrcPort : 1985
      DstPort : 1985
  Feature: FIA_TRACE
    Input  : GigabitEthernet0/0/0
    Output : <unknown>
    Entry  : 0x8a0177bc - DEBUG_COND_INPUT_PKT
    Lapsed time : 426 ns
  Feature: FIA_TRACE
    Input  : GigabitEthernet0/0/0
    Output : <unknown>
    Entry  : 0x8a017788 - IPV4_INPUT_DST_LOOKUP_CONSUME
    Lapsed time : 386 ns
  Feature: FIA_TRACE
    Input  : GigabitEthernet0/0/0
    Output : <unknown>
    Entry  : 0x8a01778c - IPV4_INPUT_FOR_US_MARTIAN
    Lapsed time : 13653 ns
  Feature: FIA_TRACE
    Input  : GigabitEthernet0/0/0
    Output : internal0/0/rp:1
    Entry  : 0x8a017730 - IPV4_INPUT_LOOKUP_PROCESS_EXT
    Lapsed time : 2360 ns
  Feature: FIA_TRACE
    Input  : GigabitEthernet0/0/0
    Output : internal0/0/rp:1
    Entry  : 0x8a017be0 - IPV4_INPUT_IPOPTIONS_PROCESS_EXT
    Lapsed time : 66 ns
  Feature: FIA_TRACE
    Input  : GigabitEthernet0/0/0
    Output : internal0/0/rp:1
    Entry  : 0x8a017bfc - IPV4_INPUT_GOTO_OUTPUT_FEATURE_EXT
    Lapsed time : 680 ns
  Feature: FIA_TRACE
    Input  : GigabitEthernet0/0/0
    Output : internal0/0/rp:1
    Entry  : 0x8a017d60 - IPV4_INTERNAL_ARL_SANITY_EXT
    Lapsed time : 320 ns
  Feature: FIA_TRACE
    Input  : GigabitEthernet0/0/0
    Output : internal0/0/rp:1
    Entry  : 0x8a017a40 - IPV4_VFR_REFRAG_EXT
    Lapsed time : 106 ns
  Feature: FIA_TRACE
    Input  : GigabitEthernet0/0/0
    Output : internal0/0/rp:1
    Entry  : 0x8a017d2c - IPV4_OUTPUT_DROP_POLICY_EXT
    Lapsed time : 1173 ns
  Feature: FIA_TRACE
    Input  : GigabitEthernet0/0/0
    Output : internal0/0/rp:1
    Entry  : 0x8a017940 - INTERNAL_TRANSMIT_PKT_EXT
    Lapsed time : 20173 ns
  LFTS Path Flow: Packet: 10    CBUG ID: 52
    Feature: LFTS
    Pkt Direction: IN
    Punt Cause  : 55
         subCause : 0
```

# Example: Using Packet Trace

This example provides a scenario in which packet trace is used to troubleshoot packet drops for a NAT configuration. This example shows how you can effectively utilize the level of detail provided by the Packet-Trace feature to gather information about an issue, isolate the issue, and then find a solution.

In this scenario, you can detect that there are issues, but are not sure where to start troubleshooting. You should, therefore, consider accessing the Packet-Trace summary for a number of incoming packets.

```
Router# debug platform condition ingress
Router# debug platform packet-trace packet 2048 summary-only
Router# debug platform condition start
Router# debug platform condition stop
Router# show platform packet-trace summary
Pkt   Input             Output            State  Reason
0     Gi0/0/0           Gi0/0/0           DROP   402 (NoStatsUpdate)
1     internal0/0/rp:0  internal0/0/rp:0  PUNT   21  (RP<->QFP keepalive)
2     internal0/0/recycle:0  Gi0/0/0      FWD
```

The output shows that packets are dropped due to NAT configuration on Gigabit Ethernet interface 0/0/0, which enables you to understand that an issue is occurring on a specific interface. Using this information, you can limit which packets to trace, reduce the number of packets for data capture, and increase the level of inspection.

```
Router# debug platform packet-trace packet 256
Router# debug platform packet-trace punt
Router# debug platform condition interface Gi0/0/0
Router# debug platform condition start
Router# debug platform condition stop
Router# show platform packet-trace summary
Router# show platform packet-trace 15
Packet: 15          CBUG ID: 238
Summary
  Input     : GigabitEthernet0/0/0
  Output    : internal0/0/rp:1
  State     : PUNT 55  (For-us control)
  Timestamp
    Start   : 1166288346725 ns (06/06/2016 09:09:42.202734 UTC)
    Stop    : 1166288383210 ns (06/06/2016 09:09:42.202770 UTC)
Path Trace
  Feature: IPV4
    Input       : GigabitEthernet0/0/0
    Output      : <unknown>
    Source      : 10.64.68.3
    Destination : 224.0.0.102
    Protocol    : 17 (UDP)
      SrcPort   : 1985
      DstPort   : 1985
IOSd Path Flow: Packet: 15    CBUG ID: 238
  Feature: INFRA
    Pkt Direction: IN
    Packet Rcvd From CPP
  Feature: IP
    Pkt Direction: IN
    Source      : 10.64.68.122
    Destination : 10.64.68.255
  Feature: IP
    Pkt Direction: IN
    Packet Enqueued in IP layer
    Source      : 10.64.68.122
    Destination : 10.64.68.255
    Interface   : GigabitEthernet0/0/0
  Feature: UDP
    Pkt Direction: IN
    src         : 10.64.68.122(1053)
    dst         : 10.64.68.255(1947)
    length      : 48

