



## **Cisco Catalyst 8300 and Catalyst 8200 Series Edge Platforms Software Configuration Guide**

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### **Americas Headquarters**

Cisco Systems, Inc.  
170 West Tasman Drive  
San Jose, CA 95134-1706  
USA  
<http://www.cisco.com>  
Tel: 408 526-4000  
800 553-NETS (6387)  
Fax: 408 527-0883





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## Preface

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This section briefly describes the objectives of this document and provides links to additional information on related products and services:

- [Objectives, on page xv](#)
- [Important Information on Features and Commands, on page xv](#)
- [Related Documentation, on page xv](#)
- [Document Conventions, on page xvi](#)
- [Obtaining Documentation and Submitting a Service Request, on page xvii](#)

## Objectives

This guide provides an overview of the Cisco Catalyst 8300 and 8200 Series Edge Platforms and explains how to configure the various features on these routers.

## Important Information on Features and Commands

For more information about Cisco IOS XE software, including features available on the router (described in configuration guides), see the [Cisco IOS XE 17 Software Documentation](#) set.

To verify support for specific features, use Cisco Feature Navigator. For more information about this, see [Using Cisco Feature Navigator, on page 37](#).

To find reference information for a specific Cisco IOS XE command, see the [Cisco IOS Master Command List, All Releases](#).

## Related Documentation

- [Hardware Installation Guide for the Cisco C8000 Series Router](#)
- [Release Notes for the Cisco C8000 Series Routers](#)

## Commands

Cisco IOS XE commands are identical in look, feel, and usage to Cisco IOS commands on most platforms. To find reference information for a specific Cisco IOS XE command, see the [Cisco IOS Master Command List, All Releases](#) document.

## Features

The router runs Cisco IOS XE software which is used on multiple platforms. To verify support for specific features, use the Cisco Feature Navigator tool. For more information, see [Using Cisco Feature Navigator, on page 37](#).

# Document Conventions

This documentation uses the following conventions:

Convention	Description
<b>^</b> or <b>Ctrl</b>	The <b>^</b> and <b>Ctrl</b> symbols represent the Control key. For example, the key combination <b>^D</b> or <b>Ctrl-D</b> means hold down the <b>Control</b> key while you press the <b>D</b> key. Keys are indicated in capital letters but are not case sensitive.
<i>string</i>	A string is a nonquoted set of characters shown in italics. For example, when setting an SNMP community string to public, do not use quotation marks around the string or the string will include the quotation marks.

Command syntax descriptions use the following conventions:

Convention	Description
<b>bold</b>	Bold text indicates commands and keywords that you enter exactly as shown.
<i>italics</i>	Italic text indicates arguments for which you supply values.
[x]	Square brackets enclose an optional element (keyword or argument).
	A vertical line indicates a choice within an optional or required set of keywords or arguments.
[x   y]	Square brackets enclosing keywords or arguments separated by a vertical line indicate an optional choice.
{x   y}	Braces enclosing keywords or arguments separated by a vertical line indicate a required choice.



Nested sets of square brackets or braces indicate optional or required choices within optional or required elements. For example:

Convention	Description
[x {y   z}]	Braces and a vertical line within square brackets indicate a required choice within an optional element.

Examples use the following conventions:

Convention	Description
screen	Examples of information displayed on the screen are set in Courier font.
<b>bold screen</b>	Examples of text that you must enter are set in Courier bold font.
<>	Angle brackets enclose text that is not printed to the screen, such as passwords.
!	An exclamation point at the beginning of a line indicates a comment line. (Exclamation points are also displayed by the Cisco IOS XE software for certain processes.)
[ ]	Square brackets enclose default responses to system prompts.



**Caution** Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.



**Note** Means *reader take note*. Notes contain helpful suggestions or references to materials that may not be contained in this manual.

## Obtaining Documentation and Submitting a Service Request

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- To find warranty information for a specific product or product family, access [Cisco Warranty Finder](#).



# CHAPTER 1

## Overview

---

This chapter includes information about Cisco Catalyst 8300 and 8200 Series Edge Platforms and describes the autonomous mode and controller mode. It contains the following sections:

- [Introduction, on page 1](#)
- [Supported Modules and Features-on Cisco 8300 and 8200 Series Edge Platforms, on page 3](#)

## Introduction

The Cisco Catalyst 8300 and 8200 Series Edge Platforms are best-of-breed, 5G-ready, cloud edge platforms designed for accelerated services, multi-layer security, cloud-native agility, and edge intelligence to accelerate your journey to cloud.

Cisco Catalyst 8300 and 8200 Series Edge Platforms with Cisco IOS XE SD-WAN Software deliver Cisco's secure, cloud-scale SD-WAN solution for the branch. The Cisco Catalyst 8300 and 8200 Series Edge Platforms is built for high performance and integrated SD-WAN Services along with flexibility to deliver security and networking services together from the cloud or on premises. It provides higher WAN port density and a redundant power supply capability. The Cisco Catalyst 8300 and 8200 Series Edge Platforms have a wide variety of interface options to choose from—ranging from lower and higher module density with backward compatibility to a variety of existing WAN, LAN, LTE, voice, and compute modules. Powered by Cisco IOS XE, fully programmable software architecture, and API support, these platforms can facilitate automation at scale to achieve zero-touch IT capability while migrating workloads to the cloud. The Cisco Catalyst 8300 and 8200 Series Edge Platforms also come with Trustworthy Solutions 2.0 infrastructure that secures the platforms against threats and vulnerabilities with integrity verification and remediation of threats.

The Cisco Catalyst 8300 and 8200 Series Edge Platforms are well suited for medium-sized and large enterprise branch offices for high WAN IPsec performance with integrated SD-WAN services.

Cisco Catalyst 8300 and 8200 Series Edge Platforms target these use-cases:

- Enterprise Branch office, Managed Service Provide CPE, Internet Gateway for DIA, SASE cloud platform with SD-WAN
- Next-generation of Software Defined (SD) Branch routing platforms

This document is a summary of software functionality that is specific to the Cisco Catalyst 8300 and 8200 Series Edge Platforms. You can 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 device and includes the Cisco IOS XE functionality. To access Cisco IOS XE SD-WAN functionality

switch to the Controller mode. You can use the existing Plug and Play workflow to determine the mode of the device.

You can use the `universalk9` image to deploy both Cisco IOS XE SD-WAN and Cisco IOS XE on Cisco IOS XE platforms. The Cisco IOS XE Amsterdam 17.3 helps in seamless upgrades of both the SD-WAN and non-SDWAN features and deployments.

## Switch Between Controller and Autonomous Modes Using Cisco CLI

Use the **controller-mode** command in Privileged EXEC mode to switch between controller and autonomous modes.

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

```
Device# controller-mode disable
```

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

```
Device# controller-mode enable
```



**Note** When the device mode is switched from autonomous to controller, the startup configuration and the information in NVRAM (certificates), are erased. This action is same as the **write erase**.

When the device mode is switched from controller to autonomous, all Yang-based configuration is preserved and can be reused if you switch back to controller mode. If you want to switch the mode from controller to autonomous, ensure that the configuration on the device is set to auto-boot.

## Switch Between Controller and Autonomous Modes using Bootstrap Configuration Files

On a device that already runs a Cisco IOS XE non SD-WAN image, after installing Cisco IOS XE Release 17.3.2 or later image, the device boots up in autonomous mode.

On a device that already runs a Cisco IOS XE SD-WAN image, after installing Cisco IOS XE Release 17.3.1r or later image, the device boots up in controller mode.

To switch modes, use the **controller-mode enable** command to switch from autonomous to controller mode and **controller-mode disable** command to switch from controller mode to autonomous mode. After the device boots up, the configuration present in the configuration file is applied.

After the device boots up in controller mode, the configuration present in the configuration file is applied.

For more information on how to use a single `universalk9` image to deploy Cisco IOS XE SD-WAN and Cisco IOS XE functionality on all the supported devices, see the [Install and Deploy Cisco IOS XE and Cisco IOS XE SD-WAN Functionality on Edge Platforms](#) guide.

The following are the Cisco Catalyst 8300 and 8200 Series Edge Platforms models:

- C8300-2N2S-4T2X
- C8300-2N2S-6T
- C8300-1N1S-4T2X

- C8300-1N1S-6T
- C8200-1N-4T
- C8200L-1N-4T

## Supported Modules and Features-on Cisco 8300 and 8200 Series Edge Platforms

The following table provides the supported modules and features on Cisco Catalyst 8300 and 8200 Series Edge Platforms.

**Table 1: Supported Modules and Features on Cisco 8300 and 8200 Series Edge Platforms**

Features	Cisco 8300	Cisco 8200	Cisco 8200L
Service Plane Applications (UTD, AppQoE, and TcpOpt)	Yes	No	No
CPU Core	8 Core C8300-2N2S-4T2X supports 12 Core	8 Core	4 Core
CPU Memory	8 G	8 G	4 G
Backplane Support	10 G	10 G	1 G





## CHAPTER 2

# Basic Platform Configuration

This section includes information about some basic platform configuration in Autonomous mode, and contains the following sections:

- [Default Configuration, on page 5](#)
- [Configuring Global Parameters, on page 9](#)
- [Configuring Gigabit Ethernet Interfaces, on page 10](#)
- [Configuring a Loopback Interface, on page 11](#)
- [Configuring Module Interfaces, on page 12](#)
- [Dynamic Allocation of Cores, on page 12](#)
- [Enabling Cisco Discovery Protocol, on page 14](#)
- [Configuring Command-Line Access, on page 14](#)
- [Configuring Static Routes, on page 16](#)
- [Configuring Dynamic Routes, on page 18](#)

## Default Configuration

When you boot up the device in autonomous mode, the device looks for a default file name—the PID of the device. For example, the Cisco Catalyst 8000 Series Edge Platforms look for a file named c8000.cfg. The device looks for this file before finding the standard files-router-config or the ciscortr.cfg.

The device looks for the c8000.cfg file in the bootflash. If the file is not found in the bootflash, the device then looks for the standard files-router-config and ciscortr.cfg. If none of the files are found, the device then checks for any inserted USB that may have stored these files in the same particular order.



---

**Note** If there is a configuration file with the PID as its name in an inserted USB, but one of the standard files are in bootflash, the system finds the standard file for use.

---

Use the **show running-config** command to view the initial configuration, as shown in the following example:

```
Router# show running-config
Building configuration...

Current configuration : 6504 bytes
!
! Last configuration change at 05:04:58 UTC Mon Jul 6 2020
!
```

```

version 17.3
service config
service timestamps debug datetime msec
service timestamps log datetime msec
service call-home
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
platform hardware throughput crypto 1G
!
hostname Router
!
boot-start-marker
boot system bootflash:c8000be-universalk9.17.03.01prd8.SPA.bin
boot-end-marker
!
!
!
no aaa new-model

!
!
!
login on-success log

!
!
subscriber templating

!
!
multilink bundle-name authenticated
no device-tracking logging theft

!
!
!
crypto pki trustpoint TP-self-signed-2347094934
  enrollment selfsigned
  subject-name cn=IOS-Self-Signed-Certificate-2347094934
  revocation-check none
  rsakeypair TP-self-signed-2347094934
!
crypto pki trustpoint SLA-TrustPoint
  enrollment pkcs12
  revocation-check crl
!
!
crypto pki certificate chain TP-self-signed-2347094934
  certificate self-signed 01
    30820330 30820218 A0030201 02020101 300D0609 2A864886 F70D0101 05050030
    31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D 43657274
    69666963 6174652D 32333437 30393439 3334301E 170D3230 30353238 32333331
    30325A17 0D333030 31303130 30303030 305A3031 312F302D 06035504 03132649
    4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D32 33343730
    39343933 34308201 22300D06 092A8648 86F70D01 01010500 0382010F 00308201

    8B2FA1A7 29F5E8BD 57EB2459 CBBA7D64 4471BD34 0EC80AF2 0B693D0C 8DC3F771
    5D377065 57F16FD6 1B7AE4D3 3C5824B5 46FCDA97 4A5CA003 8B0BF2C9 E04A84E5
    E34E5EC6 AF94ACF3 DE5F9295 AA1C474F 30902D92 77F67A29 E4934212 DB9B253F
    1EC8F61F FD32D662 2F062666 13B8DC71 031F2119 551A487F 77E3BD46 3E5E7BBD
    9669BD8E FC4AEE6E EAD00DA5 DD56E370 716EC5CC 67DA7F35 6F4B3428 AD6EF6BD
    92868FAD 84871242 08C4FBED D5DB5249 336EB488 0D9A0B02 8BEE4BF9 5D03C416
    266E0F49 81030203 010001A3 53305130 0F060355 1D130101 FF040530 030101FF
    301F0603 551D2304 18301680 14AE8751 EF7BF338 F7AB9FD8 E3EB151C F9E68DFA

```





```

    negotiation auto
  !
interface GigabitEthernet0/0/1
  no ip address
  negotiation auto
  !
interface GigabitEthernet0/0/2
  no ip address
  negotiation auto
  !
interface GigabitEthernet0/0/3
  no ip address
  negotiation auto
  !
interface GigabitEthernet0/0/4
  no ip address
  negotiation auto
  !
interface GigabitEthernet0/0/5
  no ip address
  negotiation auto
  !
ip http server
ip http authentication local
ip http secure-server
ip http client source-interface GigabitEthernet0/0/0
ip forward-protocol nd

!
!
!
control-plane
!
!
mgcp behavior rsip-range tgcp-only
mgcp behavior comedia-role none
mgcp behavior comedia-check-media-src disable
mgcp behavior comedia-sdp-force disable
!
mgcp profile default

!
!
dspfarm profile 7 conference security
  shutdown

!
line con 0
  exec-timeout 0 0
  stopbits 1
line aux 0
  stopbits 1
line vty 0 4
  login
  transport input ssh
!
call-home
  ! If contact email address in call-home is configured as sch-smart-licensing@cisco.com
  ! the email address configured in Cisco Smart License Portal will be used as contact email
  address to send SCH notifications.
  contact-email-addr sch-smart-licensing@cisco.com
  profile "CiscoTAC-1"
  active
  destination transport-method http

```

```

!
!
end

```

## Configuring Global Parameters

To configure the global parameters for your device, follow these steps.

### SUMMARY STEPS

1. **configure terminal**
2. **hostname *name***
3. **enable secret *password***
4. **no ip domain-lookup**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> <pre>Router&gt; enable Router# configure terminal Router(config)#</pre>	Enters global configuration mode when using the console port.  Use the following to connect to the device with a remote terminal: <pre>telnet router-name or address Login: login-id Password: ***** Router&gt; enable</pre>
Step 2	<b>hostname <i>name</i></b> <b>Example:</b> <pre>Router(config)# hostname Router</pre>	Specifies the name for the device.
Step 3	<b>enable secret <i>password</i></b> <b>Example:</b> <pre>Router(config)# enable secret crlny5ho</pre>	Specifies an encrypted password to prevent unauthorized access to the device.
Step 4	<b>no ip domain-lookup</b> <b>Example:</b> <pre>Router(config)# no ip domain-lookup</pre>	Disables the device from translating unfamiliar words (typos) into IP addresses.  For complete information on global parameter commands, see the <a href="#">Cisco IOS Release Configuration Guide</a> documentation set.

# Configuring Gigabit Ethernet Interfaces

To manually define onboard Gigabit Ethernet interfaces, follow these steps, beginning from global configuration mode.

## SUMMARY STEPS

1. **interface** `gigabitethernet slot/bay/port`
2. **ip address** `ip-address mask`
3. **ipv6 address** `ipv6-address/prefix`
4. **no shutdown**
5. **exit**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>interface</b> <code>gigabitethernet slot/bay/port</code> <b>Example:</b> Router(config)# <b>interface</b> <code>gigabitethernet 0/0/1</code>	Enters the configuration mode for a Gigabit Ethernet interface on the device.
<b>Step 2</b>	<b>ip address</b> <code>ip-address mask</code> <b>Example:</b> Router(config-if)# <b>ip address</b> <code>192.0.2.2 255.255.255.0</code>	Sets the IP address and subnet mask for the specified Gigabit Ethernet interface. Use this Step if you are configuring an IPv4 address.
<b>Step 3</b>	<b>ipv6 address</b> <code>ipv6-address/prefix</code> <b>Example:</b> Router(config-if)# <b>ipv6 address</b> <code>2001.db8::ffff:1/128</code>	Sets the IPv6 address and prefix for the specified Gigabit Ethernet interface. Use this step instead of Step 2, if you are configuring an IPv6 address.
<b>Step 4</b>	<b>no shutdown</b> <b>Example:</b> Router(config-if)# <b>no shutdown</b>	Enables the Gigabit Ethernet interface and changes its state from administratively down to administratively up.
<b>Step 5</b>	<b>exit</b> <b>Example:</b> Router(config-if)# <b>exit</b>	Exits configuration mode for the Gigabit Ethernet interface and returns to privileged EXEC mode.

# Configuring a Loopback Interface

## Before you begin

The loopback interface acts as a placeholder for the static IP address and provides default routing information. To configure a loopback interface, follow these steps.

## SUMMARY STEPS

1. **interface** *type number*
2. (Option 1) **ip address** *ip-address mask*
3. (Option 2) **ipv6 address** *ipv6-address/prefix*
4. **exit**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>interface</b> <i>type number</i> <b>Example:</b>  Router(config)# <b>interface</b> Loopback 0	Enters configuration mode on the loopback interface.
<b>Step 2</b>	(Option 1) <b>ip address</b> <i>ip-address mask</i> <b>Example:</b>  Router(config-if)# <b>ip address</b> 10.108.1.1 255.255.255.0	Sets the IP address and subnet mask on the loopback interface. (If you are configuring an IPv6 address, use the <b>ipv6 address</b> <i>ipv6-address/prefix</i> command described below.
<b>Step 3</b>	(Option 2) <b>ipv6 address</b> <i>ipv6-address/prefix</i> <b>Example:</b>  Router(config-if)# <b>2001:db8::ffff:1/128</b>	Sets the IPv6 address and prefix on the loopback interface.
<b>Step 4</b>	<b>exit</b> <b>Example:</b>  Router(config-if)# <b>exit</b>	Exits configuration mode for the loopback interface and returns to global configuration mode.

## Example

### Verifying Loopback Interface Configuration

This configuration example shows the loopback interface configured on the Gigabit Ethernet interface with an IP address of 203.0.113.1/32, which acts as a static IP address. The loopback interface points back to virtual-template1, which has a negotiated IP address.

```

!
interface loopback 0
ip address 203.0.113.1 255.255.255.255 (static IP address)
ip nat outside
!
interface Virtual-Template1
ip unnumbered loopback0
no ip directed-broadcast
ip nat outside

```

Enter the **show interface loopback** command. You should see an output similar to the following example:

```

Router# show interface loopback 0
Loopback0 is up, line protocol is up
  Hardware is Loopback
  Internet address is 203.0.113.1/32
  MTU 1514 bytes, BW 8000000 Kbit/sec, DLY 5000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation LOOPBACK, loopback not set
  Keepalive set (10 sec)
  Last input never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/0 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
    Received 0 broadcasts (0 IP multicasts)
    0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 packets output, 0 bytes, 0 underruns
    Output 0 broadcasts (0 IP multicasts)
    0 output errors, 0 collisions, 0 interface resets
    0 output buffer failures, 0 output buffers swapped out

```

Alternatively, use the **ping** command to verify the loopback interface, as shown in the following example:

```

Router# ping 203.0.113.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 203.0.113.1, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/1/1 ms

```

## Configuring Module Interfaces

For detailed information about configuring service modules, see "Service Modules" in the "Service Module Management" section of the Cisco Service Module Configuration Guide.