Router#show platform packet-trace packet 10
Packet: 10          CBUG ID: 10
Summary
  Input     : GigabitEthernet0/0/0
  Output    : internal0/0/rp:0
  State     : PUNT 55  (For-us control)
  Timestamp
    Start   : 274777907351 ns (01/10/2020 10:56:47.918494 UTC)
    Stop    : 274777922664 ns (01/10/2020 10:56:47.918509 UTC)
Path Trace
  Feature: IPV4(Input)
    Input       : GigabitEthernet0/0/0
    Output      : <unknown>
    Source      : 10.78.106.2
    Destination : 224.0.0.102
    Protocol    : 17 (UDP)
```

```
      SrcPort   : 1985
      DstPort   : 1985

IOSd Path Flow: Packet: 10    CBUG ID: 10
  Feature: INFRA
    Pkt Direction: IN
Packet Rcvd From DATAPLANE
 Feature: IP
    Pkt Direction: IN
    Packet Enqueued in IP layer
    Source      : 10.78.106.2
    Destination : 224.0.0.102
    Interface   : GigabitEthernet0/0/0

  Feature: UDP
    Pkt Direction: IN DROP
    Pkt : DROPPED
    UDP: Discarding silently
    src        : 881 10.78.106.2(1985)
    dst         : 224.0.0.102(1985)
    length      : 60

Router#show platform packet-trace packet  12
Packet: 12          CBUG ID: 767
Summary
  Input     : GigabitEthernet3
  Output    : internal0/0/rp:0
  State     : PUNT 11  (For-us data)
  Timestamp
    Start   : 16120990774814 ns (01/20/2020 12:38:02.816435 UTC)
    Stop    : 16120990801840 ns (01/20/2020 12:38:02.816462 UTC)
Path Trace
  Feature: IPV4(Input)
    Input       : GigabitEthernet3
    Output      : <unknown>
    Source      : 12.1.1.1
    Destination : 12.1.1.2
    Protocol    : 6 (TCP)
      SrcPort   : 46593
      DstPort   : 23
IOSd Path Flow: Packet: 12    CBUG ID: 767
  Feature: INFRA
    Pkt Direction: IN
    Packet Rcvd From DATAPLANE

  Feature: IP
    Pkt Direction: IN
    Packet Enqueued in IP layer
    Source      : 12.1.1.1
    Destination : 12.1.1.2
    Interface   : GigabitEthernet3

  Feature: IP
    Pkt Direction: IN
    FORWARDEDTo transport layer
    Source        : 12.1.1.1
    Destination   : 12.1.1.2
    Interface     : GigabitEthernet3

  Feature: TCP
    Pkt Direction: IN
    tcp0: I NoTCB 12.1.1.1:46593 12.1.1.2:23 seq 1925377975 OPTS 4 SYN  WIN 4128

Router# show platform packet-trace summary
Pkt   Input                     Output                    State  Reason
```

```
0     INJ.2                     Gi1                       FWD
1     Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
2     INJ.2                     Gi1                       FWD
3     Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
4     INJ.2                     Gi1                       FWD
5     INJ.2                     Gi1                       FWD
6     Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
7     Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
8     Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
9     Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
10    INJ.2                     Gi1                       FWD
11    INJ.2                     Gi1                       FWD
12    INJ.2                     Gi1                       FWD
13    Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
14    Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
15    Gi1                       internal0/0/rp:0          PUNT   11  (For-us data)
16    INJ.2                     Gi1                       FWD
```

The following example displays the packet trace data statistics.

```
Router#show platform packet-trace statistics
Packets Summary
  Matched  3
  Traced   3
Packets Received
  Ingress  0
  Inject   0
Packets Processed
  Forward  0
  Punt     3
    Count       Code  Cause
    3           56    RP injected for-us control
  Drop     0
  Consume  0

          PKT_DIR_IN
             Dropped       Consumed       Forwarded
INFRA            0             0              0
TCP              0             0              0
UDP              0             0              0
IP               0             0              0
IPV6             0             0              0
ARP              0             0              0

         PKT_DIR_OUT
             Dropped       Consumed       Forwarded
INFRA            0             0              0
TCP              0             0              0
UDP              0             0              0
IP               0             0              0
IPV6             0             0              0
ARP              0             0              0
```

The following example displays packets that are injected and punted to the forwarding processor from the control plane.

```
Router#debug platform condition ipv4 10.118.74.53/32 both
 Router#Router#debug platform condition start
Router#debug platform packet-trace packet 200
Packet count rounded up from 200 to 256

Router#show platform packet-tracer packet 0
show plat pack pa 0
Packet: 0           CBUG ID: 674
Summary
```

```
  Input     : GigabitEthernet1
  Output    : internal0/0/rp:0
  State     : PUNT 11  (For-us data)
  Timestamp
    Start   : 17756544435656 ns (06/29/2020 18:19:17.326313 UTC)
    Stop    : 17756544469451 ns (06/29/2020 18:19:17.326346 UTC)
Path Trace
  Feature: IPV4(Input)
    Input       : GigabitEthernet1
    Output      : <unknown>
    Source      : 10.118.74.53
    Destination : 198.51.100.38
    Protocol    : 17 (UDP)
      SrcPort   : 2640
      DstPort   : 500

IOSd Path Flow: Packet: 0    CBUG ID: 674
  Feature: INFRA
  Pkt Direction: IN
    Packet Rcvd From DATAPLANE

  Feature: IP
  Pkt Direction: IN
    Packet Enqueued in IP layer
    Source      : 10.118.74.53
    Destination : 198.51.100.38
    Interface   : GigabitEthernet1

  Feature: IP
  Pkt Direction: IN
  FORWARDED To transport layer
    Source        : 10.118.74.53
    Destination   : 198.51.100.38
    Interface     : GigabitEthernet1

  Feature: UDP
  Pkt Direction: IN
  DROPPED
 UDP: Checksum error: dropping
 Source      : 10.118.74.53(2640)
 Destination : 198.51.100.38(500)

Router#show platform packet-tracer packet 2
Packet: 2           CBUG ID: 2

IOSd Path Flow:
  Feature: TCP
  Pkt Direction: OUTtcp0: O SYNRCVD 198.51.100.38:22 198.51.100.55:52774 seq 3052140910
OPTS 4 ACK 2346709419 SYN  WIN 4128

  Feature: TCP
  Pkt Direction: OUT
  FORWARDED
 TCP: Connection is in SYNRCVD state
 ACK         : 2346709419
 SEQ         : 3052140910
 Source      : 198.51.100.38(22)
 Destination : 198.51.100.55(52774)


  Feature: IP
  Pkt Direction: OUTRoute out the generated packet.srcaddr: 198.51.100.38, dstaddr:
198.51.100.55
```

```
  Feature: IP
  Pkt Direction: OUTInject and forward successful srcaddr: 198.51.100.38, dstaddr:
198.51.100.55

  Feature: TCP
  Pkt Direction: OUTtcp0: O SYNRCVD 198.51.100.38:22 198.51.100.55:52774 seq 3052140910
OPTS 4 ACK 2346709419 SYN  WIN 4128
Summary
  Input     : INJ.2
  Output    : GigabitEthernet1
  State     : FWD
  Timestamp
    Start   : 490928006866 ns (06/29/2020 13:31:30.807879 UTC)
    Stop    : 490928038567 ns (06/29/2020 13:31:30.807911 UTC)
Path Trace
  Feature: IPV4(Input)
    Input       : internal0/0/rp:0
    Output      : <unknown>
    Source      : 172.18.124.38
    Destination : 172.18.124.55
    Protocol    : 6 (TCP)
      SrcPort   : 22
      DstPort   : 52774
  Feature: IPSec
    Result    : IPSEC_RESULT_DENY
    Action    : SEND_CLEAR
    SA Handle : 0
    Peer Addr : 55.124.18.172
    Local Addr: 38.124.18.172


Router#
```

# Feature Information for Packet Trace

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to{start hypertext} http://www.cisco.com/go/cfn{end hypertext}. An account on Cisco.com is not required.

*Table 15: Feature Information for Packet Trace*

| Feature Name | Releases | Feature Information |
|---|---|---|
| Packet Trace | Cisco IOS XE | The Packet Trace feature was introduced. |

CHAPTER 16

# Packet Drops

This document provides information about packet drops on C84xx platforms.

## Information About Packet Drops

**High Level Packet Flow**

Cisco ASR 1000 Series Router comprises the following functional elements in the system:

- • Cisco ASR 1000 Series Route Processor (RP)

- • Cisco ASR 1000 Series Embedded Services Processor (ESP)

- • Cisco ASR 1000 Series SPA Interface Processor (SIP) or Modular Interface Processor

The Cisco ASR 1000 Series Routers introduce the Cisco Quantum Flow Processor (QFP) as their hardware architecture. In the QFP based architecture, all packets are forwarded through ESP, so, if a problem occurs in ESP, the forwarding stops.

## Viewing Packet Drops

You can run the show drops command to troubleshoot the root cause of packet drops.

With the **show drops** command, you can identify the following:

- The root cause of the drop based on the feature or the protocol.

- The history of the QFP Drops.

# Viewing Packet Drop Information

Perform the following steps to view and filter the packet drop information for your instance based on the interface, protocol, or feature:

### SUMMARY STEPS

1. **enable**
2. **show drops**
3. **show drops** { **bqs** | **crypto**| **firewall**| **interface**| **ip-all**| **nat**| **punt**| **qfp**| **qos**|**history**}

### DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router> enable` | Enables the privileged EXEC mode. Enter your password, if prompted. |
| **Step 2** | **show drops**<br>**Example:**<br>`Router# show drops` | Displays the drop statistics. |
| **Step 3** | **show drops** { **bqs** \| **crypto**\| **firewall**\| **interface**\| **ip-all**\| **nat**\| **punt**\| **qfp**\| **qos**\|**history**}<br>**Example:**<br>`Router# show drops history qfp` | Displays the drop statistics and the summary for the interface or the protocol that you choose. |

#### Example

**Example for Viewing Packet Drop Information: Sample Output**

The following is a sample output of the show drops command. This sample output displays the **packet drops** information related to the Quantum Flow Processor (QFP).

```
Router#show drops
bqs BQS related drops
crypto IPSEC related drops
firewall Firewall related drops
history History of drops
interface Interface drop statistics
ip-all IP related drops
nat NAT related drops
punt Punt path related drops
qfp QFP drop statistics
qos QoS related drops
| Output modifiers
<cr> <cr>
```