## Dynamic Allocation of Cores

Dynamic core allocations on the Catalyst 8000 Series Edge platforms provide flexibility for users to leverage the CPU cores for different services and/or CEF/IPSec performances. The Catalyst 8000 Series Edge platforms are equipped with a minimum of 8 CPU 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.

From Cisco IOS XE Release 17.4 onwards, 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 }
```

From Cisco IOS XE Release 17.5.1 onwards, Catalyst 8000 Series Edge Platforms supports changing the core allocation dynamically. You do not have to reboot the devices to have the new allocation to take effect.

Following are the list of Catalyst 8000 Series Edge platforms that support changing the core allocations dynamically:

- C8300-2N1S-6T
- C8300-2N1S-4T2X
- C8300-2N2S-6T
- C8300-2N2S-4T2X
- C8200-1N-4T




---

**Note** By default, when a device boots up, the mode is service-plane-heavy.

---

The following show command output shows the CPU cores allocation for the data plane :

```
Router# show platform software cpu alloc

CPU alloc information:
Control plane cpu alloc: 0
Data plane cpu alloc: 1-7
Service plane cpu alloc: 0
Template used: CLI-data_plane_heavy
```




---

**Note** In the above example, the maximum data plane core allocation is 7.

---

The following show command output shows the CPU cores allocation for the service plane:

```
Router# show platform software cpu alloc

CPU alloc information:
Control plane cpu alloc: 0
Data plane cpu alloc: 4-7
Service plane cpu alloc: 1-3
Template used: CLI-service_plane_heavy
```

The following show command output shows the PPE status:

```
Router# show platform hardware qfp active datapath infrastructure sw-cio

Credits Usage:

ID      Port  Wght  Global  WRKR0  WRKR1  Total
1       rc10  1:    474    0      38     512
```

```

1      rc10  128:  480    0    32    512
2      ipc   1:    508    0     3    511
3 vxe_punti 1:    474    0    38    512
4      fpe0  1:    976    0    48   1024
5      fpe1  1:    976    0    48   1024
6      fpe2  1:    976    0    48   1024
7      fpe3  1:    976    0    48   1024

```

Core Utilization over preceding 5475356.7738 seconds

```

-----
      ID:      0      1
% PP:    0.63    0.00
% RX:    0.00    1.54
% TM:    0.00    1.63
% COFF:   0.00    0.69
% IDLE:  99.37   96.15

```

## Enabling Cisco Discovery Protocol

Cisco Discovery Protocol (CDP) is enabled by default on the router.

For more information on using CDP, see [Cisco Discovery Protocol Configuration Guide](#).

## Configuring Command-Line Access

To configure parameters to control access to the device, follow these steps.

### SUMMARY STEPS

1. **line** [**console** | **tty** | **vtty**] *line-number*
2. **password** *password*
3. **login**
4. **exec-timeout** *minutes* [*seconds*]
5. **exit**
6. **line** [**console** | **tty** | **vtty**] *line-number*
7. **password** *password*
8. **login**
9. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>line</b> [ <b>console</b>   <b>tty</b>   <b>vtty</b> ] <i>line-number</i> <b>Example:</b>  Router(config)# <b>line console 0</b>	Enters line configuration mode, and specifies the type of line.  The example provided here specifies a console terminal for access.
<b>Step 2</b>	<b>password</b> <i>password</i> <b>Example:</b>	Specifies a unique password for the console terminal line.



	Command or Action	Purpose
	Router(config-line)# <b>password</b> 5dr4Hepw3	
<b>Step 3</b>	<b>login</b> <b>Example:</b> Router(config-line)# <b>login</b>	Enables password checking at terminal session login.
<b>Step 4</b>	<b>exec-timeout</b> <i>minutes</i> [ <i>seconds</i> ] <b>Example:</b> Router(config-line)# <b>exec-timeout</b> 5 30 Router(config-line)#	Sets the interval during which the EXEC command interpreter waits until user input is detected. The default is 10 minutes. Optionally, adds seconds to the interval value.  The example provided here shows a timeout of 5 minutes and 30 seconds. Entering a timeout of <b>0 0</b> specifies never to time out.
<b>Step 5</b>	<b>exit</b> <b>Example:</b> Router(config-line)# <b>exit</b>	Exits line configuration mode to re-enter global configuration mode.
<b>Step 6</b>	<b>line</b> [ <b>console</b>   <b>tty</b>   <b>vty</b> ] <i>line-number</i> <b>Example:</b> Router(config)# <b>line</b> vty 0 4 Router(config-line)#	Specifies a virtual terminal for remote console access.
<b>Step 7</b>	<b>password</b> <i>password</i> <b>Example:</b> Router(config-line)# <b>password</b> aldf2ad1	Specifies a unique password for the virtual terminal line.
<b>Step 8</b>	<b>login</b> <b>Example:</b> Router(config-line)# <b>login</b>	Enables password checking at the virtual terminal session login.
<b>Step 9</b>	<b>end</b> <b>Example:</b> Router(config-line)# <b>end</b>	Exits line configuration mode, and returns to privileged EXEC mode.

### Example

The following configuration shows the command-line access commands.

You do not have to input the commands marked **default**. These commands appear automatically in the configuration file that is generated when you use the **show running-config** command.

```

!
line console 0
  exec-timeout 10 0
  password 4youreyesonly
  login
transport input none (default)
stopbits 1 (default)
line vty 0 4
  password secret
  login
!

```

## Configuring Static Routes

Static routes provide fixed routing paths through the network. They are manually configured on the device. If the network topology changes, the static route must be updated with a new route. Static routes are private routes unless they are redistributed by a routing protocol.

To configure static routes, follow these steps.

### SUMMARY STEPS

1. (Option 1) **ip route** *prefix mask {ip-address | interface-type interface-number [ip-address]}*
2. (Option 2) **ipv6 route** *prefix/mask {ipv6-address | interface-type interface-number [ipv6-address]}*
3. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	(Option 1) <b>ip route</b> <i>prefix mask {ip-address   interface-type interface-number [ip-address]}</i>  <b>Example:</b>  Router(config)# <b>ip route 192.0.2.8 255.255.0.0 10.10.10.2</b>	Specifies a static route for the IP packets. (If you are configuring an IPv6 address, use the <b>ipv6 route</b> command described below.)
<b>Step 2</b>	(Option 2) <b>ipv6 route</b> <i>prefix/mask {ipv6-address   interface-type interface-number [ipv6-address]}</i>  <b>Example:</b>  Router(config)# <b>ipv6 route 2001:db8:2::/64 2001:DB8:3000:1</b>	Specifies a static route for the IP packets.

	Command or Action	Purpose
Step 3	<b>end</b> <b>Example:</b> Router(config)# <b>end</b>	Exits global configuration mode and enters privileged EXEC mode.

### Verifying Configuration

In the following configuration example, the static route sends out all IP packets with a destination IP address of 192.0.2.8 and a subnet mask of 255.255.255.0 on the Gigabit Ethernet interface to another device with an IP address of 10.10.10.2. Specifically, the packets are sent to the configured interface.

You do not have to enter the command marked **default**. This command appears automatically in the configuration file generated when you use the **running-config** command.

```
!
ip classless (default)
ip route 192.0.2.8 255.255.255.0 10.10.10.2
```

To verify that you have configured static routing correctly, enter the **show ip route** command (or **show ipv6 route** command) and look for static routes marked with the letter S.

When you use an IPv4 address, you should see verification output similar to the following:

```
Router# show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, m - OMP
       n - NAT, Ni - NAT inside, No - NAT outside, Nd - NAT DIA
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       H - NHRP, G - NHRP registered, g - NHRP registration summary
       o - ODR, P - periodic downloaded static route, l - LISP
       a - application route
       + - replicated route, % - next hop override, p - overrides from PfR
       & - replicated local route overrides by connected

Gateway of last resort is 10.0.10.1 to network 192.0.2.6

S*    192.0.2.6/0 [254/0] via 10.0.10.1
      10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C      10.0.10.0/24 is directly connected, GigabitEthernet0/0/0
L      10.0.10.13/32 is directly connected, GigabitEthernet0/0/0
C      10.108.1.0/24 is directly connected, Loopback0
L      10.108.1.1/32 is directly connected, Loopback0
```

When you use an IPv6 address, you should see verification output similar to the following:

```
Router# show ipv6 route
IPv6 Routing Table - default - 5 entries
Codes: C - Connected, L - Local, S - Static, U - Per-user Static route
       B - BGP, R - RIP, H - NHRP, I1 - ISIS L1
       I2 - ISIS L2, IA - ISIS interarea, IS - ISIS summary, D - EIGRP
       EX - EIGRP external, ND - ND Default, NDp - ND Prefix, DCE -
Destination
```

```

NDr - Redirect, O - OSPF Intra, OI - OSPF Inter, OE1 - OSPF ext 1
OE2 - OSPF ext 2, ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
ls - LISP site, ld - LISP dyn-EID, a - Application

C 2001:DB8:3::/64 [0/0]
   via GigabitEthernet0/0/2, directly connected
S 2001:DB8:2::/64 [1/0]
   via 2001:DB8:3::1

```

## Configuring Dynamic Routes

In dynamic routing, the network protocol adjusts the path automatically, based on network traffic or topology. Changes in dynamic routes are shared with other devices in the network.

A device can use IP routing protocols, such as Routing Information Protocol (RIP) or Enhanced Interior Gateway Routing Protocol (EIGRP), to learn about routes dynamically.

- [Configuring Routing Information Protocol, on page 18](#)
- [Configuring Enhanced Interior Gateway Routing Protocol, on page 22](#)

## Configuring Routing Information Protocol

To configure the RIP on a router, follow these steps.

### SUMMARY STEPS

1. **router rip**
2. **version {1 | 2}**
3. **network ip-address**
4. **no auto-summary**
5. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>router rip</b> <b>Example:</b> Router(config)# <b>router rip</b>	Enters router configuration mode, and enables RIP on the router.
<b>Step 2</b>	<b>version {1   2}</b> <b>Example:</b> Router(config-router)# <b>version 2</b>	Specifies use of RIP version 1 or 2.

	Command or Action	Purpose
Step 3	<b>network</b> <i>ip-address</i> <b>Example:</b> Router(config-router)# <b>network</b> 192.0.2.8 Router(config-router)# <b>network</b> 10.10.7.1	Specifies a list of networks on which RIP is to be applied, using the address of the network of each directly connected network.
Step 4	<b>no auto-summary</b> <b>Example:</b> Router(config-router)# <b>no auto-summary</b>	Disables automatic summarization of subnet routes into network-level routes. This allows subprefix routing information to pass across classful network boundaries.
Step 5	<b>end</b> <b>Example:</b> Router(config-router)# <b>end</b>	Exits router configuration mode, and enters privileged EXEC mode.

### Example

### Verifying Configuration

To see this configuration, use the **show running-config** command from privileged EXEC mode.

```

!
Router# show running-config
Building configuration...

Current configuration : 6504 bytes
!
! Last configuration change at 05:04:58 UTC Mon Jul 6 2020
!
version 17.3
service config
service timestamps debug datetime msec
service timestamps log datetime msec
service call-home
platform qfp utilization monitor load 80
platform punt-keepalive disable-kernel-core
platform hardware throughput crypto 1G
!
hostname Router
!
boot-start-marker
boot system bootflash:c8000be-universalk9.17.03.01prd8.SPA.bin
boot-end-marker
!
!
!
no aaa new-model
!
login on-success log

!
subscriber templating
!

```

```

!
multilink bundle-name authenticated
no device-tracking logging theft

!

crypto pki trustpoint TP-self-signed-2347094934
  enrollment selfsigned
  subject-name cn=IOS-Self-Signed-Certificate-2347094934
  revocation-check none
  rsakeypair TP-self-signed-2347094934
!

crypto pki trustpoint SLA-TrustPoint
  enrollment pkcs12
  revocation-check crl
!

!

crypto pki certificate chain SLA-TrustPoint
certificate ca 01
  30820321 30820209 A0030201 02020101 300D0609 2A864886 F70D0101 0B050030
  32310E30 0C060355 040A1305 43697363 6F312030 1E060355 04031317 43697363
  6F204C69 63656E73 696E6720 526F6F74 20434130 1E170D31 33303533 30313934
  3834375A 170D3338 30353330 31393438 34375A30 32310E30 0C060355 040A1305
  43697363 6F312030 1E060355 04031317 43697363 6F204C69 63656E73 696E6720
  526F6F74 20434130 82012230 0D06092A 864886F7 0D010101 05000382 010F0030
  82010A02 82010100 A6BCBD96 131E05F7 145EA72C 2CD686E6 17222EA1 F1EFF64D
  CBB4C798 212AA147 C655D8D7 9471380D 8711441E 1AAF071A 9CAE6388 8A38E520
  1C394D78 462EF239 C659F715 B98C0A59 5BBB5CBD 0CFE8EA3 700A8BF7 D8F256EE
  4AA4E80D DB6FD1C9 60B1FD18 FFC69C96 6FA68957 A2617DE7 104FDC5F EA2956AC
  7390A3EB 2B5436AD C847A2C5 DAB553EB 69A9A535 58E9F3E3 C0BD23CF 58BD7188
  68E69491 20F320E7 948E71D7 AE3BCC84 F10684C7 4BC8E00F 539BA42B 42C68BB7
  C7479096 B4CB2D62 EA2F505D C7B062A4 6811D95B E8250FC4 5D5D5FB8 8F27D191
  C55F0D76 61F9A4CD 3D992327 A8BB03BD 4E6D7069 7CBADF8B DF5F4368 95135E44
  DFC7C6CF 04DD7FD1 02030100 01A34230 40300E06 03551D0F 0101FF04 04030201
  06300F06 03551D13 0101FF04 05300301 01FF301D 0603551D 0E041604 1449DC85
  4B3D31E5 1B3E6A17 606AF333 3D3B4C73 E8300D06 092A8648 86F70D01 010B0500
  03820101 00507F24 D3932A66 86025D9F E838AE5C 6D4DF6B0 49631C78 240DA905
  604EDCDE FF4FED2B 77FC460E CD636FDB DD44681E 3A5673AB 9093D3B1 6C9E3D8B
  D98987BF E40CBD9E 1AECA0C2 2189BB5C 8FA85686 CD98B646 5575B146 8DFC66A8
  467A3DF4 4D565700 6ADF0F0D CF835015 3C04FF7C 21E878AC 11BA9CD2 55A9232C
  7CA7B7E6 C1AF74F6 152E99B7 B1FCF9BB E973DE7F 5BDDEB86 C71E3B49 1765308B
  5FB0DA06 B92AFE7F 494E8A9E 07B85737 F3A58BE1 1A48A229 C37C1E69 39F08678
  80DDCD16 D6BACECA EEBC7CF9 8428787B 35202CDC 60E4616A B623CDBD 230E3AFB
  418616A9 4093E049 4D10AB75 27E86F73 932E35B5 8862FDAE 0275156F 719BB2F0
  D697DF7F 28
      quit

!

!
license feature hseck9
license udi pid C8300-1N1S-6T sn FDO2320A0CF

diagnostic bootup level minimal
!
spanning-tree extend system-id
!
!
redundancy
mode none

!

interface GigabitEthernet0/0/0
ip dhcp client client-id ascii FDO2320A0CF

```

```

ip address dhcp
negotiation auto
!
interface GigabitEthernet0/0/1
no ip address
negotiation auto
!
!
ip http server
ip http authentication local
ip http secure-server
ip http client source-interface GigabitEthernet0/0/0
ip forward-protocol nd

!
!
!
control-plane
!
!
mgcp behavior rsip-range tgcp-only
mgcp behavior comedia-role none
mgcp behavior comedia-check-media-src disable
mgcp behavior comedia-sdp-force disable
!
mgcp profile default

!
!
dspfarm profile 7 conference security
shutdown

!
line con 0
exec-timeout 0 0
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login
transport input ssh
!
call-home
! If contact email address in call-home is configured as sch-smart-licensing@cisco.com
! the email address configured in Cisco Smart License Portal will be used as contact email
address to send SCH notifications.
contact-email-addr sch-smart-licensing@cisco.com
profile "CiscoTAC-1"
active
destination transport-method http

!
!
end

```

To verify that you have configured RIP correctly, enter the **show ip route** command and look for RIP routes marked with the letter R. You should see an output similar to the one shown in the following example:

```

Router# show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2

```

```

E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

10.0.0.0/24 is subnetted, 1 subnets
C    10.108.1.0 is directly connected, Loopback0
R    192.0.2.3/8 [120/1] via 192.0.2.2, 00:00:02, Ethernet0/0/0

```

## Configuring Enhanced Interior Gateway Routing Protocol

To configure Enhanced Interior Gateway Routing Protocol (EIGRP), follow these steps.

### SUMMARY STEPS

1. **router eigrp** *as-number*
2. **network** *ip-address*
3. **end**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>router eigrp</b> <i>as-number</i> <b>Example:</b> Router(config)# <b>router eigrp</b> 109	Enters router configuration mode, and enables EIGRP on the router. The autonomous-system number identifies the route to other EIGRP routers and is used to tag the EIGRP information.
<b>Step 2</b>	<b>network</b> <i>ip-address</i> <b>Example:</b> Router(config)# <b>network</b> 192.0.2.8 Router(config)# <b>network</b> 10.10.12.15	Specifies a list of networks on which EIGRP is to be applied, using the IP address of the network of directly connected networks.
<b>Step 3</b>	<b>end</b> <b>Example:</b> Router(config-router)# <b>end</b>	Exits router configuration mode, and enters privileged EXEC mode.

### Verifying the Configuration

The following configuration example shows the EIGRP routing protocol enabled in IP networks 192.0.2.8 and 10.10.12.15. The EIGRP autonomous system number is 109. To see this configuration, use the **show running-config** command.