```
Router# show drops qfp
------------------ show platform hardware qfp active statistics drop detail
Last clearing of QFP drops statistics : Fri Feb 18 08:02:37 2022
(6d 23h 54m 29s ago)
---------------------------------------------------------------------------
ID Global Drop Stats Packets
Octets
---------------------------------------------------------------------------
319 BFDoffload 9
1350
61 Icmp 84
3780
53 IpFragErr 32136
48718168
244 IpLispHashLkupFailed 3
213
56 IpsecInput 18
4654
23 TailDrop 26713208
10952799454
216 UnconfiguredIpv6Fia 241788
26596680
------------------ show platform hardware qfp active interface all
statistics drop_summary
----------------------------------------------------------------
Drop Stats Summary:
note: 1) these drop stats are only updated when PAL
reads the interface stats.
2) the interface stats include the subinterface
Interface Rx Pkts Tx Pkts
---------------------------------------------------------------------------
GigabitEthernet1 60547 0
GigabitEthernet2 60782 27769658
GigabitEthernet3 60581 0
GigabitEthernet4 60502 1323990
Tunnel14095001 0 1990214
Tunnel14095002 0 3883238
Tunnel14095003 0 3879243
Tunnel14095004 0 2018866
Tunnel14095005 0 3875972
Tunnel14095006 0 3991497
Tunnel14095007 0 4107743
Tunnel14095008 0 3990601
```

# Verifying Packet Information

This section shows examples of command output to verify packet information.

In order to display statistics of drops for all interfaces in Packet Processor Engine (PPE), use the command **show drops qfp**.

**Note** The wrapper command **show drops qfp** is the shorthand notation for the original **show platform hardware qfp active statistics drop** command.

```
Router#show drops qfp
--------------------------------------------------------------
Global Drop Stats Octets
```

```
Packets
--------------------------------------------------------------
AttnInvalidSpid 0 0
BadDistFifo 0 0
BadIpChecksum 0 0
```

In order to display the history of QFP drops for all interfaces in Packet Processor Engine (PPE), use the command **show drops history qfp**. This command can also track the number of packet drops in the last 1-min, 5-min and 30-min time period.

**Note** The wrapper command **show drops history qfp** is the shorthand notation for the original **show platform hardware qfp active statistics drop history** command.

```
Router# show drops history qfp
Last clearing of QFP drops statistics : Mon Jun 26 07:29:14
2023
(21s ago)
--------------------------------------------------------------
Global Drop Stats 1-Min
5-Min 30-Min All
--------------------------------------------------------------
Ipv4NoAdj 0
0 0 99818
Ipv4NoRoute 0
0 0 99853
```

# Packet Drops Warnings

You can configure the warning thresholds for per drop cause and/or total QFP drop in packets per second. If the configured thresholds are exceeded, then a rate-limited syslog warning is generated. One warning is generated for total threshold exceeded and one warning per drop cause will be generated.

The warning is generated a maximum of once per minute for each drop cause. The drops over the previous minute are checked against the threshold (packets per second) x 60, and if the drops exceed this value, a warning is generated.

The following are the sample warnings for total and per drop cause respectively.

```
%QFP-5-DROP_OVERALL_RATE: Exceeded the overall drop threshold 10000 pps during the last
60-second measurement period, packets dropped in last 1 minute: 641220, last 5 minutes:
1243420, last 30 minutes: 124342200
```

```
%QFP-5-DROP_CAUSE_RATE: Exceeded the drop threshold 1000 pps for QosPolicing (drop code:
20) during the last 60-second measurement period, packets dropped due to QosPolicing in
last 1 minute: 61220, last 5 minutes: 43420, last 30 minutes: 4611200
```

# Configuring Packet Drops Warning Thresholds

Perform the following steps to configure the warning thresholds for per drop cause and/or total QFP drop in packets per second.

### SUMMARY STEPS

1. **enable**

2. **configure terminal**
3. **platform qfp drops threshold** {**per-cause** *drop_id threshold* | **total** *threshold*}

## DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router> enable` | Enables the privileged EXEC mode. Enter your password, if prompted. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Router# configure terminal` | Enters global configuration mode. |
| **Step 3** | **platform qfp drops threshold** {**per-cause** *drop_id threshold* \| **total** *threshold*}<br>**Example:**<br>`Router# platform qfp drops threshold per-cause 206 10` | Specifies the per drop cause or total threshold value for the drop.<br>**Note**<br>Use the **show platform hardware qfp active statistics drop detail** command to view the drop cause ID. |

### Example

The following examples show how to configure the warning thresholds for per drop cause and total QFP drops.

**Example for configuring warning threshold for per drop cause QFP drops**

The following example shows how to configure the warning threshold of 15 pps for drop cause ID 24.

```
Router> enable
Router# configure terminal
Router(config)#platform qfp drops threshold ?
per-cause Set warning threshold for per cause QFP drops
total Set warning threshold for total QFP drops
Router(config)#platform qfp drops threshold per-cause ?
<0-1024> QFP drop cause ID
Router(config)#platform qfp drops threshold per-cause 24 ?
<0-2147483647> Drop threshold in packets per second (pps)
Router(config)#platform qfp drops threshold per-cause 24 15
```

**Example for configuring warning threshold for total QFP drops**

The following example shows how to configure the warning threshold of 100 pps for total QFP drops.

```
Router> enable
Router# configure terminal
Router(config)#platform qfp drops threshold ?
per-cause Set warning threshold for per cause QFP drops
total Set warning threshold for total QFP drops
Router(config)#platform qfp drops threshold total ?
```

```
<0-2147483647> Drop threshold in packets per second (pps)
Router(config)#platform qfp drops threshold total 100
```

# Viewing Packet Drops Warning Thresholds

Perform the following steps to view the configured warning thresholds for per drop cause and total QFP drops.

## SUMMARY STEPS

1. **enable**
2. **show platform hardware qfp active statistics drop threshold**

## DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable**<br>**Example:**<br>`Router> enable` | Enables the privileged EXEC mode. Enter your password, if prompted. |
| **Step 2** | **show platform hardware qfp active statistics drop threshold**<br>**Example:**<br>`Router# show platform hardware qfp active statistics drop thresholds` | Displays the configured warning thresholds for per drop cause and total QFP drops.<br>**Note**<br>• The wrapper command **show drops thresholds** is the shorthand notation of the **show platform hardware qfp active statistics drop threshold**command.<br>• The wrapper command **show drops thresholds** is currently not available on Cisco 84xx Platform. |

### Example

**Example for Viewing Packet Drop Warning Thresholds**

The following is a sample output of the **show platform hardware qfp active statistics drop threshold** command.