```

Router# show running-config
.
.
.
!
```



```
router eigrp 109
 network 192.0.2.8
 network 10.10.12.15
!
```

To verify that you have configured IP EIGRP correctly, enter the **show ip route** command, and look for EIGRP routes marked by the letter D. You should see verification output similar to the following:

```
Router# show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

      10.0.0.0/24 is subnetted, 1 subnets
C       10.108.1.0 is directly connected, Loopback0
D       192.0.2.3/8 [90/409600] via 192.0.2.2, 00:00:02, Ethernet0/0
```





# CHAPTER 3

## Using Cisco IOS XE Software

This chapter describes the basics of using the Cisco IOS XE software in autonomous mode and includes the following section:

- [Using Cisco IOS XE Software, on page 25](#)

## Using Cisco IOS XE Software

### Before you begin

Use the console (CON) port to access the command-line interface (CLI) directly or when using Telnet.

The following sections describe the main methods of accessing the device:

### Procedure

	Command or Action	Purpose
Step 1	<a href="#">Accessing the CLI Using a Directly-Connected Console, on page 25</a>	
Step 2	<a href="#">Using SSH to Access Console, on page 26</a>	
Step 3	<a href="#">Accessing the CLI from a Remote Console Using Telnet, on page 27</a>	
Step 4	<a href="#">Accessing the CLI from a USB Serial Console Port, on page 29</a>	

## Accessing the CLI Using a Directly-Connected Console

The CON port is an EIA/TIA-232 asynchronous, serial connection with no-flow control and an RJ-45 connector. The CON port is located on the front panel of the chassis.

The following sections describe the procedure to access the control interface:

- [Connecting to the Console Port, on page 26](#)
- [Using the Console Interface, on page 26](#)

## Connecting to the Console Port

---

- Step 1** Configure your terminal emulation software with the following settings:
- 9600 bits per second (bps)
  - 8 data bits
  - No parity
  - No flow control
- Step 2** Connect to the CON port using the RJ-45-to-RJ-45 cable and the RJ-45-to-DB-25 DTE adapter or the RJ-45-to-DB-9 DTE adapter (labeled Terminal).
- 

## Using the Console Interface

---

- Step 1** Enter the following command:
- ```
Router> enable
```
- Step 2** (Go to Step 3 if the enable password has not been configured.) At the password prompt, enter your system password:
- ```
Password: enablepass
```
- When your password is accepted, the privileged EXEC mode prompt is displayed.
- ```
Router#
```
- You now have access to the CLI in privileged EXEC mode and you can enter the necessary commands to complete your desired tasks.
- Step 3** If you enter the **setup** command, see “Using Cisco Setup Command Facility” in the “Initial Configuration” section of the [Hardware Installation Guide for Cisco Catalyst 8300 Series Edge Platform](#).
- Step 4** To exit the console session, enter the **quit** command:
- ```
Router# quit
```
- 

## Using SSH to Access Console

Secure Shell (SSH) is a protocol which provides a secure remote access connection to network devices. To enable SSH support on the device:

---

- Step 1** Configure the hostname:
- ```
Router#configure terminal
```
- Enter configuration commands, one per line. End with CNTL/Z.
- Here, *host name* is the device hostname or IP address.
- Step 2** Configure the DNS domain of the device:

```
Router(config)# ip domain name cisco.com
```

**Step 3** Generate an SSH key to be used with SSH:

```
Router(config)# crypto key generate rsa
The name for the keys will be: Router.xxx.cisco.com Choose the size of the key modulus in the range
of 360 to 4096 for your General Purpose Keys. Choosing a key modulus greater than 512 may take a few
minutes.
How many bits in the modulus [512]: 1024 % Generating 1024 bit RSA keys, keys will be non-exportable...
[OK] (elapsed time was 0 seconds)
Router(config)#
```

**Step 4** By default, the vty's transport is Telnet. In this case, Telnet is disabled and only SSH is supported:

```
Router(config)#line vty 0 4
xxx_lab(config-line)#transport input ssh
```

**Step 5** Create a username for SSH authentication and enable login authentication:

```
Router(config)# username jsmith privilege 15 secret 0 p@ss3456
Router(config)#line vty 0 4
Router(config-line)# login local
```

**Step 6** Verify remote connection to the device using SSH.

---

## Accessing the CLI from a Remote Console Using Telnet

The following topics describe the procedure to access the CLI from a remote console using Telnet:

- [Preparing to Connect to the Device Console Using Telnet, on page 27](#)
- [Using Telnet to Access a Console Interface, on page 28](#)

### Preparing to Connect to the Device Console Using Telnet

To access the device remotely using Telnet from a TCP/IP network, configure the device to support virtual terminal lines using the **line vty** global configuration command. Configure the virtual terminal lines to require users to log in and specify a password.

See the [Cisco IOS Terminal Services Command Reference](#) document for more information about the **line vty global** configuration command.

To add a line password to the vty, specify a password with the **password** command when you configure the **login** command.

If you are using authentication, authorization, and accounting (AAA), configure the **login authentication** command. To prevent disabling login on a 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: Secure Connectivity](#) and the [Cisco IOS Security Command Reference](#) documents. For more information about the **login line-configuration** command, see the [Cisco IOS Terminal Services Command Reference](#) document.

In addition, before you make a Telnet connection to the device, you must have a valid hostname for the device or have an IP address configured on the device. For more information about the requirements for connecting to the device using Telnet, information about customizing your Telnet services, and using Telnet key sequences, see the [Cisco IOS Configuration Fundamentals Configuration Guide](#).

## Using Telnet to Access a Console Interface

---

**Step 1** From your terminal or PC, enter one of the following commands:

- **connect host** [*port*] [*keyword*]
- **telnet host** [*port*] [*keyword*]

Here, *host* is the device hostname or IP address, *port* is a decimal port number (23 is the default), and *keyword* is a supported keyword. For more information about these commands, see the [Cisco IOS Terminal Services Command Reference](#) document.

**Note** If you are using an access server, specify a valid port number, such as **telnet 198.51.100.2 2004**, in addition to the hostname or IP address.

The following example shows how to use the **telnet** command to connect to a device named **router**:

```
unix_host% telnet router
Trying 198.51.100.2...
Connected to 198.51.100.2.
Escape character is '^'.
unix_host% connect
```

**Step 2** Enter your login password:

```
User Access Verification
Password: mypassword
```

**Note** If no password has been configured, press **Return**.

**Step 3** From user EXEC mode, enter the **enable** command:

```
Router> enable
```

**Step 4** At the password prompt, enter your system password:

```
Password: enablepass
```

**Step 5** When the **enable** password is accepted, the privileged EXEC mode prompt is displayed:

```
Router#
```

**Step 6** You now have access to the CLI in privileged EXEC mode and you can enter the necessary commands to complete your desired tasks.

**Step 7** To exit the Telnet session, use the **exit** or **logout** command.

```
Router# logout
```

---

## Accessing the CLI from a USB Serial Console Port

The router provides an additional mechanism for configuring the system: a type B miniport USB serial console that supports remote administration of the router using a type B USB-compliant cable. See the “Connecting to a Console Terminal or Modem” section in the following documents:

- [Hardware Installation Guide for Cisco Catalyst 8300 Series Edge Platform](#)
- [Hardware Installation Guide for Cisco Catalyst 8200 Series Edge Platforms](#)

## Using Keyboard Shortcuts

Commands are not case sensitive. You can abbreviate commands and parameters if the abbreviations contain enough letters to be different from any other currently available commands or parameters.

The following table lists the keyboard shortcuts for entering and editing commands.

**Table 2: Keyboard Shortcuts**

| Key Name                                                 | Purpose                                               |
|----------------------------------------------------------|-------------------------------------------------------|
| <b>Ctrl-B</b> or the <b>Left Arrow</b> key <sup>1</sup>  | Move the cursor back one character.                   |
| <b>Ctrl-F</b> or the <b>Right Arrow</b> key <sup>1</sup> | Move the cursor forward one character.                |
| <b>Ctrl-A</b>                                            | Move the cursor to the beginning of the command line. |
| <b>Ctrl-E</b>                                            | Move the cursor to the end of the command line.       |
| <b>Esc B</b>                                             | Move the cursor back one word.                        |
| <b>Esc F</b>                                             | Move the cursor forward one word.                     |

## Using the History Buffer to Recall Commands

The history buffer stores the last 20 commands you entered. History substitution allows you to access these commands without retyping them, by using special abbreviated commands.

The following table lists the history substitution commands.

**Table 3: History Substitution Commands**

| Command                                                 | Purpose                                                                                                                                        |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Ctrl-P</b> or the <b>Up Arrow</b> key <sup>1</sup>   | Recalls commands in the history buffer, beginning with the most recent command. Repeat the key sequence to recall successively older commands. |
| <b>Ctrl-N</b> or the <b>Down Arrow</b> key <sup>1</sup> | Returns to more recent commands in the history buffer after recalling commands with <b>Ctrl-P</b> or the <b>Up Arrow</b> key.                  |

| Command              | Purpose                                                      |
|----------------------|--------------------------------------------------------------|
| Router# show history | While in EXEC mode, lists the last few commands you entered. |

<sup>1</sup> The arrow keys function only on ANSI-compatible terminals such as VT100s.

## Understanding Command Modes

The command modes available in Cisco IOS XE are the same as those available in traditional Cisco IOS. This is supported only on the autonomous mode. 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 4: Accessing and Exiting Command Modes**

| Command Mode         | Access Method                                                         | Prompt          | Exit Method                                                                                                  |
|----------------------|-----------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------|
| User EXEC            | Log in.                                                               | Router>         | Use the <b>logout</b> command.                                                                               |
| Privileged EXEC      | From user EXEC mode, use the <b>enable</b> command.                   | Router#         | To return to user EXEC mode, use the <b>disable</b> command.                                                 |
| Global configuration | From privileged EXEC mode, use the <b>configure terminal</b> command. | Router(config)# | To return to privileged EXEC mode from global configuration mode, use the <b>exit</b> or <b>end</b> command. |



| Command Mode            | Access Method                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Prompt               | Exit Method                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interface configuration | From global configuration mode, specify an interface using an <b>interface</b> command.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Router (config-if) # | To return to global configuration mode, use the <b>exit</b> command.<br><br>To return to privileged EXEC mode, use the <b>end</b> command.                                                                                                                                                                                                                                         |
| Diagnostic              | The device boots up or accesses diagnostic mode in the following scenarios: <ul style="list-style-type: none"> <li>• In some cases, diagnostic mode will be reached when the Cisco IOS process or processes fail. In most scenarios, however, the device will reload.</li> <li>• A user-configured access policy is configured using the <b>transport-map</b> command that directs a user into diagnostic mode.</li> <li>• A break signal (<b>Ctrl-C</b>, <b>Ctrl-Shift-6</b>, or the <b>send break</b> command) is entered and the device is configured to go to diagnostic mode when the break signal is received.</li> </ul> | Router (diag) #      | If failure of the Cisco IOS process is the reason for entering diagnostic mode, the Cisco IOS problem must be resolved and the device rebooted to get out of diagnostic mode.<br><br>If the device is in diagnostic mode because of a transport-map configuration, access the device through another port or by using a method that is configured to connect to the Cisco IOS CLI. |
| ROM monitor             | From privileged EXEC mode, use the <b>reload</b> EXEC command. Press the <b>Break</b> key during the first 60 seconds while the system is booting.                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | rommon#>             | To exit ROM monitor mode, manually boot a valid image or perform a reset with autoboot set so that a valid image is loaded.                                                                                                                                                                                                                                                        |

## Understanding Diagnostic Mode

The device boots up or accesses diagnostic mode in the following scenarios:

- The IOS process or processes fail, in some scenarios. In other scenarios, the system resets when the IOS process or processes fail.
- A user-configured access policy was configured using the **transport-map** command that directs the user into the diagnostic mode.
- A send break signal (**Ctrl-C** or **Ctrl-Shift-6**) was entered while accessing the device, and the device was configured to enter diagnostic mode when a break signal was sent.

In the diagnostic mode, a subset of the commands that are available in user EXEC mode are made available to the users. Among other things, these commands can be used to:

- Inspect various states on the device, including the IOS state.
- Replace or roll back the configuration.
- Provide methods of restarting the IOS or other processes.
- Reboot hardware, such as the entire device, a module, or possibly other hardware components.
- Transfer files into or off of the device using remote access methods such as FTP, TFTP, and SCP.

The diagnostic mode provides a more comprehensive user interface for troubleshooting than previous devices, which relied on limited access methods during failures, such as ROMMON, to diagnose and troubleshoot Cisco IOS problems. The diagnostic mode commands can work when the Cisco IOS process is not working properly. These commands are also available in privileged EXEC mode on the device when the device is working normally.

## Getting 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 that is specific to a command mode, a command, a keyword, or an argument, use one of the following commands.

| Command                                           | Purpose                                                                                                                                                    |
|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>help</code>                                 | Provides a brief description of the help system in any command mode.                                                                                       |
| <code>abbreviated-command-entry?</code>           | Provides a list of commands that begin with a particular character string.<br><br><b>Note</b> There is no space between the command and the question mark. |
| <code>abbreviated-command-entry&lt;Tab&gt;</code> | Completes a partial command name.                                                                                                                          |
| <code>?</code>                                    | Lists all the commands that are available for a particular command mode.                                                                                   |

| Command                | Purpose                                                                                                                                                      |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>command ?</code> | Lists the keywords or arguments that you must enter next on the command line.<br><br><b>Note</b> There is a space between the command and the question mark. |

### Finding Command Options: Example

This section provides information about how to display the 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 a part of a command followed by a space. The Cisco IOS XE software displays a list and brief descriptions of the available keywords and arguments. For example, if you are in global configuration mode and want to see all the keywords and arguments for the **arap** command, you should 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 using the question mark (?) to assist you in entering commands.

**Table 5: Finding Command Options**

| Command                                                                                                                 | Comment                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Router> <b>enable</b><br>Password: <password><br>Router#                                                                | Enter the <b>enable</b> 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# <b>configure terminal</b><br>Enter configuration commands, one per line.<br>End with CNTL/Z.<br>Router(config)# | Enter the <b>configure terminal</b> privileged EXEC command to enter global configuration mode. You are in global configuration mode when the prompt changes to Router (config)#                |
| Router(config)# <b>interface GigabitEthernet ?</b><br><0-1> GigabitEthernet interface number                            | Enter interface configuration mode by specifying the interface that you want to configure, using the <b>interface GigabitEthernet</b> global configuration command.                             |
| Router(config)# <b>interface GigabitEthernet 0/?</b><br><0-5> Port Adapter number                                       | Enter ? to display what you must enter next on the command line.                                                                                                                                |
| Router (config)# <b>interface GigabitEthernet 0/0/?</b><br><0-63> GigabitEthernet interface number                      | When the <cr> symbol is displayed, you can press <b>Enter</b> to complete the command.                                                                                                          |
| Router (config)# <b>interface GigabitEthernet0/0/1?</b><br>.<0-5><br>Router(config-if)#                                 | You are in interface configuration mode when the prompt changes to Router (config-if)#                                                                                                          |

| Command                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Comment                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre>Router(config-if)# ? Interface configuration commands: . . . ip          Interface Internet Protocol             config commands keepalive   Enable keepalive lan-name    LAN Name command llc2        LLC2 Interface Subcommands logging     Configure logging for interface mls         mls router sub/interface commands mpoa        MPOA interface configuration commands mtu          Set the interface MTU no          Negate a command or set its defaults ntp          Configure NTP . . Router(config-if)#</pre> | <p>Enter ? to display a list of all the interface configuration commands available for the interface. This example shows only some of the available interface configuration commands.</p>                                                                                                                                                                                                                                   |
| <pre>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 cgmp          Enable/disable CGMP dvmrp         DVMRP interface commands hello-interval Configures IP-EIGRP hello interval hold-time     Configures IP-EIGRP hold time . . . Router(config-if)# ip</pre>                                                  | <p>Enter the command that you want to configure for the interface. This example uses the <b>ip</b> command.</p> <p>Enter ? to display what you must enter next on the command line. This example shows only some of the available interface IP configuration commands.</p>                                                                                                                                                  |
| <pre>Router(config-if)# ip address ? A.B.C.D      IP address negotiated   IP Address negotiated over PPP Router(config-if)# ip address</pre>                                                                                                                                                                                                                                                                                                                                                                                   | <p>Enter the command that you want to configure for the interface. This example uses the <b>ip address</b> command.</p> <p>Enter ? to display what you must enter next on the command line. In this example, you must enter an IP address or the <b>negotiated</b> keyword.</p> <p>A carriage return (&lt;cr&gt;) is not displayed. Therefore, you must enter additional keywords or arguments to complete the command.</p> |

| Command                                                                                                                                                                                               | Comment                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <pre>Router(config-if)# ip address 198.51.100.5 ? A.B.C.D          IP subnet mask Router(config-if)# ip address 198.51.100.5</pre>                                                                    | <p>Enter the keyword or argument that you want to use. This example uses the 198.51.100.5 IP address.</p> <p>Enter ? to display what you must enter next on the command line. In this example, you must enter an IP subnet mask.</p> <p>&lt;cr&gt; is not displayed. Therefore, you must enter additional keywords or arguments to complete the command.</p>   |
| <pre>Router(config-if)# ip address 198.51.100.5 255.255.255.0 ? secondary          Make this IP address a secondary address &lt;cr&gt; Router(config-if)# ip address 198.51.100.5 255.255.255.0</pre> | <p>Enter the IP subnet mask. This example uses the 255.255.255.0 IP subnet mask.</p> <p>Enter ? to display what you must enter next on the command line. In this example, you can enter the <b>secondary</b> keyword, or you can press <b>Enter</b>.</p> <p>&lt;cr&gt; is displayed. Press <b>Enter</b> to complete the command, or enter another keyword.</p> |
| <pre>Router(config-if)# ip address 198.51.100.5 255.255.255.0 Router(config-if)#</pre>                                                                                                                | <p>Press <b>Enter</b> to complete the command.</p>                                                                                                                                                                                                                                                                                                             |

## Using 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 from a **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.

## Saving 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 may take a few minutes to save the configuration. After the configuration has been saved, the following output is displayed:

```
[OK]
Router#
```

This task saves the configuration to the NVRAM.

## Managing Configuration Files

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 also used on several other Cisco router platforms.

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

The **copy** command can be used to back up startup configuration files.

For more detailed information on managing configuration files, see the “Managing Configuration Files” section in the [Cisco IOS XE Configuration Fundamentals Configuration Guide](#).

## Filtering Output from 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.

### Example

In this example, a modifier of the **show interface** command (**include protocol**) is used to provide only the output lines in which the expression **protocol** is displayed:

```
Router# show interface | include protocol
GigabitEthernet0/0/0 is administratively down, line protocol is down
    0 unknown protocol drops
GigabitEthernet0/0/1 is administratively down, line protocol is down
    0 unknown protocol drops
GigabitEthernet0/0/2 is administratively down, line protocol is down
    0 unknown protocol drops
GigabitEthernet0/0/3 is administratively down, line protocol is down
    0 unknown protocol drops
GigabitEthernet0 is up, line protocol is up
    0 unknown protocol drops
Loopback0 is up, line protocol is up
    0 unknown protocol drops
```

## Powering Off a Device

The device can be safely turned off at any time by moving the device's power supply switch to the Off position. However, any changes to the running config since the last WRITE of the config to the NVRAM is lost.

Ensure that any configuration needed after startup is saved before powering off the device. The copy running-config startup-config command saves the configuration in NVRAM and after the device is powered up, the device initializes with the saved configuration.

## Finding Support Information for Platforms and Cisco Software Images

The Cisco IOS XE software is packaged in feature sets consisting of software images that support specific platforms. The group of feature sets that are available for a specific platform depends on which Cisco software images are included in a release. To identify the set of software images available in a specific release or to find out if a feature is available in a given Cisco IOS XE software image, you can use [Cisco Feature Navigator](#) or see the [Release Notes for Cisco IOS XE](#).

### Using Cisco Feature Navigator

Use [Cisco Feature Navigator](#) to find information about platform support and software image support. Cisco Feature Navigator is a tool that enables you to determine which Cisco IOS XE software images support a specific software release, feature set, or platform. To use the navigator tool, an account on Cisco.com is not required.

### Using Software Advisor

Cisco maintains the Software Advisor tool. See [Tools and Resources](#). Use the Software Advisor tool to see if a feature is supported in a Cisco IOS XE release, to locate the software document for that feature, or to check the minimum software requirements of Cisco IOS XE software with the hardware installed on your device. You must be a registered user on Cisco.com to access this tool.

### Using Software Release Notes

See the [Release Notes](#) document for Cisco Catalyst 8000 Series Edge Platforms for information about the following:

- Memory recommendations
- Open and resolved severity 1 and 2 caveats

Release notes are intended to be release-specific for the most current release, and the information provided in these documents may not be cumulative in providing information about features that first appeared in previous releases. For cumulative feature information, refer to the Cisco Feature Navigator at: <http://www.cisco.com/go/cfn/>.

## CLI Session Management

An inactivity timeout is configurable and can be enforced. Session locking provides protection from two users overwriting changes that the other has made. To prevent an internal process from using all the available capacity, some spare capacity is reserved for CLI session access. For example, this allows a user to remotely access a router.

- [Changing the CLI Session Timeout, on page 38](#)
- [Locking a CLI Session, on page 38](#)

## Information About CLI Session Management

An inactivity timeout is configurable and can be enforced. Session locking provides protection from two users overwriting changes that each other has made. To prevent an internal process from using all the available capacity, some spare capacity is reserved for CLI session access. For example, this allows a user to remotely access the router.

## Changing the CLI Session Timeout

**Step 1** `configure terminal`

Enters global configuration mode

**Step 2** `line console 0`

**Step 3** `session-timeout minutes`

The value of *minutes* sets the amount of time that the CLI waits before timing out. Setting the CLI session timeout increases the security of a CLI session. Specify a value of 0 for *minutes* to disable session timeout.

**Step 4** `show line console 0`

Verifies the value to which the session timeout has been set, which is shown as the value for " Idle Session ".

## Locking a CLI Session

### Before you begin

To configure a temporary password on a CLI session, use the **lock** command in EXEC mode. Before you can use the **lock** command, you need to configure the line using the **lockable** command. In this example the line is configured as **lockable**, and then the **lock** command is used and a temporary password is assigned.

**Step 1** `Router# configure terminal`

Enters global configuration mode.

**Step 2** Enter the line upon which you want to be able to use the **lock** command.

`Router(config)# line console 0`

**Step 3** `Router(config)# lockable`

Enables the line to be locked.

**Step 4** `Router(config)# exit`

**Step 5** `Router# lock`

The system prompts you for a password, which you must enter twice.

Password: <password>

Again: <password>

Locked





## CHAPTER 4

# Licenses and Licensing Models

This chapter provides information about the licenses that are available on Cisco Catalyst 8000 Edge Platforms Family, supported throughput options, and how to configure the available licenses and throughput. It also outlines the licensing models available on Cisco Catalyst 8000 Edge Platforms Family.



**Note** The information in this chapter applies predominantly to a device operating in the autonomous mode. References to the controller mode are included in certain sections for the sake of comparison and completeness. Where the information applies to controller mode, this has been called-out categorically.

For a more detailed overview on Cisco Licensing, go to <https://cisco.com/go/licensingguide>.

This chapter includes the following major sections:

- [Feature Information for Available Licenses and Licensing Models, on page 39](#)
- [Available Licenses , on page 42](#)
- [Throughput , on page 47](#)
- [How to Configure Available Licenses and Throughput , on page 59](#)
- [Available Licensing Models, on page 73](#)

## Feature Information for Available Licenses and Licensing Models

The following table provides a summary of license related changes applicable to the Cisco Catalyst 8000 Edge Platforms Family. The 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.

Table 6: Feature Information for Available Licenses and Licensing Models

| Feature Name                                                                           | Release                        | Feature Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 500 Mbps Aggregate for Tier 1 and 250 Mbps Throughput Configuration in Autonomous Mode | Cisco IOS XE 17.14.1a          | <p>On virtual platforms - when you configure a throughput of 250 Mbps or T1, if an HSECK9 license is available on the device, then throughput is capped at 500 Mbps transmitted (Tx) data only. In earlier releases, throughput was capped at 200 Mbps Tx.</p> <p>On physical platforms - when you configure a throughput of 250 Mbps or T1, if an HSECK9 license is available on the device, then aggregate throughput throttling is effective. Throughput is capped at 500 Mbps and any distribution of traffic in the upstream and downstream direction is allowed. In earlier releases, bidirectional throughput throttling was applicable to T1 and 250 Mbps - throughput was capped at 250 Mbps in each direction.</p> <p>See <a href="#">Release-Wise Changes in Throttling Behavior</a>, on page 49.</p> |
| Aggregate Throughput Throttling - Virtual Platforms                                    | Cisco IOS XE Cupertino 17.9.1a | <p>On virtual platforms of the Cisco Catalyst 8000 Edge Platforms Family, <i>for all throughput levels</i>, when you configure a bidirectional throughput value on the device, aggregate throughput throttling is effective.</p> <p>This enhancement does not change the throttling behaviour that has always been applicable to virtual platforms: any throttling applies only to data that is transmitted (Tx). Data that is received (Rx) is unthrottled.</p> <p>See <a href="#">Throughput</a>, on page 47 and <a href="#">Numeric and Tier-Based Throughput</a>, on page 47.</p>                                                                                                                                                                                                                            |
| Aggregate Throughput Throttling - Physical Platforms                                   | Cisco IOS XE Cupertino 17.8.1a | <p>On the <i>physical</i> platforms of Cisco Catalyst 8000 Edge Platforms Family, for throughput levels greater than 250 Mbps and Tier 2 and higher tiers, when you configure the bidirectional throughput value on the device, aggregate throughput throttling is effective. This means that traffic is throttled in an aggregate manner irrespective of the distribution of the traffic in the upstream and downstream direction.</p> <p>The bidirectional throughput is represented in the license PID (For example, DNA-C-<b>500M</b>-E-3Y and DNA-C-<b>T2</b>-E-3Y). The aggregate throughput is double the bidirectional throughput.</p> <p>See <a href="#">Release-Wise Changes in Throttling Behavior</a>, on page 49.</p>                                                                               |

| Feature Name                                                                                                                                                                                                                                       | Release                        | Feature Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Tier-Based Licenses                                                                                                                                                                                                                                | Cisco IOS XE Cupertino 17.7.1a | <p>Support for tier-based throughput configuration was introduced in addition to existing bandwidth-based (numeric) throughput configuration.</p> <p>Starting with the lowest throughput level, the available tiers are Tier 0 (T0), Tier 1 (T1), Tier 2 (T2), and Tier3 (T3). Each tier represents a throughput level.</p> <p>If the license PID for a product is tier-based, the license is displayed with the tier value in the CSSM Web UI.</p> <p>For a product with a tier-based license, you can <i>configure</i> a tier-based throughput value, and you can also <i>convert</i> to a tier-based throughput value.</p> <p>See <a href="#">Throughput</a> , on page 47 and <a href="#">Numeric and Tier-Based Throughput</a>, on page 47.</p> |
| Cisco Digital Network Architecture (DNA) licenses                                                                                                                                                                                                  | Cisco IOS XE Amsterdam 17.3.2  | <p>Support for Cisco DNA licenses was introduced on Cisco Catalyst 8000 Edge Platforms Family.</p> <p>Cisco DNA Licenses are categorised into network-stack licenses and a DNA-stack add-on licenses.</p> <p>See <a href="#">Cisco DNA License</a>, on page 42.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| High Security License (HSECK9)                                                                                                                                                                                                                     | Cisco IOS XE Amsterdam 17.3.2  | <p>Support for the HSECK9 license was introduced on Cisco Catalyst 8000 Edge Platforms Family.</p> <p>See <a href="#">High Security License</a> , on page 44.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <p>Cisco Unified Border Element license (Cisco UBE license)</p> <p>Cisco Unified Communications Manager Express license (Cisco Unified CME license)</p> <p>Cisco Unified Survivable Remote Site Telephony license (Cisco Unified SRST license)</p> | Cisco IOS XE Amsterdam 17.3.2  | <p>Support for Cisco UBE, Cisco Unified CME, Cisco Unified SRST licenses was introduced on Cisco Catalyst 8000 Edge Platforms Family</p> <p>See <a href="#">Cisco CUBE License</a>, on page 46, <a href="#">Cisco Unified CME License</a>, on page 46, and <a href="#">Cisco Unified SRST License</a>, on page 46.</p>                                                                                                                                                                                                                                                                                                                                                                                                                              |

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](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

# Available Licenses

This section lists all the licenses that are available on Cisco Catalyst 8000 Edge Platforms Family, usage guidelines, and ordering considerations.

## Cisco DNA License

A Cisco Digital Network Architecture (DNA) software license combines several feature-specific licenses.




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**Note** A Cisco DNA license includes all feature licenses except the following: High Security (HSECK9), Cisco Unified Border Element (Cisco UBE), Cisco Unified Communications Manager Express (Cisco Unified CME), and Cisco Unified Survivable Remote Site Telephony (Cisco Unified SRST). See [Ordering Considerations for a Cisco DNA License, on page 43](#).

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Cisco DNA licenses are categorized into network-stack licenses and DNA-stack add-on licenses.

### Cisco DNA Licenses Available on Catalyst 8000V Edge Software, Catalyst 8200, and 8300 Series Edge Platforms:

Network-stack licenses:

- Network Essentials
- Network Advantage: includes features available with Network Essentials, and more.
- Network Premier: includes features available Network Essentials, Network Advantage, and more.

DNA-stack add-on licenses:

- Cisco DNA Essentials: add-on license available only with Network Essentials.
- Cisco DNA Advantage: add-on license available only with Network Advantage. Includes features available with DNA Essentials and more.
- Cisco DNA Premier: add-on license available only with Network Premier. Includes features available with DNA Essentials, DNA Advantage and more.

### Cisco DNA Licenses Available on Catalyst 8500 Series Edge Platforms:

Network-stack licenses:

- Network Advantage
- Network Premier: includes features available Network Advantage, and more.

DNA-stack add-on licenses:

- Cisco DNA Advantage
- Cisco DNA Premier: add-on license available only with Network Premier. Includes features available with DNA Advantage and more.

## Guidelines for Using a Cisco DNA License

- Guidelines that apply to all platforms in the Cisco Catalyst 8000 Edge Platforms Family:
  - A network-stack license is a perpetual or permanent license and has no expiration date.
  - A DNA-stack add-on license is a subscription or term license and is valid only until a certain date. A 3-year and 5-year option is available for all DNA-stack add-on licenses. A 7-year subscription option is available for certain DNA-stack add-on licenses.
  - Tier 3 (T3) or higher tiers are not supported with the Network Essentials and DNA Essentials licenses.  
  
This also means that if you have configured T3 or higher tiers as the throughput, you cannot change the boot level license to Network Essentials and DNA Essentials.  
  
For information about the various tiers available with Cisco DNA Licenses, see [Tier and Numeric Throughput Mapping, on page 50](#).
- Guidelines that apply only to Catalyst 8000V Edge Software:  
  
On Catalyst 8000V Edge Software, when you configure a network-stack license, you must also configure the corresponding DNA-stack add-on license.
- Guidelines that apply only to Catalyst 8200, 8300, 8500 Series Edge Platforms:
  - The DNA-stack add-on license that is available with each network-stack license is optional. You can configure a network-stack license without a DNA-stack add-on license, but you cannot configure DNA-stack add-on license without the corresponding network-stack license.
  - If you use a DNA-stack add-on license, renew the license before term expiry to continue using it, or deactivate the DNA-stack add-on license and then reload the device to continue operating with the network-stack license capabilities.

## Ordering Considerations for a Cisco DNA License

A Cisco DNA license subsumes all performance, boost, and technology package licenses (securityk9, uck9, and appxk9). This means that when you order a Cisco DNA network-stack license, or a Cisco DNA-stack add-on license, if a performance, boost, and technology package license is required or applicable, it is automatically added to the order.

The license Product ID (PID) you purchase can only be a DNA-stack add-on license PID.

Even if you order a Cisco DNA license along with new hardware, the license is not preconfigured on the device. You must configure the boot level license and then the throughput, on the device.

When ordering a Cisco DNA license, you are also specifying a throughput value. If the throughput you order is greater than 250 Mbps, an HSECK9 license is *required* on all variants of Cisco Catalyst 8000 Edge Platforms Family - except for Catalyst 8500 and 8500L Series Edge Platforms. For more information, see [High Security License, on page 44](#).

When you order a license PID with a tier-based throughput value of *T1*, an HSECK9 license is automatically added to the order.

## High Security License

The High Security license (HSECK9 license) is an export-controlled license and is restricted by U.S. export control laws. This license is required for the use of full cryptographic functionality, that is, throughput greater than 250 Mbps, and tunnel count over and above a certain number (refer to table below). This requirement applies to all devices of Cisco Catalyst 8000 Edge Platforms Family except for Catalyst 8500 and 8500L Series Edge Platforms.

Only on Catalyst 8500 and 8500L Series Edge Platforms, throughput and tunnel scale are not impacted by the non-availability of the HSECK9 license. On these platforms, the HSECK9 license is required only for compliance purposes. On all remaining models of Cisco Catalyst 8000 Edge Platforms Family, supported tunnel count and throughput are restricted in the absence of an HSECK9 license. The table below specifies supported tunnel count and supported throughput without the HSECK9 license:

| PID             | No. Of Tunnels<br><i>Without HSECK9 License</i> | Supported Throughput<br><i>Without HSECK9 License</i> |
|-----------------|-------------------------------------------------|-------------------------------------------------------|
| C8000V          | 150                                             | T0, T1                                                |
| C8200-1N-4T     | 1000                                            | T0, T1                                                |
| C8200L-1N-4T    | 1000                                            | T0, T1                                                |
| C8300-1N1S-4T2X | 1000                                            | T0, T1                                                |
| C8300-1N1S-6T   | 1000                                            | T0, T1                                                |
| C8300-2N2S-4T2X | 1000                                            | T0, T1                                                |
| C8300-2N2S-6T   | 1000                                            | T0, T1                                                |
| C8500-12X4QC    | N/A                                             | N/A                                                   |
| C8500-12X       | N/A                                             | N/A                                                   |
| C8500-20X6C     | N/A                                             | N/A                                                   |
| C8500L-8S4X     | N/A                                             | N/A                                                   |



**Note** The term "throughput" refers to encrypted throughput on physical platforms. On virtual platforms, it refers to encrypted *and* unencrypted throughput - combined.

By using an HSECK9 license, the tunnel count restriction is lifted and you can also configure throughput greater than 250 Mbps. For detailed information about the available throughput options, see [Tier and Numeric Throughput Mapping, on page 50](#).

To know if an HSECK9 license is being used on a device, enter the **show license summary** command in privileged EXEC mode. On all devices in the Cisco Catalyst 8000 Edge Platforms Family, the HSECK9 license as displayed as: Router US Export Lic. for DNA (DNA\_HSEC). For example:

```

Device# show license summary

Account Information:
  Smart Account: Eg-SA As of Dec 03 15:26:02 2021 UTC
  Virtual Account: Eg-VA

License Usage:
  License                               Entitlement Tag                               Count Status
  -----
  network-advantage_T2                 (NWSTACK_T2_A)                               1 IN USE
  dna-advantage_T2                     (DSTACK_T2_A)                               1 IN USE
  Router US Export Lic... (DNA_HSEC)         1 IN USE

```

## Guidelines for Using an HSECK9 License

The HSECK9 license is tied to the chassis. Therefore, one HSECK9 license is required for each chassis UDI where you want to use cryptographic functionality.

An HSECK9 license requires authorization before use. This authorization is provided by a Smart Licensing Authorization Code (SLAC). You must install a SLAC for each HSECK9 license you use. A SLAC is generated in and obtained from CSSM. How you obtain SLAC from CSSM depends on the topology you have implemented. For more information, see [Installing SLAC for an HSECK9 License, on page 62](#).

To know if SLAC is installed, enter the **show license authorization** command in privileged exec mode, to confirm. If SLAC is installed, the status field displays: SMART AUTHORIZATION INSTALLED on <timestamp>. For example:

```

Device# show license authorization
Overall status:
  Active: PID:C8300-1N1S-4T2X, SN:FDO2250A0J5
  Status: SMART AUTHORIZATION INSTALLED on Dec 03 08:24:35 2021 UTC
  Last Confirmation code: 418b11b3

Authorizations:
  Router US Export Lic. for DNA (DNA_HSEC):
  Description: U.S. Export Restriction Compliance license for DNA based Routers
  Total available count: 1
  Enforcement type: EXPORT RESTRICTED
  Term information:
  Active: PID:C8300-1N1S-4T2X, SN:FDO2250A0J5
  Authorization type: SMART AUTHORIZATION INSTALLED
  License type: PERPETUAL
  Term Count: 1