```
Router#show platform hardware qfp active statistics drop thresholds
------------------------------------------------------
Drop ID         Drop Cause Name             Threshold
------------------------------------------------------
10             BadIpChecksum                 100
206            PuntPerCausePolicerDrops      10
20             QosPolicing                   200
                Total                         30
```

The following is a sample output of the **show drops thresholds** wrapper command.

```
Router#show platform hardware qfp active statistics drop thresholds
------------------------------------------------------
Drop ID         Drop Cause Name             Threshold
------------------------------------------------------
10             BadIpChecksum                 100
206            PuntPerCausePolicerDrops      10
20             QosPolicing                   200
                Total                         30
```

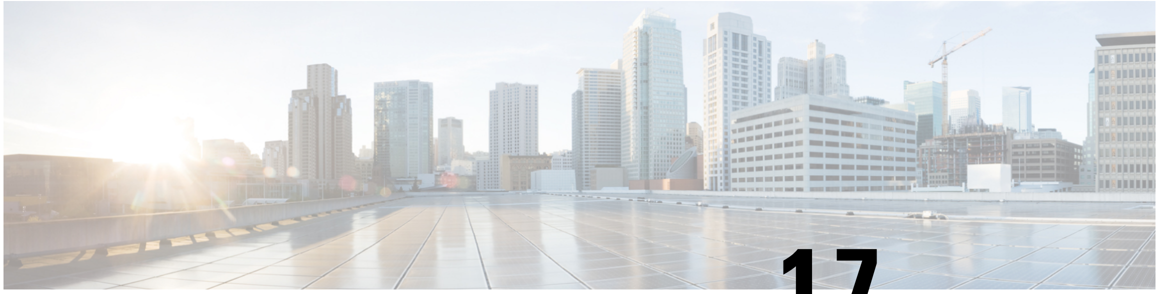
# Feature Information for Packet Drops

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 www.cisco.com/go/cfn. An account on Cisco.com is not required.

*Table 16: Feature Information for Packet Drops*

| Feature Name | Releases | Feature Information |
|---|---|---|
| Packet Drops | Cisco IOS XE <> | This feature was introduced. |



CHAPTER 17

# Configure SFP+

**Note** Several Cisco platforms, NIMs, and SM cards support configuring multiple-rate SFPs on same interface, e.g., 1G SFP or 10G SFP+ on a 10G port.

In a port-channel bundle, all member interfaces should be of same speed, and duplex. It is recommended to use duplex interfaces of the same speed as member interfaces for configuring a port-channel.

For more information about interfaces that support multiple-rate SFPs, see the corresponding datasheets.

## SUMMARY STEPS

1. **enable** *source-interface gigabitethernet slot/port*
2. **configure terminal**
3. **interface tengigabitethernet** *slot/port*

## DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable** *source-interface gigabitethernet slot/port*<br>**Example:**<br>`Router# enable` | Enables the privileged EXEC mode. If prompted, enter your password. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Router# configure terminal` | Enters the global configuration mode. |
| **Step 3** | **interface tengigabitethernet** *slot/port*<br>**Example:**<br>*`Router(config)# interface tengigabitethernet 4/11`* | Specifies the 10-Gigabit Ethernet interface to be configured.<br>Here:<br>slot/port—Specifies the location of the interface. |

# Configure FEC

Forward Error Correction (FEC) checks and recovers potential errors during long-range data transmission. The Cisco C84xx Series Platforms have long range SFP, therefore FEC must be configured.

## SUMMARY STEPS

1. **enable** *source-interface gigabitethernet slot/port*
2. **configure terminal**
3. **interface twentyfivegigabitethernet** *slot/port*
4. **fec** { **auto** | **cl108** | **cl74** | **off**}

## DETAILED STEPS

### Procedure

| | Command or Action | Purpose |
|---|---|---|
| **Step 1** | **enable** *source-interface gigabitethernet slot/port*<br>**Example:**<br>`Router# enable` | Enables the privileged EXEC mode. If prompted, enter your password. |
| **Step 2** | **configure terminal**<br>**Example:**<br>`Router# configure terminal` | Enters the global configuration mode. |
| **Step 3** | **interface twentyfivegigabitethernet** *slot/port*<br>**Example:**<br>*`Router(config)# interface twentyfivegigabitethernet 0/0/16 4/11`* | Specifies the 10-Gigabit Ethernet interface to be configured.<br>Here:<br>slot/port—Specifies the location of the interface. |
| **Step 4** | **fec** { **auto** \| **cl108** \| **cl74** \| **off**}<br>**Example:**<br>*`Router(config)# interface twentyfivegigabitethernet 0/0/16 4/11`* | Configures FEC on the 25-Gigabit Ethernet interface.<br>Following are the modes of the fec command:<br>• auto— Enables FEC based on SFP type<br>• cl108— Enables clause108 <= RS-FEC(528,514)<br>• cl74— Enables clause74 <= FC-FEC<br>• disable— Disables FEC on interface<br>**Note**<br>• The fec command is only applicable to 25G links. |

| | Command or Action | Purpose |
|---|---|---|
| | | • For 10/25G dual-rate SFP, if the speed is changed from 25G to 10G, fec configuration should be removed first before speed change. |

CHAPTER 18

# Cisco Thousand Eyes Enterprise Agent application hosting

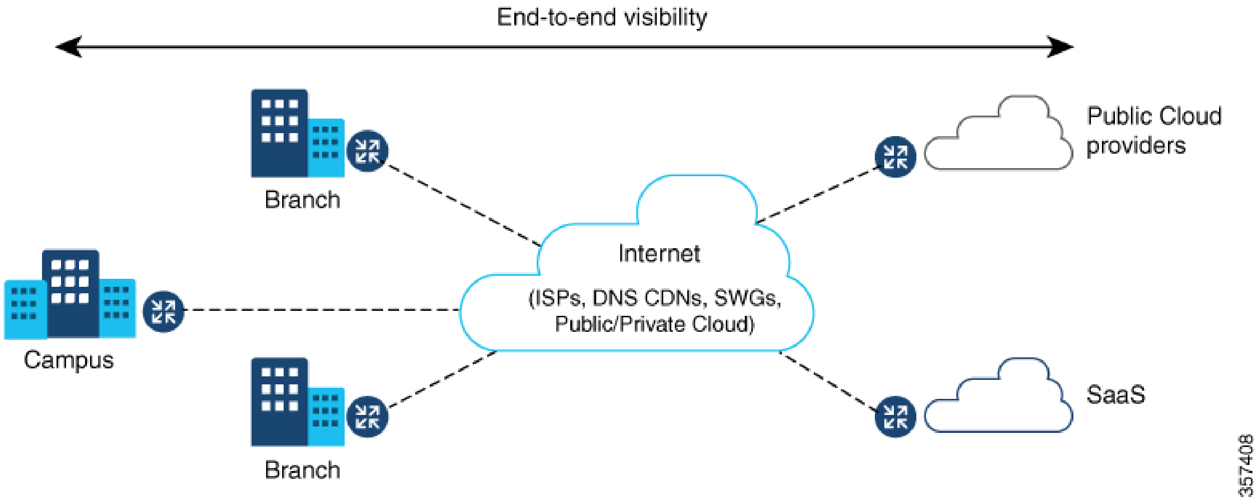