Purchased Licenses:
  No Purchase Information Available

```

## Ordering Considerations for an HSECK9 License

If you order your DNA licenses in the same order as Catalyst 8000 hardware platforms, the option to order an HSECK9 license is available or is selected, if applicable. For example, in case of Catalyst 8500 Series Edge Platforms, when you order hardware, an HSECK9 license is automatically added to the order, because throughput support *starts* at greater than 250 Mbps on these platforms. Further, the requisite SLAC for the HSECK9 license is also factory-installed on the device.

If you order your DNA licenses in an order that is separate from your Catalyst 8000 hardware platforms, you must separately order the HSECK9 license in the order for the Catalyst 8000 hardware platforms, if required.

If you plan to use an HSECK9 license with new hardware that you are ordering, provide your Smart Account and Virtual Account information *with* the hardware order. This enables Cisco to factory-install SLAC for the

HSECK9 license on the hardware. You must still configure throughput on the device before you start using it.



---

**Note** If the HSECK9 license is ordered separately (not with the hardware order), SLAC cannot be factory-installed.

---

## Cisco CUBE License

A Cisco Unified Border Element License (Cisco UBE license) does not require any boot level configuration before you enable it. After purchase, you can refer to the configuration guide to configure the available Cisco UBE features.

For information about the features available with a Cisco UBE license, see the *Cisco Unified Border Element Configuration Guide* for the required release at: <https://www.cisco.com/c/en/us/support/unified-communications/unified-border-element/products-installation-and-configuration-guides-list.html>.

For information about supported platforms and about purchasing a Cisco UBE license, see the datasheet at: <https://www.cisco.com/c/en/us/products/collateral/unified-communications/unified-border-element/data-sheet-c78-729692.html>. You must order a Cisco UBE license separately if required. It is not automatically included with any other license.

For information about how to report usage of a Cisco UBE license, see [Smart Licensing Using Policy for Cisco Enterprise Routing Platforms](#). In the context of this licensing model, a Cisco UBE license is an *unenforced* license.

## Cisco Unified CME License

A Cisco Unified Communications Manager Express License (Cisco Unified CME license) does not require any boot level configuration before you enable it. After purchase, you can refer to the configuration guide to configure the available features.

For information about the features available with a Cisco Unified CME license, see the [Cisco Unified Communications Manager Express System Administrator Guide](#).

For information about supported platforms and about purchasing a Cisco Unified CME license, see the datasheet at:

<https://www.cisco.com/c/en/us/products/collateral/unified-communications/unified-communications-manager-express/datasheet-c78-744069.html>.

You must order a Cisco Unified CME license separately if required. It is not automatically included with any other license.

For information about how to report usage of a Cisco Unified CME license, see [Smart Licensing Using Policy for Cisco Enterprise Routing Platforms](#). In the context of this licensing model, a Cisco Unified CME license is an *unenforced* license.

## Cisco Unified SRST License

A Cisco Unified Survivable Remote Site Telephony License (Cisco Unified SRST license) does not require any boot level configuration before you enable it. After purchase, you can refer to the configuration guide to configure the available Unified SRST features.

For information about the features available with a Cisco Unified SRST license, see the [Cisco Unified SCCP and SIP SRST System Administrator Guide \(All Versions\)](#).



For information about supported platforms and about purchasing a Cisco Unified SRST license, see the datasheet at: <https://www.cisco.com/c/en/us/products/collateral/unified-communications/unified-communications-manager-express/datasheet-c78-744069.html>. You must order a Cisco Unified SRST license separately if required. It is not automatically included with any other license.

For information about how to report usage of a Unified SRST license, see [Smart Licensing Using Policy for Cisco Enterprise Routing Platforms](#). In the context of this licensing model, a Unified SRST license is an *unenforced* license.

## Throughput

The *throughput* tells you how much data is allowed to be transferred through the device. You configure this value in the autonomous mode. Data is then transmitted (Tx) and received (Rx) at the configured rate.

If you don't explicitly configure a throughput, default throughput is effective.

To know the configured throughput of a device, enter the applicable command:

- For physical platforms enter the **show platform hardware throughput crypto** command, in privileged EXEC mode.
- For virtual platforms enter the **show platform hardware throughput level** command, in privileged EXEC mode.

The following sections provide information about how a throughput value is represented, whether the throughput on a device refers to encrypted or unencrypted throughput and what this means, and if and how a limit may be enforced on device throughput.

## Numeric and Tier-Based Throughput

The throughput you are entitled to, is specified in the device's Cisco DNA license product ID (PID). It is a value that can be represented by a number or by a tier. It is this same value that is also configured on the device.

### Numeric Throughput Value

When throughput is represented by a number, it is called a numeric throughput value. For example, DNA-C-**10M**-E-3Y is a license PID with a numeric throughput value of 10M, that is, 10 Mbps.

Depending on the device, some of the other available numeric throughput values are: 15M, 25M, 50M, 100M, 250M, 500M, 1G, 2.5G, 5G, 10G, and so on. Throughput *greater* than 250 Mbps requires an HSECK9 license.

### Tier-Based Throughput Value

When throughput is represented by a tier, it is called a tier-based throughput value. A tier represents a throughput level and is mapped to a numeric throughput value. For example, DNA-C-**T0**-E-3Y is a license PID with a tier-based throughput value of T0. The numeric equivalent it is mapped to is a throughput of up to 25 Mbps.




---

**Note** Tier-based throughput configuration is supported starting with Cisco IOS XE Cupertino 17.7.1a. From this release onwards, tier-based throughput configuration is also the recommended way of configuring throughput on the device.

---

Starting with the lowest throughput level, the available tiers are Tier 0 (T0), Tier 1 (T1), Tier 2 (T2), Tier 3 (T3), Tier 4 (T4), and Tier 5 (T5). T2 and higher tiers require an HSECK9 license.

Note the following about tiers:

- Not all tiers are available with all Cisco DNA licenses.  
For example, T3 and higher tiers are not available with the Network Essentials and DNA-Essentials licenses. This also means that if you have T3 as the configured throughput, you cannot change the boot level license to Network Essentials and DNA Essentials.
- Each tier maps to or means a different numeric value for different platforms.

The different platforms in the Cisco Catalyst 8000 Edge Platforms Family support different maximum throughput levels. For example, T2 means 1G throughput for C8300-2N2S-4T2X, 500M for C8200-1N-4T, and 250M for C8200L-1N-4T.

To know which tiers are available with a particular DNA License and to know the numeric equivalent of each tier for a particular platform and see the [Tier and Numeric Throughput Mapping, on page 50](#) section in this chapter.

To know when to configure a numeric throughput value and when to configure tier-based throughput on your device, see the [Numeric vs. Tier-Based Throughput Configuration, on page 57](#) section in this chapter.

## Encrypted and Unencrypted Throughput

Encrypted throughput, also known as crypto throughput, is throughput that is protected by a cryptographic algorithm.

Unencrypted throughput on the other hand, is in plain text. Unencrypted throughput is also referred to as Cisco Express Forwarding (CEF) traffic.




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**Important** In case of physical platforms (Catalyst 8200, 8300, and 8500 Series Edge Platforms), all references to “throughput” in this document refer to cryptographic throughput.

In case of virtual platforms (Catalyst 8000V Edge Software), all references to “throughput” in this document refer to encrypted *and* unencrypted throughput, combined.

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## Throttled and Unthrottled Throughput

Throttled throughput, is throughput on which a limit has been enforced. (When you configure a throughput value, you are throttling device throughput to the configured extent.)

Unthrottled throughput means that no limit is enforced, and the device throughput is at the maximum capability of the device.



- Note** On virtual platforms, if throughput is throttled, throttling applies only to Tx data. Rx is always unthrottled. On physical platforms, if throughput is throttled, throttling applies to Tx and Rx data.
- On physical platforms (Catalyst 8200, 8300, and 8500 Series Edge Platforms), unencrypted throughput (Tx and Rx), is unthrottled by default.

## Types of Throttling Behavior: Aggregate and Bidirectional

The system can impose throttling in a bidirectional manner or an aggregate manner.

### Bidirectional throughput throttling

Here the system throttles data in each direction. When bidirectional throttling is effective, Tx data is capped at the bidirectional throughput value and the Rx data is capped at the bidirectional throughput value - separately. (Note the exception that always applies to virtual platforms: Rx is unthrottled.)

For example, if the bidirectional throughput value is 25 Mbps or T0 and bidirectional throughput throttling is effective:

- On virtual platforms, Tx data is capped at 25 Mbps. Rx is unthrottled.
- On physical platforms, Tx data is capped at 25 Mbps and Rx data is capped at 25 Mbps.



- Note** The value that you see in a license PID (whether numeric or tier-based) represents a bidirectional throughput value.

### Aggregate throughput throttling

Here the system doubles the configured value and throttles throughput at this aggregate limit. When aggregate throughput throttling is effective, traffic is not throttled separately in each direction.

For example, if the bidirectional throughput value that is configured is 500 Mbps and aggregate throughput throttling is effective:

- On virtual platforms, Tx data is capped at 1 Gbps. Rx is unthrottled.
- On physical platforms, traffic in the upstream and downstream direction can be any ratio within the 1 Gbps aggregate limit. For instance, 800 Mbps Tx and 200 Mbps Rx, or, 300 Mbps Tx and 700 Mbps Rx)

## Release-Wise Changes in Throttling Behavior

To know if the throughput on your device will be throttled in a bidirectional manner or in an aggregate manner, check the software version running on the device, and refer to the release-wise changes in throttling behavior described below.

- **Until Cisco IOS XE Cupertino 17.7.x:** Only bidirectional throughput throttling is effective. This applies to physical and virtual platforms.
- **Starting with Cisco IOS XE Cupertino 17.8.1a:**

- Only on physical platforms, when you configure a *throughput value greater than 250 Mbps* or T2 and higher tiers, aggregate throughput throttling is effective.

On C8200L-1N-4T, if you configure a numeric value of 250 Mbps, bidirectional throughput throttling is effective and a maximum of 250 Mbps is available in each direction. But if you configure tier T2, aggregate throttling is effective and 500 Mbps is available for use in any Tx and Rx ratio.

- On virtual platforms, Tx throttling continues to apply, and Rx continues to remain unthrottled.

- **Starting with Cisco IOS XE Cupertino 17.9.1a:** On virtual platforms, for all throughput levels and all tiers, aggregate throughput throttling is effective.




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**Note** If the aggregate for the throughput level you configure on a virtual platform amounts to *greater than 250 Mbps*, aggregate throughput throttling is not effective unless an HSECK9 license is available on the device (that is, SLAC is installed).

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- **Starting with Cisco IOS XE 17.14.1a:** On physical and virtual platforms, when you configure a throughput of 250 Mbps or T1, aggregate throughput throttling is effective - as long as an HSECK9 license is available on the device. On virtual platforms, this means that Tx throughput is capped at 500 Mbps. On physical platforms, this means an aggregate limit of 500 Mbps is available for use in any Tx and Rx ratio.

If an HSECK9 license is not available on the device and you configure a throughput value of 250 Mbps, or T1, then bidirectional throughput throttling is effective. On virtual platforms this means Tx throughput is throttled at 250 Mbps. On physical platforms throughput is throttled at 250 Mbps in each direction.

## Tier and Numeric Throughput Mapping

The following tables provide information about about the numeric equivalent of each tier, and the DNA licenses that each tier is available with.




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**Tip** The mapping tables clarify only the numeric equivalent of a tier. This mapping does not reflect the final throughput that you are entitled to. The entitled throughput depends on the device's capability, the software version running on the device, and throttling behavior for that version.

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**Note** When you purchase a license PID with a tier-based throughput value of *T1*, an HSECK9 license is automatically provided.

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Network Premium and DNA Premium

Network Advantage and DNA Advantage

Network Essentials and DNA Essentials

\* = HSECK9 license required. On C8500 and C8500L, the HSECK9 license is required for compliance purposes only.

Table 7: Tier and Numeric Throughput Mapping for Virtual Platforms (C8000v)

| Tiers from 17.9.1a:      | T0  |     | T1  |      | T2*  |      |     | T3*  |    |     | T4*         |
|--------------------------|-----|-----|-----|------|------|------|-----|------|----|-----|-------------|
| Tiers in 17.7.x, 17.8.x: | T0  | T1  |     |      | T2*  |      |     | T3*  |    |     | T4*         |
| Numeric Mapping:         | 15M | 25M | 50M | 100M | 250M | 500M | 1G  | 2.5G | 5G | 10G | Unthrottled |
| Available DNA Licenses:  | YYY | YYY | YYY | YYY  | YYY  | YYY  | YYY | YY   | YY | YY  | YY          |

Table 8: Tier and Numeric Throughput Mapping for Physical Platforms (C8200, C8300, C8500)

| Tiers from 17.8.1a:       | T0  |     | T1  |     | T2*  |      |      | T3* |      |    | T4* | T5*  |             |
|---------------------------|-----|-----|-----|-----|------|------|------|-----|------|----|-----|------|-------------|
| Tiers in 17.7.x:          | T0  |     | T1  |     |      | T2*  |      |     | T3*  |    |     | n.a. | n.a.        |
| Configured Numeric Value: | 10M | 15M | 25M | 50M | 100M | 250M | 500M | 1G  | 2.5G | 5G | 10G | 50G  | Unthrottled |
| C8200-1N-4T               | YYY | YYY | YYY | YYY | YYY  | YYY  | YYY  |     |      |    |     |      |             |
| C8200L-1N-4T              | YYY | YYY | YYY | YYY | YYY  | YYY  |      |     |      |    |     |      |             |
| C8300-1N1S-4T2X           | YYY | YYY | YYY | YYY | YYY  | YYY  | YYY  | YYY | YY   |    |     |      |             |
| C8300-1N1S-6T             | YYY | YYY | YYY | YYY | YYY  | YYY  | YYY  | YYY |      |    |     |      |             |
| C8300-2N2S-4T2X           | YYY | YYY | YYY | YYY | YYY  | YYY  | YYY  | YYY | YY   |    |     |      |             |
| C8300-2N2S-6T             | YYY | YYY | YYY | YYY | YYY  | YYY  | YYY  | YYY |      |    |     |      |             |
| C8500-12X                 |     |     |     |     |      |      |      |     | YY   | YY | YY  |      |             |
| C8500-12X4QC              |     |     |     |     |      |      |      |     | YY   | YY | YY  |      |             |
| C8500-20X6C               |     |     |     |     |      |      |      |     |      |    |     | YY   | YY          |
| C8500L-8S4X               |     |     |     |     |      |      |      | YY  | YY   | YY | YY  |      |             |

## Entitled Throughput and Throttling Specifications in the Autonomous Mode

These tables tell you about the throughput you are entitled to. This is based on the device, the throughput value, which can be aggregate or numeric, and the release, which determines if throttling is imposed in an aggregate or bidirectional manner.

Table 9: C8000v

| Throughput = Encrypted and Unencrypted Throughput<br>Rx is Unthrottled<br>* HSECK9 license is required. |                                                |                                                |                                               |                                                 |
|---------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------------|-----------------------------------------------|-------------------------------------------------|
| Supported Throughput Values (default 10M)                                                               | Entitled Throughput & Throttling in >= 17.4.1a | Entitled Throughput & Throttling in >= 17.7.1a | Entitled Throughput & Throttling in >=17.9.1a | Entitled Throughput & Throttling in >=17.14.1a  |
| 10M                                                                                                     | 10M Tx Only                                    | 10M Tx Only                                    | 20M Tx Only                                   | 20M Tx Only                                     |
| 15M                                                                                                     | 15M Tx Only                                    | 15M Tx Only                                    | 30M Tx Only                                   | 30M Tx Only                                     |
| 25M                                                                                                     | 25M Tx Only                                    | 25M Tx Only                                    | 50M Tx Only                                   | 50M Tx Only                                     |
| 50M                                                                                                     | 50M Tx Only                                    | 50M Tx Only                                    | 100M Tx Only                                  | 100M Tx Only                                    |
| 100M                                                                                                    | 100M Tx Only                                   | 100M Tx Only                                   | 200M Tx Only                                  | 200M Tx Only                                    |
| 250M                                                                                                    | 250M Tx Only                                   | 250M Tx Only                                   | 250M Tx Only                                  | With HSECK9: 500M Tx<br>Without HSECK9: 250M Tx |
| 500M*                                                                                                   | 500M Tx Only                                   | 500M Tx Only                                   | 1G Tx Only                                    | 1G Tx Only                                      |
| 1G*                                                                                                     | 1G Tx Only                                     | 1G Tx Only                                     | 2G Tx Only                                    | 2G Tx Only                                      |
| 2.5G*                                                                                                   | 2.5G Tx Only                                   | 2.5G Tx Only                                   | 5G Tx Only                                    | 5G Tx Only                                      |
| 5G*                                                                                                     | 5G Tx Only                                     | 5G Tx Only                                     | 10G Tx Only                                   | 10G Tx Only                                     |
| 10G*                                                                                                    | 10G Tx Only                                    | 10G Tx Only                                    | 20G Tx Only                                   | 20G Tx Only                                     |
| T0                                                                                                      | -                                              | 15M Tx Only                                    | 50M Tx Only                                   | 50M Tx Only                                     |
| T1                                                                                                      | -                                              | 100M Tx Only                                   | 200M Tx Only                                  | With HSECK9: 500M Tx<br>Without HSECK9: 250M Tx |
| T2*                                                                                                     | -                                              | 1G Tx Only                                     | 2G Tx Only                                    | 2G Tx Only                                      |
| T3*                                                                                                     | -                                              | 10 Tx Only                                     | 20G Tx Only                                   | 20G Tx Only                                     |
| T4*                                                                                                     | -                                              | Unthrottled                                    | Unthrottled                                   | Unthrottled                                     |

Table 10: C8200-1N-4T

| Throughput = Encrypted Throughput<br>* HSECK9 license is required. |  |
|--------------------------------------------------------------------|--|
|                                                                    |  |

| Supported Throughput Values (default 10M) | Entitled Throughput & Throttling in >= 17.4.1a | Entitled Throughput & Throttling in >= 17.7.1a | Entitled Throughput & Throttling in >= 17.8.1a | Entitled Throughput & Throttling in >= 17.14.1a                   |
|-------------------------------------------|------------------------------------------------|------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------|
| 10M                                       | 10M Bidirectional                              | 10M Bidirectional                              | 10M Bidirectional                              | 10M Bidirectional                                                 |
| 15M                                       | 15M Bidirectional                              | 15M Bidirectional                              | 15M Bidirectional                              | 15M Bidirectional                                                 |
| 25M                                       | 25M Bidirectional                              | 25M Bidirectional                              | 25M Bidirectional                              | 25M Bidirectional                                                 |
| 50M                                       | 50M Bidirectional                              | 50M Bidirectional                              | 50M Bidirectional                              | 50M Bidirectional                                                 |
| 100M                                      | 100M Bidirectional                             | 100M Bidirectional                             | 100M Bidirectional                             | 100M Bidirectional                                                |
| 250M                                      | 250M Bidirectional                             | 250M Bidirectional                             | 250M Bidirectional                             | With HSECK9: 500M Aggregate<br>Without HSECK9: 250M Bidirectional |
| 500M*                                     | 500M Bidirectional                             | 500M Bidirectional                             | 1G Aggregate                                   | 1G Aggregate                                                      |
| T0                                        | -                                              | 15M Bidirectional                              | 25M Bidirectional                              | 25M Bidirectional                                                 |
| T1                                        | -                                              | 100M Bidirectional                             | 100M Bidirectional                             | With HSECK9: 500M Aggregate<br>Without HSECK9: 250M Bidirectional |
| T2                                        | -                                              | 500M Bidirectional                             | 1G Aggregate                                   | 1G Aggregate                                                      |

Table 11: C8200L-1N-4T

| Throughput = Encrypted Throughput<br>* HSECK9 license is required. |                                                   |                                                |                                                |                                                                   |
|--------------------------------------------------------------------|---------------------------------------------------|------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------|
| Supported Throughput Values (default 10M)                          | Entitled Throughput & Throttling in >= >= 17.5.1a | Entitled Throughput & Throttling in >= 17.7.1a | Entitled Throughput & Throttling in >= 17.8.1a | Entitled Throughput & Throttling in >= 17.14.1a                   |
| 10M                                                                | 10M Bidirectional                                 | 10M Bidirectional                              | 10M Bidirectional                              | 10M Bidirectional                                                 |
| 15M                                                                | 15M Bidirectional                                 | 15M Bidirectional                              | 15M Bidirectional                              | 15M Bidirectional                                                 |
| 25M                                                                | 25M Bidirectional                                 | 25M Bidirectional                              | 25M Bidirectional                              | 25M Bidirectional                                                 |
| 50M                                                                | 50M Bidirectional                                 | 50M Bidirectional                              | 50M Bidirectional                              | 50M Bidirectional                                                 |
| 100M                                                               | 100M Bidirectional                                | 100M Bidirectional                             | 100M Bidirectional                             | 100M Bidirectional                                                |
| 250M                                                               | 250M Bidirectional                                | 250M Bidirectional                             | 250M Bidirectional                             | With HSECK9: 500M Aggregate<br>Without HSECK9: 250M Bidirectional |

## Entitled Throughput and Throttling Specifications in the Autonomous Mode

|     |   |                                                                                                                                                                                                                                                                                    |                    |                                                                   |
|-----|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|-------------------------------------------------------------------|
| T0  | - | 15M Bidirectional                                                                                                                                                                                                                                                                  | 25M Bidirectional  | 25M Bidirectional                                                 |
| T1  | - | 100M Bidirectional                                                                                                                                                                                                                                                                 | 100M Bidirectional | With HSECK9: 500M Aggregate<br>Without HSECK9: 250M Bidirectional |
| T2* | - | 250M Bidirectional                                                                                                                                                                                                                                                                 | 500M Aggregate     | 500M Aggregate                                                    |
| -   | - | <b>Note</b> From 17.8.1a, On C8200-1N-4T-L, if you configure a numeric value of 250 Mbps, a maximum of 250 Mbps is available in each direction. But if you configure tier-based value T2 (which requires an HSECK9 license), 500 Mbps is available for use in any Tx and Rx ratio. |                    |                                                                   |

Table 12: C8300-1N1S-4T2X, C8300-2N2S-4T2X

| Throughput = Encrypted Throughput<br>* HSECK9 license is required. |                                               |                                                |                                                |                                                                   |
|--------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------|
| Supported Throughput Values (default 10M)                          | Entitled Throughput & Throttling in >= 17.3.2 | Entitled Throughput & Throttling in >= 17.7.1a | Entitled Throughput & Throttling in >= 17.8.1a | Entitled Throughput & Throttling in >= 17.14.1a                   |
| 10M                                                                | 10M Bidirectional                             | 10M Bidirectional                              | 10M Bidirectional                              | 10M Bidirectional                                                 |
| 15M                                                                | 15M Bidirectional                             | 15M Bidirectional                              | 15M Bidirectional                              | 15M Bidirectional                                                 |
| 25M                                                                | 25M Bidirectional                             | 25M Bidirectional                              | 25M Bidirectional                              | 25M Bidirectional                                                 |
| 50M                                                                | 50M Bidirectional                             | 50M Bidirectional                              | 50M Bidirectional                              | 50M Bidirectional                                                 |
| 100M                                                               | 100M Bidirectional                            | 100M Bidirectional                             | 100M Bidirectional                             | 100M Bidirectional                                                |
| 250M                                                               | 250M Bidirectional                            | 250M Bidirectional                             | 250M Bidirectional                             | With HSECK9: 500M Aggregate<br>Without HSECK9: 250M Bidirectional |
| 500M*                                                              | 500M Bidirectional                            | 500M Bidirectional                             | 1G Aggregate                                   | 1G Aggregate                                                      |
| 1G*                                                                | 1G Bidirectional                              | 1G Bidirectional                               | 2G Aggregate                                   | 2G Aggregate                                                      |
| 2.5G*                                                              | 2.5G Bidirectional                            | 2.5G Bidirectional                             | 5G Aggregate                                   | 5G Aggregate                                                      |
| T0                                                                 | -                                             | 15M Bidirectional                              | 25M Bidirectional                              | 25M Bidirectional                                                 |
| T1                                                                 | -                                             | 100M Bidirectional                             | 100M Bidirectional                             | With HSECK9: 500M Aggregate<br>Without HSECK9: 250M Bidirectional |
| T2*                                                                | -                                             | 1G Bidirectional                               | 2G Aggregate                                   | 2G Aggregate                                                      |



|     |   |                   |               |               |
|-----|---|-------------------|---------------|---------------|
| T3* | - | 10G Bidirectional | 20G Aggregate | 20G Aggregate |
|-----|---|-------------------|---------------|---------------|

Table 13: C8300-1N1S-6T, C8300-2N2S-6T

| Throughput = Encrypted Throughput<br>* HSECK9 license is required. |                                               |                                                |                                                |                                                                   |
|--------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------|------------------------------------------------|-------------------------------------------------------------------|
| Supported Throughput Values (default 10M)                          | Entitled Throughput & Throttling in >= 17.3.2 | Entitled Throughput & Throttling in >= 17.7.1a | Entitled Throughput & Throttling in >= 17.8.1a | Entitled Throughput & Throttling in >= 17.14.1a                   |
| 10M                                                                | 10M Bidirectional                             | 10M Bidirectional                              | 10M Bidirectional                              | 10M Bidirectional                                                 |
| 15M                                                                | 15M Bidirectional                             | 15M Bidirectional                              | 15M Bidirectional                              | 15M Bidirectional                                                 |
| 25M                                                                | 25M Bidirectional                             | 25M Bidirectional                              | 25M Bidirectional                              | 25M Bidirectional                                                 |
| 50M                                                                | 50M Bidirectional                             | 50M Bidirectional                              | 50M Bidirectional                              | 50M Bidirectional                                                 |
| 100M                                                               | 100M Bidirectional                            | 100M Bidirectional                             | 100M Bidirectional                             | 100M Bidirectional                                                |
| 250M                                                               | 250M Bidirectional                            | 250M Bidirectional                             | 250M Bidirectional                             | With HSECK9: 500M Aggregate<br>Without HSECK9: 250M Bidirectional |
| 500M*                                                              | 500M Bidirectional                            | 500M Bidirectional                             | 1G Aggregate                                   | 1G Aggregate                                                      |
| 1G*                                                                | 1G Bidirectional                              | 1G Bidirectional                               | 2G Aggregate                                   | 2G Aggregate                                                      |
| T0                                                                 | -                                             | 15M Bidirectional                              | 25M Bi-directional                             | 25M Bi-directional                                                |
| T1                                                                 | -                                             | 100M Bidirectional                             | 100M Bi-directional                            | With HSECK9: 500M Aggregate<br>Without HSECK9: 250M Bidirectional |
| T2*                                                                | -                                             | 1G Bidirectional                               | 2G Aggregate                                   | 2G Aggregate                                                      |

Table 14: C8500-12X, C8500-12X40C

| Throughput = Encrypted Throughput<br>*HSECK9 license required for compliance purposes only. |                                               |                                                |                                                |
|---------------------------------------------------------------------------------------------|-----------------------------------------------|------------------------------------------------|------------------------------------------------|
| Supported Throughput Values (default 10M)                                                   | Entitled Throughput & Throttling in >= 17.3.2 | Entitled Throughput & Throttling in >= 17.7.1a | Entitled Throughput & Throttling in >= 17.8.1a |
| 2.5G*                                                                                       | 2.5G Bidirectional                            | 2.5G Bidirectional                             | 5G Aggregate                                   |
| 5G*                                                                                         | 5G Bidirectional                              | 5G Bidirectional                               | 10G Aggregate                                  |
| 10G*                                                                                        | 10G Bidirectional                             | 10G Bidirectional                              | 20G Aggregate                                  |

|     |   |                   |               |
|-----|---|-------------------|---------------|
| T3* | - | 10G Bidirectional | 20G Aggregate |
|-----|---|-------------------|---------------|

Table 15: C8500L-8S4X

| Throughput = Encrypted Throughput<br>*HSECK9 license required for compliance purposes only. |                                                   |                                                   |                                                   |
|---------------------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------|---------------------------------------------------|
| Supported Throughput Values<br>(default 10M)                                                | Entitled Throughput &<br>Throttling in >= 17.4.1a | Entitled Throughput &<br>Throttling in >= 17.7.1a | Entitled Throughput &<br>Throttling in >= 17.8.1a |
| 1G*                                                                                         | 1G Bidirectional                                  | 1G Bidirectional                                  | 2G Aggregate                                      |
| 2.5G*                                                                                       | 2G Bidirectional                                  | 2G Bidirectional                                  | 5G Aggregate                                      |
| 5G*                                                                                         | 5G Bidirectional                                  | 5G Bidirectional                                  | 10G Aggregate                                     |
| 10G*                                                                                        | 10G Bidirectional                                 | 10G Bidirectional                                 | 20G Aggregate                                     |
| T2*                                                                                         | -                                                 | 1G Bidirectional                                  | 2G Aggregate                                      |
| T3*                                                                                         | -                                                 | 10G Bidirectional                                 | 20G Aggregate                                     |

Table 16: C8500-20X6C

| Throughput = Encrypted Throughput<br>*HSECK9 license required for compliance purposes only. |                                                   |
|---------------------------------------------------------------------------------------------|---------------------------------------------------|
| Supported Throughput Values<br>(default T4)                                                 | Entitled Throughput and Throttling in >= 17.10.1a |
| T4*                                                                                         | 50G Aggregate                                     |
| T5*                                                                                         | Unthrottled                                       |

## Entitled Throughput and Throttling Specifications in the SD-WAN Controller Mode

| PID                               | Introductory Release for PID | Throughput Without HSECK9 - Bi-directional | Throughput With HSECK9 (>=17.3.2 and <17.8.1a, Bi-directional) | Throughput With HSECK9 (>17.8.1a, Aggregate) |
|-----------------------------------|------------------------------|--------------------------------------------|----------------------------------------------------------------|----------------------------------------------|
| C8300-1N1S-4T2X<br>(default 250M) | 17.3.2                       | 250M                                       | unthrottled                                                    | unthrottled                                  |
| C8300-2N2S-6T<br>(default 250M)   | 17.3.2                       | 250M                                       | 1G                                                             | 2G                                           |

| PID                                   | Introductory Release for PID | Throughput Without HSECK9 - Bi-directional | Throughput With HSECK9 (>=17.3.2 and <17.8.1a, Bi-directional) | Throughput With HSECK9 (>17.8.1a, Aggregate) |
|---------------------------------------|------------------------------|--------------------------------------------|----------------------------------------------------------------|----------------------------------------------|
| C8300-1N1S-6T<br>(default 250M)       | 17.3.2                       | 250M                                       | 1G                                                             | 2G                                           |
| C8300-2N2S-4T2X<br>(default 250M)     | 17.3.2                       | 250M                                       | unthrottled                                                    | unthrottled                                  |
| C8200-1N-4T<br>(default 250M)         | 17.4.1a                      | 250M                                       | 500M                                                           | 1G                                           |
| C8200L-1N-4T<br>(default 250M)        | 17.5.1a                      | 250M                                       | 250M                                                           | 500M                                         |
| C8500-12X4QC<br>(default unthrottled) | 17.3.2                       | unthrottled                                | unthrottled                                                    | unthrottled                                  |
| C8500-12X<br>(default unthrottled)    | 17.3.2                       | unthrottled                                | unthrottled                                                    | unthrottled                                  |
| C8500L-8S4X<br>(default unthrottled)  | 17.4.1a                      | unthrottled                                | unthrottled                                                    | unthrottled                                  |
| C8500-20X6C<br>(default T4)           | 17.10.1a                     | unthrottled                                | -                                                              | unthrottled                                  |
| C8000v<br>(default 250M)              | 17.4.1a                      | 250M                                       | unthrottled                                                    | unthrottled                                  |

## Numeric vs. Tier-Based Throughput Configuration

With the introduction of tier-based throughput configuration in Cisco IOS XE Cupertino 17.7.1a, when you configure throughput on the device, both numeric and tier-based options are available. This section provides information about when to configure a numeric throughput value and when to configure tier-based throughput.

### Identifying whether you have tier-based or numeric licenses

Cisco Smart Software Manager (CSSM) is a portal that enables you to manage all your Cisco software licenses. All the license PIDs you purchase are listed in the CSSM Web UI at: <https://software.cisco.com> → **Manage licenses**. One way of identifying whether you have a tier-based or numeric licenses is to see how the license is displayed in CSSM.

To do this, log in to the portal and in the corresponding Smart Account and Virtual Account, navigate to **Inventory > Licences**, to display the licenses in the account. The screenshot below shows you how both are displayed:

Figure 1: Numeric and Tier Values Displayed in the CSSM Web UI

|   |                                      |              |         |
|---|--------------------------------------|--------------|---------|
| + | Routing DNA Advantage: Tier 2        | → Tier-Based | Prepaid |
| + | Routing DNA Advantage: Tier 2: 1G    | → Numeric    | Prepaid |
| + | Routing DNA Advantage: Tier 2: 250M  |              | Prepaid |
| + | Routing DNA Advantage: Tier 2: 500M  |              | Prepaid |
| + | Routing DNA Advantage: Tier 3        |              | Prepaid |
| + | Routing DNA Advantage: Tier 3: 5G    |              | Prepaid |
| + | Routing DNA Advantage: Tier 4        |              | Prepaid |
| + | Routing DNA Essentials: Tier 1: 100M |              | Prepaid |
| + | Routing DNA Essentials: Tier 2       |              | Prepaid |
| + | Routing DNA Essentials: Tier 2: 1G   |              | Prepaid |
| + | Routing DNA Essentials: Tier 2: 250M |              | Prepaid |
| + | Routing DNA Essentials: Tier 2: 500M |              | Prepaid |
| + | Routing DNA Essentials: Tier 3       |              | Prepaid |
| + | Routing DNA Premier: Tier 1: 100M    |              | Prepaid |
| + | Routing DNA Premier: Tier 2: 1G      |              | Prepaid |

#### Recommendations for whether to configure a numeric or tier-based throughput value

- If you purchase a numeric license PID, the license is displayed with the numeric throughput value *and* tier-based value in the CSSM Web UI. For such a license, we recommend that you configure only a numeric throughput value.

See [Configuring a Numeric Throughput](#), on page 63.

- If you purchase a tier-based license PID, the license is displayed with only the tier value in the CSSM Web UI. For such a license, you can either configure a tier-based throughput value to match the display in the CSSM Web UI, or you can configure a numeric throughput value.

See [Configuring a Tier-Based Throughput, on page 65](#) or [Configuring a Numeric Throughput, on page 63](#).



---

**Note** There is no functional impact if you have tier-based license PID in CSSM and you configure a numeric throughput value on the device.

---

### When to *convert* the configured value to a numeric or tier-based one

The following scenarios further clarify when you can *convert* from numeric to tier-based throughput configuration, or from tier-based throughput configuration to numeric, when conversion is required, and when it is optional:

- You have configured a numeric throughput value on the device and the license PID is a numeric license: *You must not* convert to tier-based throughput value.
- You have configured a numeric throughput value on the device and the license PID is a tier-based license: You can convert the throughput configuration to tier-based value - but this is optional. There is no functional impact if you do not convert to a tier-based throughput value.

If you want to convert to a tier-based value, see [Converting From a Numeric Throughput Value to a Tier, on page 70](#)

- You are upgrading to a release where tier-based throughput values are supported and the license PID is tier-based: You can convert the throughput to tier-based value after upgrade - but this is optional. There is no functional impact if you do not convert to a tier-based throughput value.

See [Upgrading from a Release Supporting Numeric Throughput to a Release Supporting Tiers, on page 72](#).

- You are upgrading to a release where tier-based throughput values are supported, and your license PID is numeric: *You must not* convert to a tier-based throughput value.
- You are downgrading to a release where only numeric throughput values are supported and your license PID and throughput configuration are tier-based: *You must* change configuration to a numeric throughput value, *before you downgrade*.

See [Downgrading from a Release Supporting Tiers to a Release Supporting Only Numeric Throughput, on page 73](#).

## How to Configure Available Licenses and Throughput

This section provides information about the sequence in which you must complete tasks, for the various licenses available on the Cisco Catalyst 8000 Edge Platforms Family - before you can start using them.

For a Cisco DNA license: **Configure a Boot Level License** → **Configure Numeric or Tier-Based Throughput** → **Implement a Smart Licensing Using Policy Topology** → **Report License Usage (If Applicable)**.

For an HSECK9 license: **Configure a Boot Level License** → **Implement a Smart Licensing Using Policy Topology** → **Install SLAC**<sup>1</sup> → **Enable HSECK9 on applicable platforms**<sup>2</sup> → **Configure Numeric or Tier-Based Throughput** → **Report License Usage (If Applicable)**.

For a Cisco UBE, or Cisco Unified CME, or Cisco Unified SRST license: **Implement a Smart Licensing Using Policy Topology** → **Report License Usage (If Applicable)**.

## Configuring a Boot Level License

If you have purchased a Cisco DNA license for a new device, or if you have an existing device and you want to change (upgrade or downgrade, add or remove) the currently configured license on your device, complete the following task.

This sets a boot level license and requires a reload before the configured changes are effective.

### Step 1 show version

Displays the currently set boot level license.

In the accompanying example, Network Advantage and DNA Advantage licences are configured on the device.

#### Example:

```
Device# show version
<output truncated>
Technology Package License Information:

-----
Technology      Type           Technology-package Current  Technology-package Next Reboot
-----
Smart License   Perpetual      network-advantage network-advantage
Smart License   Subscription   dna-advantage   dna-advantage

<output truncated>
```

### Step 2 configure terminal

Enters global configuration mode.

#### Example:

```
Device# configure terminal
```

### Step 3

Depending on whether the device is a physical or virtual one, configure the applicable command:

- For physical platforms: **[no] license boot level {network-advantage [addon dna-advantage] | network-essentials [addon dna-essentials] | network-premier [addon dna-premier] }**
- For virtual platforms: **[no] license boot level {network-advantage {addon dna-advantage} | network-essentials {addon dna-essentials} | network-premier {addon dna-premier} }**

Sets a boot level license.

On all platforms, first configure a network-stack license. Only after this can you configure the corresponding add-on license.

<sup>1</sup> If a SLAC has been factory-installed by Cisco (in case of new hardware), skip this step

<sup>2</sup> Enter the **license feature hseck9** command in global configuration mode for Catalyst 8200, and 8300 Series Edge Platforms only.

In the command syntax note how the configuration of a DNA-stack add-on license is optional on physical platforms, but mandatory on virtual platforms.

The accompanying example, shows configuration on a C8300-1N1S-4T2X router, which is a physical platform. The network-stack license, Network Premier and the corresponding add-on license, DNA-Premier are configured.

**Example:**

```
Device(config)# license boot level network-premier addon dna-premier
% use 'write' command to make license boot config take effect on next boot
```

**Step 4**     **exit**

Exits global configuration mode and returns to privileged EXEC mode.

**Example:**

```
Device# exit
```

**Step 5**     **copy running-config startup-config**

Saves your entries in the configuration file.

**Example:**

```
Device# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
<output truncated>
```

**Step 6**     **reload**

Reloads the device. License levels configured in Step 3 are effective and displayed only after this reload.

**Example:**

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

*Dec  8 01:04:12.287: %SYS-5-RELOAD: Reload requested by console.
Reload Reason: Reload Command.
<output truncated>
```

**Step 7**     **show version**

Displays the currently set boot level license.

In the accompanying example, the output confirms that Network Premier and DNA-Premier licenses are configured.

**Example:**

```
Device# show version
<output truncated>
Technology Package License Information:

-----
Technology      Type           Technology-package Current  Technology-package Next Reboot
-----
Smart License   Perpetual     network-premier   network-premier
Smart License   Subscription  dna-premier       dna-premier
<output truncated>
```

**Step 8**     **show license summary**

Displays a summary of license usage, which includes information about licenses being used, the count, and status.

**Example:**

```
Device# show license summary
```

```
Account Information:
```

```
Smart Account: Eg-SA As of Dec 08 08:10:33 2021 UTC
```

```
Virtual Account: Eg-VA
```

```
License Usage:
```

License	Entitlement Tag	Count	Status
network-premier_T2	(NWSTACK_T2_P)	1	IN USE
dna-premier_T2	(DSTACK_T2_P)	1	IN USE

**Step 9** Complete usage reporting - if required

After you configure a license level, you may have to send a RUM report (Resource Utilization Measurement Report) to CSSM to report license usage information. To know if reporting is required, you can wait for a system message or refer to the policy using show commands.

- The system message, which indicates that reporting is required: %SMART\_LIC-6-REPORTING\_REQUIRED: A Usage report acknowledgement will be required in [dec] days. [dec] is the amount of time (in days) left to meet reporting requirements.
- If using **show** commands, refer to the output of the **show license status** privileged EXEC command and check the `Next ACK deadline` field. This means a RUM report must be sent and the acknowledgement (ACK) from CSSM must be installed by this date.

*How* you send the RUM report, depends on the topology you have implemented in the Smart Licensing Using Policy environment. For more information, see [How to Configure Smart Licensing Using Policy: Workflows by Topology](#).

## Installing SLAC for an HSECK9 License

A Smart Licensing Authorization Code (SLAC) is generated in and obtained from Cisco Smart Software Manager (CSSM) portal.

There are multiple ways in which a product may be connected to the CSSM, in order to obtain a SLAC. Each way of connecting to CSSM is called a topology. You must implement one of the supported topologies so you can then install SLAC in the corresponding method.

For information about all the methods, see the [Supported Topologies](#) section of the [Smart Licensing Using Policy for Cisco Enterprise Routing Platforms](#) document.



**Note** Ensure that a boot level license is already configured on the device. See [Configuring a Boot Level License, on page 60](#). In the output of the show version privileged EXEC command ensure that a license is mentioned in the `License Level` field.

### Required Tasks After Installing SLAC

Complete the following required tasks after installing SLAC - only if applicable to the platform:



Platform	Required Tasks After Installing SLAC
For Catalyst 8200 and 8300 Series Edge Platforms	Enter the <b>license feature hseck9</b> command in global configuration mode. This <i>enables</i> the HSECK9 license on these platforms.
For the <i>C8500L</i> models of the Catalyst 8500 Series Edge Platforms	Reload the device after installing SLAC.

## Configuring a Numeric Throughput

This task shows you how to change the numeric throughput level on physical and virtual platforms. If you do not configure a throughput level, the platform's default throughput level is effective.

Configuration of a throughput level requires a reload on physical platforms (Catalyst 8200, 8300, and 8500 Series Edge Platforms). A reload is not required for virtual platforms (Catalyst 8000V Edge Software).

### Before you begin

- Read sections [Numeric and Tier-Based Throughput, on page 47](#) and [Numeric vs. Tier-Based Throughput Configuration, on page 57](#).
- Ensure that a boot level license is already configured on the device. Otherwise you will not be able to configure a throughput value. See [Configuring a Boot Level License, on page 60](#). In the output of the **show version** privileged EXEC command ensure that a license is mentioned in the `License Level` field.
- If you are configuring throughput greater than 250 Mbps, you must install a Smart Licensing Authorization Code (SLAC) before you start with this task. See [Installing SLAC for an HSECK9 License, on page 62](#).
- You can configure the `250M` value with or without an HSECK9 license. The system allows both. The difference is that aggregate throttling is effective if HSECK9 is available on the device. See: [Release-Wise Changes in Throttling Behavior, on page 49](#).
- Note the throughput you are entitled to. This is indicated in the Cisco DNA license PID you purchase.