This chapter provides information on Cisco Thousand Eyes Enterprise Agent Application Hosting. The following sections are included in this chapter:

## Cisco ThousandEyes enterprise agent application hosting

Cisco ThousandEyes is a network intelligence platform that allows you to use its agents to run a variety of tests from its agents to monitor the network and application performance. This application enables you to view end-to-end paths across networks and services that impact your business. Cisco ThousandEyes application actively monitors the network traffic paths across internal, external, and internet networks in real time, and helps to analyse the network performance. Also, isco ThousandEyes application provides application availability insights that are enriched with routing and device data for a multidimensional view of digital experience.

From Cisco IOS XE Release 17.8.1, you can use application-hosting capabilities to deploy the Cisco ThousandEyes Enterprise Agent as a container application on Cisco C8400 Series Secure Router. This agent application runs as a docker image using Cisco IOx docker-type option. For more information on how to configure Cisco ThousandEyes in controller mode, see Cisco SD-WAN Systems and Interfaces Configuration Guide.

*Figure 1: Network View through ThousandEyes Application*



# Feature Information for Cisco ThousandEyes Enterprise Agent Application Hosting

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 www.cisco.com/go/cfn. An account on Cisco.com is not required.

*Table 17: Feature Information for ThousandEyes Enterprise Agent Application Hosting*

| Feature Name | Releases | Feature Information |
|---|---|---|
| Cisco ThousandEyes Enterprise Agent Application Hosting | Cisco IOS XE 17.8.1 | With the integration of ThousandEyes Agent Application running on routing platforms using the app-hosting capabilities as container, you can have visibility into application experience with deep insights into the Internet, cloud providers, and enterprise networks. |

# Supported platforms and system requirements

The following table lists the supported platforms and system requirements.

| Platforms | Bootflash | FRU Storage | DRAM |
|---|---|---|---|
| Cisco C8400 Series Secure Router | | | |
| C8475-G2 | 32 GB | 32 GB M.2 USB | 32 GB |
| C8455-G2 | 32 GB | 32 GB M.2 USB | 32 GB |

**Note** The minimum DRAM and bootflash storage requirement for running Cisco ThousandEyes Enterprise Agent is 8 GB. If the device does not have enough memory or storage, we recommend that you upgrade DRAM or add an external storage such as SSD/M.2 USB. When the available resources are not sufficient to run other applications, Cisco IOx generates an error message.

# Workflow to install and run the Cisco ThousandEyes application

To install and run the Cisco ThousandEyes image on a device, perform these steps:

### Procedure

**Step 1** Create a new account on the Cisco ThousandEyes portal.

**Step 2** Download the Cisco ThousandEyes application package from the software downloads page and ensure that you use the agent version 4.2.2.

**Step 3** Copy the image on the device.

**Step 4** Install and launch the image.

**Step 5** Connect the agent to the controller.

**Note**
When you order platforms that support Cisco ThousandEyes application with Cisco IOS XE 17.8.1 software, the Cisco ThousandEyes application package is available in the bootflash of the device.

# Workflow to host the Cisco ThousandEyes application

To install and launch the application, perform these steps:

### Before you begin

Create a new account on the Cisco ThousandEyes portal and generate the token. The Cisco ThousandEyes agent application uses this token to authenticate and check into the correct Cisco ThousandEyes account. you see a message stating that your token is invalid and you want to troubleshoot the issue, see Troubleshoot the Cisco ThousandEyes application, on page 126.

**Note** If you configure the correct token and Domain Name Server (DNS) information, the device is discovered automatically.

### Procedure

**Step 1** Enable Cisco IOX application environment on the device.

- Use the following commands for non-SD-WAN (autonomous mode) images:

```
config terminal
 iox
end
write
```

- Use the following commands for SD-WAN (controller mode) images:

```
config-transaction
iox
commit
```

**Step 2** If the IOx command is accepted, wait for a few seconds and check whether the IOx process is up and running by using the **show iox** command. The output must display that the show IOxman process is running.

```
Device #show iox

IOx Infrastructure Summary:
---------------------------
IOx service (CAF) 1.11.0.0     : Running
IOx service (HA)               : Not Supported
IOx service (IOxman)           : Running
IOx service (Sec storage)      : Not Supported
Libvirtd 1.3.4                 : Running
```

**Step 3** Ensure that the ThousandEyes application LXC tarball is available in the device *bootflash:*.

**Step 4** Create a virtual port group interface to enable the traffic path to the Cisco ThousandEyes application:

```
interface VirtualPortGroup 0
          ip address 192.168.35.1 255.255.255.0
        exit
```

**Step 5** Configure the app-hosting application with the generated token:

```
app-hosting appid te
          app-vnic gateway1 virtualportgroup 0 guest-interface 0
          guest-ipaddress 192.168.35.2 netmask 255.255.255.0
          app-default-gateway 192.168.35.1 guest-interface 0
          app-resource docker
                   prepend-pkg-opts □ Required to get the default run-time options from package.yaml

                   run-opts 1 "--hostname thousandeyes"
             run-opts 2 "-e TEAGENT_ACCOUNT_TOKEN=<ThousandEyes token>"
        run-opts 3 "-e TEAGENT_PROXY_TYPE=STATIC -e TEAGENT_PROXY_LOCATION=proxy.something.other:80"

          name-server0 75.75.75.75 □ ISP’s DNS server
        end

app-hosting appid te
 app-resource docker
  prepend-pkg-opts
  run-opts 2 “--hostname
```

**Note**

You can use the proxy configuration only if the Cisco ThousandEyes agent does not have an internet access without a proxy. Also, the hostname is optional. If you do not provide the hostname during the installation, the device hostname is used as the Cisco ThousandEyes agent hostname. The device hostname is displayed on the Cisco ThousandEyes portal. The DNS name server information is optional. If the Cisco ThousandEyes agent uses a private IP address, ensure that you establish a connection to the device through NAT.

**Step 6** Configure the **start** command to run the application automatically when the application is installed on the device using the **install** command:

```
app-hosting appid te
         start
```

**Step 7** Convert the device to app-heavy mode and reload the device using the following commands:

```
Device(config)#platform resource app-heavy
Please reboot to activate this template

Device(config)#end
Device#wr mem
Building configuration...
[OK]
Device#

Device#reload
Proceed with reload? [confirm]
```

**Step 8** Install the ThousandEyes application:

```
app-hosting install appid <appid> package [bootflash: | harddisk: | https:]
```

Select a location to install the ThousandEyes application from these options:

```
Device# app-hosting install appid te package ?
           bootflash:  Package path  ISR4K case if image is locally available in bootflash:
           harddisk:   Package path  Cat8K case if image is locally available in M.2 USB
           https:      Package path  Download over the internet if image is not locally present in
 router. URL to ThousandEyes site hosting agent image to be provided here
```

**Step 9** Check if the application is up and running:

```
Device#show app-hosting list
 App id                                  State
---------------------------------------------------------
  te                                      RUNNING
```

**Note**

If any of these steps fail, use the **show logging** command and check the IOx error message. If the error message is about insufficient disk space, clean the storage media (bootflash or hard disk) to free up the space. Use the **show app-hosting resource** command to check the CPU and disk memory.

## Download and copy the image to the device

To download and copy the image to bootflash, perform these steps:

## Procedure

**Step 1** Check if the Cisco ThousandEyes image is precopied to *bootflash:/<directory name>*.

**Step 2** If the image is not available in the device directory, perform these steps:

a) If the device has a direct access to internet, use the *https:*. option in the **application install** command. This option downloads the image from the Cisco ThousandEyes software downloads page into *bootflash:/apps* and installs the application.

```
Device# app-hosting install appid <appid string> package [bootflash: | flash | http | https://
| ftp | ] URL to image location hosted on ThousandEyes portal

Device# app-hosting install appid te1000 package
https://downloads.thousandeyes.com/enterprise-agent/thousandeyes-enterprise-agent-4.0.2.cisco.tar

Installing package
'https://downloads.thousandeyes.com/enterprise-agent/thousandeyes-enterprise-agent-4.0.2.cisco.tar'
 for 'te1000'.

Use 'show app-hosting list' for progress.
*Jun 29 23:43:29.244: %IOSXE-6-PLATFORM: R0/0: IOx:  App verification successful
*Jun 29 23:45:00.449: %IM-6-INSTALL_MSG: R0/0: ioxman: app-hosting: Install succeeded: te1000
installed successfully Current state is DEPLOYED
*Jun 29 23:45:01.801: %IOSXE-6-PLATFORM: R0/0: IOx:  App verification successful
*Jun 29 23:45:51.054: %IM-6-START_MSG: R0/0: ioxman: app-hosting: Start succeeded: te1000 started
 successfully Current state is RUNNING