**Step 1** Depending on whether the device is a physical or virtual one, enter the applicable command:

- For physical platforms: **show platform hardware throughput crypto**
- For virtual platforms: **show platform hardware throughput level**

Displays the current throughput level on the device.

In the accompanying example:

- The **show platform hardware throughput crypto** sample output is of a physical platform (a C8300-2N2S-4T2X). Here the throughput level is throttled at 250M.
- The **show platform hardware throughput level** sample output is of a virtual platform (a C8000V).

### Example:

```
Device# show platform hardware throughput crypto
Current configured crypto throughput level: 250M
Level is saved, reboot is not required
Current enforced crypto throughput level: 250M
```

```
Crypto Throughput is throttled at 250M
Default Crypto throughput level: 10M
Current boot level is network-advantage
```

OR

```
Device# show platform hardware throughput level
The current throughput level is 1000000 kb/s
```

## Step 2 configure terminal

Enters global configuration mode.

### Example:

```
Device# configure terminal
```

## Step 3 Depending on whether the device is a physical or virtual one, configure the applicable command:

- For physical platforms: **platform hardware throughput crypto {100M | 10M | 15M | 1G | 2.5G | 250M | 25M | 500M | 50M}**
- For virtual platforms: **platform hardware throughput level MB {100 | 1000 | 10000 | 15 | 25 | 250 | 2500 | 50 | 500 | 5000}**

Configures the throughput level. The displayed throughput options depend on the device.

**Note** On physical and virtual platforms, ensure that a boot level license is configured. Otherwise the command is not recognized as a valid one on the command line interface.

In the accompanying example:

- 1 Gbps is configured on the physical platform. The software version running on the device is Cisco IOS XE Cupertino 17.8.1a and this means aggregate throughput throttling applies. After reload, the sum of upstream and downstream throughput will not exceed the 2 Gbps limit.
- 5000 Mbps is configured on the virtual platform. The software version running on the device is Cisco IOS XE Cupertino 17.8.1a and this means Tx data is throttled at 5000 Mbps. Rx is unthrottled.

### Example:

```
Device(config)# platform hardware throughput crypto ?
 100M 100 mbps bidirectional thput
 10M   10 mbps bidirectional thput
 15M   15 mbps bidirectional thput
 1G    2 gbps aggregate thput
 2.5G  5 gbps aggregate thput
 250M  250 mbps bidirectional thput
 25M   25 mbps bidirectional thput
 500M  1gbps aggregate thput
 50M   50 mbps bidirectional thput
Device(config)# platform hardware throughput crypto 1G
% These values don't take effect until the next reboot.
Please save the configuration.
```

OR

```
Device(config)# platform hardware throughput level MB 5000
%Throughput has been set to 5000 Mbps.
```

## Step 4 exit

Exits global configuration mode and returns to privileged EXEC mode.

**Example:**

```
Device# exit
```

**Step 5** **copy running-config startup-config**

Saves your entries in the configuration file.

**Example:**

```
Device# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
```

**Step 6** **reload**

Reloads the device.

**Note** Perform this step only if the device you are configuring throughput on a physical platform.

Skip this step if you are configuring throughput on a virtual platform.

**Example:**

```
Device# reload
```

**Step 7** Depending on whether the device is a physical or virtual one, enter the applicable command:

- **For physical platforms: show platform hardware throughput crypto**
- **For virtual platforms: show platform hardware throughput level**

Displays the current throughput level on the device.

**Tip** On physical platforms, you can also enter the **show platform hardware qfp active feature ipsec state** privileged EXEC command to display the configured throughput level.

**Example:**

```
Device# show platform hardware throughput crypto
Current configured crypto throughput level: 1G
    Level is saved, reboot is not required
Current enforced crypto throughput level: 1G
Crypto Throughput is throttled at 2G(Aggregate)
Default Crypto throughput level: 10M
```

OR

```
Device# show platform hardware throughput level
The current throughput level is 5000000 kb/s
```

## Configuring a Tier-Based Throughput

This task shows you how to configure a tier-based throughput level on physical and virtual platforms. If you do not configure a throughput level, the platform's default throughput level is effective.

Tier-based throughput levels are supported starting with Cisco IOS XE Cupertino 17.7.1a only.

Configuration of a throughput level requires a reload on physical platforms (Catalyst 8200, 8300, and 8500 Series Edge Platforms). A reload is not required for virtual platforms (Catalyst 8000V Edge Software).

**Before you begin**

- Read sections [Numeric and Tier-Based Throughput, on page 47](#) and [Numeric vs. Tier-Based Throughput Configuration, on page 57](#).
- Ensure that a boot level license is already configured on the device. Otherwise you will not be able to configure a throughput value. See [Configuring a Boot Level License, on page 60](#). In the output of the **show version** privileged EXEC command ensure that a license is mentioned in the `License Level` field.
- If you are configuring Tier 2 (T2) or a higher tier, you must install a Smart Licensing Authorization Code (SLAC) before you start with this task. See [Installing SLAC for an HSECK9 License, on page 62](#).
  - On physical platforms, T2 or higher tiers are not displayed if SLAC is not installed.
  - On virtual platforms, all tier options are displayed even if SLAC is not installed. But SLAC is required if you want to configure T2 or a higher tier.
- If you want to configure Tier 3 (T3) ensure that the boot level license is Network Advantage/ DNA Advantage, or Network Premier/DNA Premier. T3 and higher tiers are not supported with Network Essentials and DNA Essentials.
- You can configure the `T1` value with or without an HSECK9 license. The system allows both. The difference is that aggregate throttling is effective if HSECK9 is available on the device. See: [Release-Wise Changes in Throttling Behavior, on page 49](#).
- Note the throughput you are entitled to. This is indicated in the Cisco DNA license PID you purchase.

**Step 1**

Depending on whether the device is a physical or virtual one, enter the applicable command:

- For physical platforms: **show platform hardware throughput crypto**
- For virtual platforms: **show platform hardware throughput level**

Displays the current throughput level on the device.

In the accompanying example:

- The **show platform hardware throughput crypto** sample output is of a physical platform (a C8300-2N2S-4T2X). Here throughput is currently throttled at 250 Mbps.
- The **show platform hardware throughput level** sample output is of a virtual platform (a C8000V). Here the current throughput level is 10 Mbps.

**Example:**

```
Device# show platform hardware throughput crypto
show platform hardware throughput crypto
Current configured crypto throughput level: 250M
  Level is saved, reboot is not required
Current enforced crypto throughput level: 250M
Crypto Throughput is throttled at 250M
Default Crypto throughput level: 10M
Current boot level is network-premier
```

OR

```
Device# show platform hardware throughput level
The current throughput level is 10000 kb/s
```

**Step 2** show license authorization

(Optional) Displays SLAC information on the product instance.

In the accompanying example:

- SLAC is installed on the physical platform. This is so we can configure T2.
- SLAC is not available on the virtual platform. Note how this affects throughput configuration in the subsequent steps.

**Example:**

```
Device# show license authorization
Overall status:
  Active: PID:C8300-2N2S-4T2X,SN:FDO2250A0J5
  Status: SMART AUTHORIZATION INSTALLED on Mar 02 05:05:19 2022 UTC
  Last Confirmation code: 418b11b3

Authorizations:
  Router US Export Lic. for DNA (DNA_HSEC):
  Description: U.S. Export Restriction Compliance license for
  DNA based Routers
  Total available count: 1
  Enforcement type: EXPORT RESTRICTED
  Term information:
  Active: PID:C8300-1N1S-4T2X,SN:FDO2250A0J5
  Authorization type: SMART AUTHORIZATION INSTALLED
  License type: PERPETUAL
  Term Count: 1

Purchased Licenses:
  No Purchase Information Available

OR

Device# show license authorization
Overall status:
  Active: PID:C8000V,SN:9I8GRCH8CMN
  Status: NOT INSTALLED
```

**Step 3** configure terminal

Enters global configuration mode.

**Example:**

```
Device# configure terminal
```

**Step 4** Depending on whether the device is a physical or virtual one, configure the applicable command:

- For physical platforms: **platform hardware throughput crypto {T0 | T1 | T2 | T3 | T4 | T5}**
- For virtual platforms: **platform hardware throughput level MB {T0 | T1 | T2 | T3 | T4 }**

Configures a tier-based throughput. The throughput options that are displayed, depend on the device.

**Note** Only tiers are mentioned in command, for the sake of clarity. When you enter the command on the CLI, numeric and tier values are displayed - as shown in the accompanying example.

The following apply to both physical and virtual platforms:

- Ensure that you have configured a boot level license already. Otherwise the command for throughput configuration is not recognized as a valid one on the command line interface.

- If you are configuring T2 or a higher tier, you have installed SLAC.

On a physical platform, you will not be able to configure T2 or a higher tier if SLAC is not installed.

On a virtual platform, if you configure T2 or a higher tier without SLAC, the product instance automatically tries to reach CSSM to request and install SLAC. If it is successful, throughput is set to the configured tier. If it is not successful, the system sets the throughput to 250 Mbps. If and when SLAC is installed, the throughput is automatically set to the last configured value.

In the accompanying example:

- 1 Gbps is configured on the physical platform. The software version running on the device is Cisco IOS XE Cupertino 17.8.1a and this means aggregate throughput throttling applies. After reload, the sum of upstream and downstream throughput will not exceed the 2 Gbps limit.
- 5000 Mbps is configured on the virtual platform. The software version running on the device is Cisco IOS XE Cupertino 17.8.1a and this means Tx data is throttled at 5000 Mbps. Rx is unthrottled.
- On the physical platform (**platform hardware throughput crypto**), T2 and higher tiers are displayed, because SLAC is installed. If SLAC were not available, T1 would have been the highest tier displayed.

The software version running on the device is Cisco IOS XE Cupertino 17.8.1a and this means aggregate throughput throttling applies. After reload, the sum of upstream and downstream throughput will not exceed the 2 Gbps limit.

- On the virtual platform (**platform hardware throughput level MB**), all tiers are displayed. After T2 is configured, the system message alerts you to the fact that the configuration is not set, because SLAC is not installed.

#### Example:

```
Device(config)# platform hardware throughput crypto ?
100M 100 mbps bidirectional thput
10M   10 mbps bidirectional thput
15M   15 mbps bidirectional thput
1G    2 gbps aggregate thput
2.5G  5 gbps aggregate thput
250M  250 mbps bidirectional thput
25M   25 mbps bidirectional thput
500M  1gbps aggregate thput
50M   50 mbps bidirectional thput
T0    T0(up to 15 mbps) bidirectional thput
T1    T1(up to 100 mbps) bidirectional thput
T2    T2(up to 2 gbps) aggregate thput
T3    T3(up to 5 gbps) aggregate thput
```

```
Device(config)# platform hardware throughput crypto T2
% These values don't take effect until the next reboot.
Please save the configuration.
*Mar 02 05:06:19.042: %CRYPTO_SL_TP_LEVELS-6-SAVE_CONFIG_AND_RELOAD:
New throughput level not applied until reload; please save config
```

OR

```
Device(config)# platform hardware throughput level MB ?
100   Mbps
1000  Mbps
10000 Mbps
15    Mbps
25    Mbps
250   Mbps
2500  Mbps
50    Mbps
500   Mbps
```

```

5000  Mbps
T0    Tier0 (up to 15M throughput)
T1    Tier1 (up to 100M throughput)
T2    Tier2 (up to 1G throughput)
T3    Tier3 (up to 10G throughput)
T4    Tier4 (unthrottled)

```

```

Device(config)# platform hardware throughput level MB T2
%Requested throughput will be set once HSEC authorization
code is installed

```

**Step 5 exit**

Exits global configuration mode and returns to privileged EXEC mode.

**Example:**

```
Device# exit
```

**Step 6 copy running-config startup-config**

Saves your entries in the configuration file.

**Example:**

```

Device# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]

```

**Step 7 reload**

Reloads the device.

**Note** Perform this step only if the device you are configuring throughput on a physical platform.

Skip this step if you are configuring throughput on a virtual platform.

**Example:**

```
Device# reload
```

**Step 8** Depending on whether the device is a physical or virtual one, enter the applicable command:

- **For physical platforms: show platform hardware throughput crypto**
- **For virtual platforms: show platform hardware throughput level**

Displays the current throughput level on the device.

In the accompanying example:

- On the physical platform, the tier value is set to T2.

**Tip** On a physical platform, you can also enter the **show platform hardware qfp active feature ipsec state** privileged EXEC command to display the configured throughput level.

- On the virtual platform, throughput is set to 250 Mbps. If and when SLAC is installed, the throughput will be automatically set to the last configured value, which is T2.

**Example:**

```

Device# show platform hardware throughput crypto
Current configured crypto throughput level: T2
Level is saved, reboot is not required

```

```
Current enforced crypto throughput level: 1G
Crypto Throughput is throttled at 2G(Aggregate)
Default Crypto throughput level: 10M
Current boot level is network-premier
```

OR

```
Device# show platform hardware throughput level
The current throughput level is 250000 kb/s
```

## Converting From a Numeric Throughput Value to a Tier

This task shows you how to convert a numeric throughput value to a tier-based throughput value. To know how numeric throughput values are mapped to tier values refer to the table here: [Tier and Numeric Throughput Mapping, on page 50](#).

Converting the throughput level requires a reload on physical platforms (Catalyst 8200, 8300, and 8500 Series Edge Platforms). A reload is not required for virtual platforms (Catalyst 8000V Edge Software).

### Before you begin

- Read section [Numeric vs. Tier-Based Throughput Configuration, on page 57](#).
- If you are converting numeric throughput that is equal or greater than 250 Mbps, ensure that a SLAC is installed on the device. See [Installing SLAC for an HSECK9 License, on page 62](#).
- The software version running on the device is Cisco IOS XE Cupertino 17.7.1a or a later release.

**Step 1** Depending on whether the device is a physical or virtual one, enter the applicable command:

- For physical platforms: **show platform hardware throughput crypto**
- For virtual platforms: **show platform hardware throughput level**

Displays the currently running throughput on the device.

### Example:

```
Device# show platform hardware throughput crypto
Current configured crypto throughput level: 500M
Level is saved, reboot is not required
Current enforced crypto throughput level: 500M
Crypto Throughput is throttled at 500M
Default Crypto throughput level: 10M
Current boot level is network-premier
```

OR

```
Device# show platform hardware throughput level
The current throughput level is 100000 kb/s
```

**Step 2** Depending on whether the device is a physical or virtual one, enter the applicable command:

- For physical platforms: **license throughput crypto auto-convert**
- For virtual platforms: **license throughput level auto-convert**

Converts the numeric throughput to a tier-based throughput value. The converted tier value is displayed on the CLI.



**Example:**

```
Device# license throughput crypto auto-convert
Crypto throughput auto-convert from level 500M to T2

% These values don't take effect until the next reboot.
Please save the configuration.
*Dec 8 03:21:01.401: %CRYPTO_SL_TP_LEVELS-6-SAVE_CONFIG_AND_RELOAD:
New throughput level
not applied until reload; please save config

OR

Device# license throughput level auto-convert
%Throughput tier set to T1 (100 Mbps)
% Tier conversion is successful.
Please write memory to save the tier config
```

**Step 3** **copy running-config startup-config**

Saves your entries in the configuration file.

**Note** Even though the command you use to convert from numeric to tier-based throughput is a privileged EXEC command, it changes running configuration from a numeric value to a tier-based value. You must therefore save configuration for the next reload to be displayed with a tier value.

**Example:**

```
Device# copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
```

**Step 4** **reload**

Reloads the device.

**Note** A reload is required only on physical platforms.

**Example:**

```
Device# reload
Proceed with reload? [confirm]
*Dec 8 03:24:09.534: %SYS-5-RELOAD: Reload requested by console.
Reload Reason:
Reload Command
```

**Step 5** Depending on whether the device is a physical or virtual one, enter the applicable command:

- For physical platforms: **show platform hardware throughput crypto**
- For virtual platforms: **show platform hardware throughput level**

Displays the currently running throughput on the device.

**Example:**

```
Device# show platform hardware throughput crypto
Current configured crypto throughput level: T2
Level is saved, reboot is not required
Current enforced crypto throughput level: 1G
Crypto Throughput is throttled at 1G
Default Crypto throughput level: 10M
Current boot level is network-premier
```

OR

```
Device# show platform hardware throughput level
The current throughput level is 100000 kb/s
```

**Step 6** Verify that conversion is complete.

- For physical platforms: **license throughput crypto auto-convert**
- For virtual platforms: **license throughput level auto-convert**

**Tip** To cross-check that conversion is complete, you can also enter the conversion command again. If the numeric throughput value has already been converted, the system displays a message confirming this.

**Example:**

```
Device# license throughput crypto auto-convert
Crypto throughput is already tier based, no need to convert.
```

OR

```
Device# license throughput level auto-convert
% Tier conversion not possible since the device is already
in tier licensing
```

## Upgrading from a Release Supporting Numeric Throughput to a Release Supporting Tiers

If you are upgrading to Cisco IOS XE Cupertino 17.7.1 or later release *and* the license PID is a tier-based one, you can convert throughput configuration to a tier-based value, or you can retain the numeric throughput configuration.



**Note** There is no functional impact if you have tier-based license PID in CSSM and a numeric throughput value is configured on the device.

If you want to convert to a tier-based value note the required action depending on the throughput level that is configured:

Throughput Configuration Before Upgrade	Action Before Upgrade	Action After Upgrade to 17.7.1 or Later
Lesser than 250 Mbps	No action required.	<a href="#">Converting From a Numeric Throughput Value to a Tier, on page 70</a>
Equal to 250 Mbps	Obtain an HSECK9 license and install SLAC if you want to convert to T2.	<a href="#">Converting From a Numeric Throughput Value to a Tier, on page 70</a>
Greater than 250 Mbps	No action required.	<a href="#">Converting From a Numeric Throughput Value to a Tier, on page 70</a>

## Downgrading from a Release Supporting Tiers to a Release Supporting Only Numeric Throughput

If you are downgrading to a release where only numeric throughput configuration is supported, you *must* convert tier-based throughput configuration to a numeric throughput value before downgrade. This is applicable even if the license PID is a tier-based license PID.



**Caution** If a tier-based throughput value was configured before downgrade and you downgrade without changing to a numeric value, tier configuration is not recognized by a pre-17.7.1 image and configuration fails. Further, throughput may not be restored to the pre-downgrade level and you have to configure a numeric throughput level after downgrade.

Throughput Configuration Before Downgrade	Action Before Downgrade	Action After Downgrade to a pre-17.7.1 Version
Numeric	No action required.	No action required.
Tier	<a href="#">Configuring a Numeric Throughput, on page 63</a>	No action required.

## Available Licensing Models

The licensing model defines *how* you account for or report the licenses that you use, to Cisco. The following licensing models are available on the Cisco Catalyst 8000 Edge Platforms Family:

### Smart Licensing Using Policy

With this licensing model, you purchase the licenses you want to use, configure them on the device, and then report license usage – as required. You do not have to complete any licensing-specific operations, such as registering or generating keys before you start using the software and the licenses that are tied to it - unless you are using export-controlled and enforced licenses.

This licensing model is supported on all products in the Cisco Catalyst 8000 Edge Platforms Family.

For more information, see [Smart Licensing Using Policy for Cisco Enterprise Routing Platforms](#).

### Pay As You Go (PAYG) Licensing



**Note** This licensing model is available only on Catalyst 8000V Edge Software.

Cisco Catalyst 8000V supports the PAYG licensing model with Amazon Web Services (AWS) and Microsoft Azure Marketplace - in both the autonomous mode and the controller mode. The Cisco Catalyst 8000V hourly-billed Amazon Machine Image (AMI) or the Pay As You Go licensing model allows you to consume an instance for a defined period of time.