Device#show app-hosting detail appid te1000  ( Details of Application)
App id                  : te1000
Owner                   : iox
State                   : RUNNING
Application
  Type                  : docker
  Name                  : ThousandEyes Enterprise Agent
  Version               : 4.0
  Author                : ThousandEyes <support@thousandeyes.com>
  Path                  : bootflash:thousandeyes-enterprise-agent-4.0-22.cisco.tar
Resource reservation
  Memory                : 500 MB
  Disk                  : 1 MB
  CPU                   : 1500 units
  CPU-percent           : 70 %
```

b) If the device has a proxy server, copy the image manually to *bootflash:/apps*.

c) Download the Cisco ThousandEyes application package from the software downloads page and ensure that you use the agent version 4.0.2.

d) Create an application directory in the *bootflash:* to copy the image:

```
Device# mkdir bootflash:apps
Create directory filename [apps]?
Created dir bootflash:/apps
```

e) Copy the Cisco ThousandEyes image to the *bootflash:apps* directory.

f) Validate the image using the **verify** command:

```
verify /md5 bootflash:apps/<file name>
```

# Connect the Cisco ThousandEyes Agent with the controller

### Before you begin

Ensure that you have an Internet connection before you connect the agent with the controller.

### Procedure

After the Cisco ThousandEyes application is up and running, the agent (ThousandEyes-agent ) process connects to the controller that is running on the cloud environment.

**Note**
If you have issues related to connectivity, the application logs the relevant error messages in the application-specific logs (*/var/logs*).

# Modify the agent parameters

To modify the agent parameters, perform these actions:

### Procedure

**Step 1** Stop the application using the **app-hosting stop appid appid** command.

**Step 2** Deactivate the application using the **app-hosting deactivate appid appid** command.

**Step 3** Make the required changes to app-hosting configuration.

**Step 4** Activate the application using the **app-hosting activate appid appid** command.

**Step 5** Start the application using the **app-hosting start appid appid** command.

# Uninstall the application

To uninstall the application, perform these steps:

### Procedure

**Step 1** Stop the application using the **app-hosting stop appid te** command.

**Step 2** Check if the application is in active state using the **show app-hosting list** command.

**Step 3** Deactivate the application using the **app-hosting deactivate appid te** command.

**Step 4** Ensure that the application is not in active state. Use the **show app-hosting list** command to check status of the application.

**Step 5** Uninstall the application using the **app-hosting uninstall appid te** command.

**Step 6** After the uninstallation process is complete, use the **show app-hosting list** command to check if the application is uninstalled successfully.

# Troubleshoot the Cisco ThousandEyes application

To troubleshoot the Cisco ThousandEyes application, perform these steps:

1. Connect to Cisco ThousandEyes agent application using the **app-hosting connect appid appid session /bin/bash** command.
2. Verify the configuration applied to the application at the following path */etc/te-agent.cfg*.
3. View the logs at the following path */var/log/agent/te-agent.log*. You can use these logs to troubleshoot the configuration.

### Check the ThousandEyes application status

When the Cisco ThousandEyes application is in running state, it is registered on the ThousandEyes portal. If the application does not show up in a few minutes after the agent is in running state, check the following using the **app-hosting connect appid thousandeyes_enterprise_agent session** command:

```
Device#app-hosting connect appid thousandeyes_enterprise_agent session
Device# cat /var/log/agent/te-agent.log
2021-02-04 08:59:29.642 DEBUG [e4736a40] [te.agent.AptPackageInterface] {} Initialized APT
 package interface
2021-02-04 08:59:29.642 INFO  [e4736a40] [te.agent.main] {} Agent version 1.103.0 starting.
  Max core size is 0 and max open files is 1024
2021-02-04 08:59:29.642 DEBUG [e4736a40] [te.agent.db] {} Vacuuming database
2021-02-04 08:59:29.643 INFO  [e4736a40] [te.agent.db] {} Found version 0, expected version
 50
2021-02-04 08:59:29.672 INFO  [e4708700] [te.probe.ServerTaskExecutor] {} ProbeTaskExecutor
 started with 2 threads.
2021-02-04 08:59:29.673 INFO  [e2f05700] [te.probe.ProbeTaskExecutor.bandwidth] {}
ProbeTaskExecutor started with 1 threads.
2021-02-04 08:59:29.673 INFO  [e2704700] [te.probe.ProbeTaskExecutor.realtime] {}
ProbeTaskExecutor started with 1 threads.
2021-02-04 08:59:29.673 INFO  [e1f03700] [te.probe.ProbeTaskExecutor.throughput] {}
ProbeTaskExecutor started with 1 threads.
2021-02-04 08:59:29.674 DEBUG [e4736a40] [te.agent.DnssecTaskProceessor] {} Agent is not
running bind
2021-02-04 08:59:29.674 DEBUG [e4736a40] [te.snmp.RequestDispatcher] {} Initialised SNMP++
 session
2021-02-04 08:59:29.674 DEBUG [e4736a40] [te.snmp.RequestDispatcher] {} Initialised SNMP++
 session
2021-02-04 08:59:29.674 DEBUG [e4736a40] [te.snmp.RequestDispatcher] {} Initialised SNMP++
 session
2021-02-04 08:59:29.674 INFO  [e4736a40] [te.agent.main] {} Agent starting up
2021-02-04 08:59:29.675 INFO  [e4736a40] [te.agent.main] {} No agent id found, attempting
to obtain one
2021-02-04 08:59:29.675 INFO  [e4736a40] [te.agent.ClusterMasterAdapter] {} Attempting to
get agent id from sc1.thousandeyes.com
2021-02-04 08:59:29.679 ERROR [e4736a40] [te.agent.main] {} Error calling create_agent:
Curl error - Couldn't resolve host name
2021-02-04 08:59:29.680 INFO  [e4736a40] [te.agent.main] {} Sleeping for 30 seconds
Note :
```

**Note** Check the DNS server connection. If the Cisco ThousandEyes agent is assigned to a private IP address, check the NAT configuration.