- In the autonomous mode, you can directly launch an instance from the AWS or Azure Marketplace and start using it. The licenses are embedded in the image and the selected license package and configured throughput level are effective when you launch the instance
- In the controller mode, which is supported from Cisco IOS-XE Bengaluru 17.5.1, you must first onboard the device into Cisco SD-WAN as per [Onboard Cisco Catalyst 8000V Edge Software Hosted by a Cloud Service, Using PAYG Licensing](#). After this, when you launch the instance from AWS, the device comes-up with the license already installed for unlimited throughput.

### Managed Service Licensing Agreement

A Managed Service License Agreement (MSLA) is a buying program agreement, designed for Service Providers.

- **MSLA in Cisco SD-WAN Controller Mode**

In the Cisco SD-WAN controller mode, an MSLA is supported on all products in the Cisco Catalyst 8000 Edge Platforms Family. For more information, see:

[Managed Service Licensing Agreement \(MSLA\) for Cisco SD-WAN At-a-Glance](#)

[Cisco SD-WAN Getting Started Guide](#) → *Manage Licenses for Smart Licensing Using Policy*.

[Cisco vManage How-Tos for Cisco IOS XE SD-WAN Devices](#) → *Manage Licenses for Smart Licensing Using Policy*.

- **MSLA in Autonomous Mode**

In the autonomous mode, an MSLA is available only with Catalyst 8000V Edge Software, starting from Cisco IOS XE Cupertino 17.9.1a.

For more information, see: [MSLA](#).



# CHAPTER 5

## Change of Authorization

Change of Authorization (CoA) provides a mechanism to change the attributes of an authentication, authorization, and accounting (AAA) session after it is authenticated.

Identity-Based Networking Services supports change of authorization (CoA) commands for session query, reauthentication, and termination, port bounce and port shutdown, and service template activation and deactivation.

- [Feature Information for Change of Authorization, on page 75](#)
- [Information About Change of Authorization, on page 76](#)
- [Restrictions for Change of Authorization, on page 77](#)
- [How to Configure Change of Authorization, on page 78](#)
- [Configuration Examples for Change of Authorization, on page 79](#)

## Feature Information for Change of Authorization

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](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 17: Feature Information for Change of Authorization**

Feature Name	Releases	Feature Information
Change of Authorization	Cisco IOS XE Amsterdam 17.4.1	The Change of Authorization The following commands were introduced by this feature: <b>show aaa servers</b> , <b>show aaa group radius</b> , <b>show device-tracking policies</b> , <b>show device-tracking database</b> <b>show access-session interface</b> <i>interface-name</i>
Change of Authorization	Cisco IOS XE Amsterdam 17.3.1a	The Change of Authorization The following commands were introduced by this feature: <b>show ip access-lists</b> , <b>show ip access-list interface</b> , <b>debug epm plugin acl event</b> , <b>debug epm plugin acl errors</b>

# Information About Change of Authorization

## Change of Authorization-Reauthentication Procedure

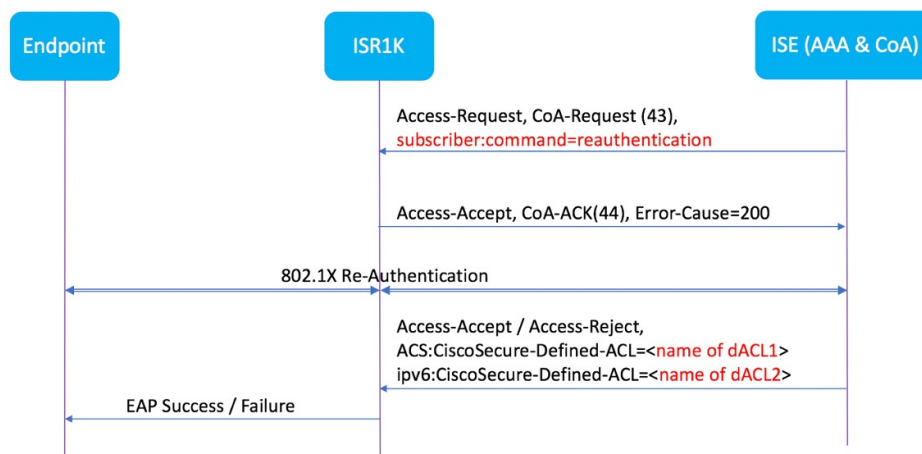
Change of Authorization (CoA) provides a mechanism to change the attributes of an authentication, authorization, and accounting (AAA) session after it is authenticated. The main steps in this procedure are:

- Authentication
- Posture Assessment
- CoA Re-Authentication
- Network Access Authorization



When a policy changes for a user or user group in AAA, administrators can send RADIUS CoA packets from the AAA server, such as a Cisco Identity Secure Engine (ISE) to reinitialize authentication and apply the new policy. This section provides an overview of the RADIUS interface including available primitives and how they are used during a CoA.

The RADIUS CoA provides a mechanism to change the attributes of an AAA session after it is authenticated. When policy changed on user or user group in RADIUS server, administrators can initiate RADIUS CoA process from RADIUS server to re-authenticate or re-authorize new policy



By default, the RADIUS interface is enabled on the device. However, some basic configuration is required for the following attributes:

- Security and Password
- Accounting

After posture assessment is successful, full network access is pushed down to the device for specific client through CoA re-authentication command based on its compliance state derived from last assessment. It is

optional to enforce downloadable ACLs with Permit-ALL or limited access to certain resources to corresponding clients. Per-session CoA requests are supported for session identification, session termination, host reauthentication, port shutdown, and port bounce. This model comprises one request (CoA-Request) and two possible response codes:

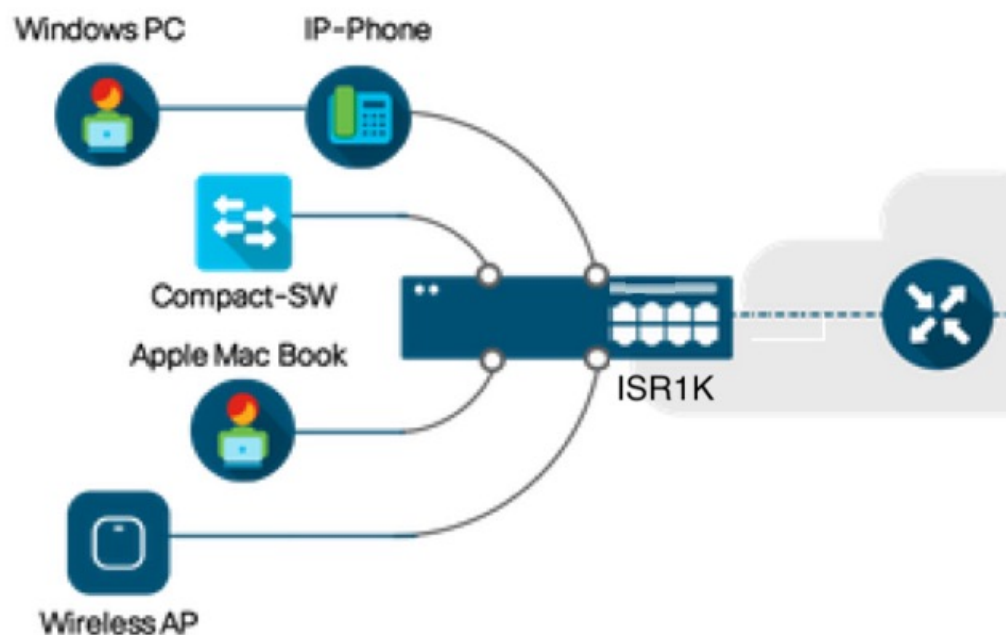
- CoA acknowledgement (ACK) [CoA-ACK]
- CoA nonacknowledgement (NAK) [CoA-NAK]

## Change of Authorization

Change of Authorization (CoA) is a critical part of a solution to initiate re-authenticate or re-authorization to an endpoint's network access based on its posture assessment result. This feature is integrated with Cisco AnyConnect, version 4.8 and Cisco ISE, version 2.6.

The network topology below shows a typical Cisco 1000 Series Integrated Services Router as a branch router in a network for secure access with ISE and other network services deployed in Campus or Data Center.

**Figure 2: Cisco ISR1000 in a Network for Secure Access with ISE and other Network Services**



CoA is critical part of the solution to initiate re-authenticate or re-authorization to endpoint's network access based on its posture assessment result. Downloadable ACL is the Target/Purpose of the entire solution. The per-client basis customized security policies are achieved by it.

## Restrictions for Change of Authorization

- Only 8 ports SKUs have TCAM to support DACL and Redirect ACL
- xACL can only match exact value(>,<,>=,<= are not supported)

- Switch ASIC TCAM has only 255 entries (IPv4 ACL entries) in total
- No IPv4 option header support, no IP fragment support in ACL packet inspection
- IPv6 is not supported in this feature
- Port ACL is not supported in this feature
- SISF: Only support none-secure device-tracking (tracking policy with security level 'glean')
- Multi-auth vlan is not supported on Cisco 1000 Series Integrated Services Routers
- Tracking is not getting replaced by 'enable tracking'
- VLAN change does not happen consistently with multiple iterations on client interfaces

## How to Configure Change of Authorization

### Essential dot1x | SAnet Configuration

```

aaa new-model
aaa authentication dot1x default group coa-ise
aaa authorization network default group coa-ise
dot1x system-auth-control
aaa group server radius coa-ise
  server name coa
radius server coa
  address ipv4 10.10.1.10 auth-port 1812 acct-port 1813
  key cisco123
policy-map type control subscriber simple_coa
  event session-started match-all
  10 class always do-until-failure
  10 authenticate using dot1x
interface gigabitethernet0/0/1
  switchport access vlan 22
  switchport mode access
  access-session closed
  access-session port-control auto
  dot1x pae authenticator
service-policy type control subscriber simple_coa

```

### Configure Change of Authorization

```

aaa server radius dynamic-author
  client
  server-key *****
  auth-type any
  ignore server-key
ip access-list extended redirect_acl
  20 deny udp any eq bootps any
  25 deny udp any eq domain any
  30 deny udp any any eq bootpc
  40 deny udp any eq bootpc any
  50 deny ip any host %{ise.ip}
  60 permit tcp any any eq www

```



```

70 permit tcp any any eq 443
device-tracking tracking
device-tracking policy tracking_test
security-level glean
no protocol ndp
no protocol dhcp6
tracking enable
interface 0/0/1
device-tracking attach-policy tracking_test

```

## Configuration Examples for Change of Authorization

### Example: Check if the RADIUS Server is Active

```

Device# show aaa servers
RADIUS: id 1, priority 1, host 10.75.28.231, auth-port 1812, acct-port 1813, hostname host
State: current UP, duration 188755s, previous duration 0s
Dead: total time 0s, count 0
Platform State from SMD: current UP, duration 188755s, previous duration 0s

```

### Example: Device Tracking Policy

```

Device# show aaa group radius coa3 **** port 1813 new-code
User successfully authenticated
USER ATTRIBUTES
username          0   "coa3"

```

To check if the parameters are enabled:

```

Device# show device-tracking policies
Target           Type Policy           Feature           Target range
Gi0/1/1          PORT tracking_test Device-tracking   vlan all
Gi0/1/2          PORT tracking_test Device-tracking   vlan all
Gi0/1/3          PORT tracking_test Device-tracking   vlan all
Gi0/1/4          PORT tracking_test Device-tracking   vlan all

```

To check the SISF table:

```

Device# show device-tracking database
Binding Table has 1 entries, 1 dynamic (limit 100000)
0001:MAC and LLA match      0002:Orig trunk      0004:Orig access
0008:Orig trusted trunk    0010:Orig trusted access 0020:DHCP assigned
0040:Cga authenticated     0080:Cert authenticated 0100:Statically assigned
Network Address      Link Address      Interface  vlan  prlvl  age  state      Time
left
ARP 10.11.22.20      0050.5683.3f97    Gi0/1/4   22   0005   11s  REACHABLE
295 s

```

To check if the access-session is authenticated and authorized:

```

Device# show access-session interface gigabitEthernet 0/1/7 detail
Interface: GigabitEthernet0/1/7
IIF-ID: 0x0DB9315A

```

```
MAC Address: b496.913d.4f9b
IPv6 Address: Unknown
IPv4 Address: 10.10.22.27
User-Name: coa2
Status: Authorized
  Domain: DATA
  Oper host mode: multi-auth
  Oper control dir: both
  Session timeout: N/A
  Common Session ID: 611C4B0A00000053F483D7B0
  Acct Session ID: Unknown
  Handle: 0x21000049
  Current Policy: POLICY_COA
Server Policies: Filter-ID: Filter_ID_COA2
Method status list: Method      State
                   dot1x      Authc Success
```



## CHAPTER 6

# Managing the Device Using Web User Interface

The Web User Interface (Web UI) is an embedded GUI-based device-management tool that provides the ability to provision the device, to simplify device deployment and manageability, and to enhance the user experience. It comes with the default image, so there is no need to enable anything or install any license on the device. You can use WebUI to build configurations, and to monitor and troubleshoot the device without having CLI expertise. This chapter includes the these sections:

- [Setting Up Factory Default Device Using Web UI](#) , on page 81
- [Using Web User Interface for Day One Setup](#), on page 85
- [Monitor and Troubleshoot Device Plug and Play \(PnP\) Onboarding using WebUI](#) , on page 86

## Setting Up Factory Default Device Using Web UI

Quick Setup Wizard allows you perform the basic router configuration. To configure the router:



**Note** Before you access the Web UI, you need to have the basic configuration on the device.

**Step 1** Connect the RJ-45 end of a serial cable to the RJ-45 console port on the router.

**Step 2** After the device initial configuration wizard appears, enter **No** to get into the device prompt when the following system message appears on the router.

Would you like to enter the initial configuration dialog? [yes/no]: no

**Step 3** From the configuration mode, enter the following configuration parameters.

```
!  
ip dhcp pool WEBUIPool  
network 192.168.1.0 255.255.255.0  
default-router 192.168.1.1  
  
username admin privilege 15 password 0 default  
!  
interface gig 0/0/1  
ip address 192.168.1.1 255.255.255.0  
!
```

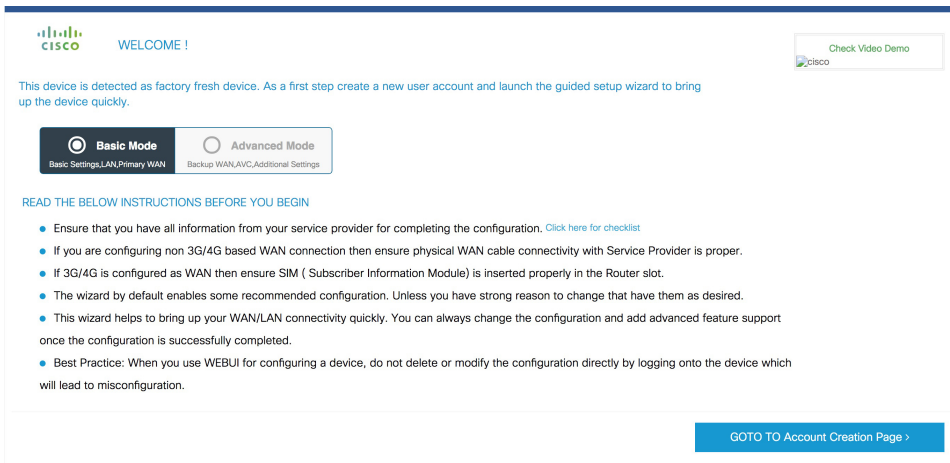
**Step 4** Connect the PC to the router using an Ethernet cable to the gig 0/0/1 interface.

- Step 5** Set up your PC as a DHCP client to obtain the IP address of the router automatically.
- Step 6** Launch the browser and enter the device IP address in your browser's address line. For a secure connection, type `https://192.168.1.1/#/dayZeroRouting`. For a less secure connection, enter `http://192.168.1.1/#/dayZeroRouting`.
- Step 7** Enter the default username (admin) and the password as default.

## Using Basic or Advanced Mode Setup Wizard

To configure the router using the basic or advanced mode setup:

- Step 1** Choose the **Basic Mode** or **Advanced Mode** and click **Go To Account Creation Page**.
- Step 2** Enter the username and password. Reenter the password to confirm.
- Step 3** Click **Create and Launch Wizard**.
- Step 4** Enter the device name and domain name.
- Step 5** Select the appropriate time zone from the **Time Zone** drop-down list.
- Step 6** Select the appropriate date and time mode from the **Date and Time** drop-down list.
- Step 7** Click **LAN Settings**.



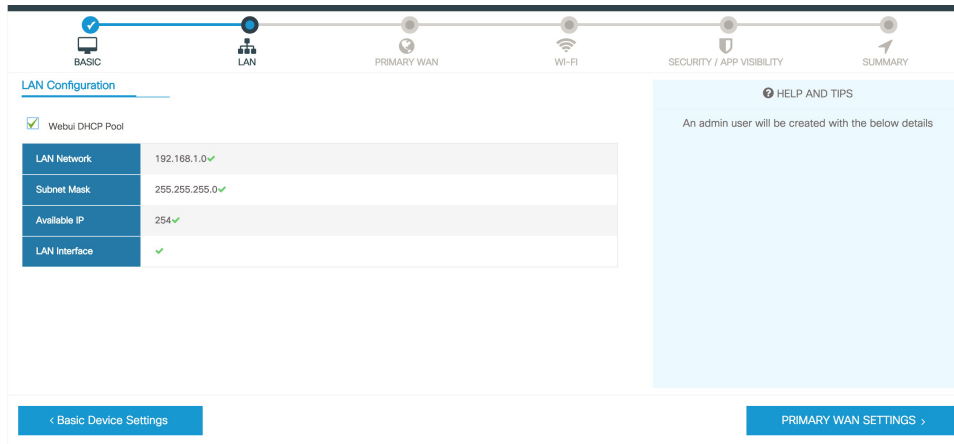
## Configure LAN Settings

- Step 1** Choose the **Web DHCP Pool/DHCP Pool** name or the **Create and Associate Access VLAN** option.
- If you choose the Web DHCP Pool, specify the following:
    - Pool Name**—Enter the DHCP Pool Name.
    - Network**—Enter network address and the subnet mask.
  - If you choose the Create and Associate Access VLAN option, specify the following:
    - Access VLAN**—Enter the Access VLAN identification number. The range is from 1 to 4094.

**Network**—Enter the IP address of the VLAN.

**Management Interfaces**—Select the interface and move to the selected list box using the right and left arrows. You can also double click or drag and drop to move the interface to the selected list box.

**Step 2** Click **Primary WAN Settings**.



## Configure Primary WAN Settings

- Step 1** Select the primary WAN type. You can configure Serial, 3G/4G, Ethernet, or Broadband (xDSL) as primary WAN depending on the WAN types supported by the router.
- Step 2** Select the interface from the drop-down list.
- Step 3** Check the **Get DNS Server info directly from ISP** check box to get the DNS server information directly from the service provider. You can also manually enter the Primary DNS and Secondary DNS.
- Step 4** Check the **Get IP automatically from ISP** check box to get the IP address information directly from the service provider. You can also manually enter the IP address and subnet mask.
- Step 5** Check the **Enable NAT** check box to enable NAT. It is recommended to enable NAT.
- Step 6** Check the **Enable PPPOE** check box to enable PPPoE. If you have enabled PPPoE, select the required authentication mode. The options are: **PAP** and **CHAP**.
- Step 7** Enter the user name and password provided by the service provider.
- Step 8** Click **Security / APP Visibility WAN Settings**.

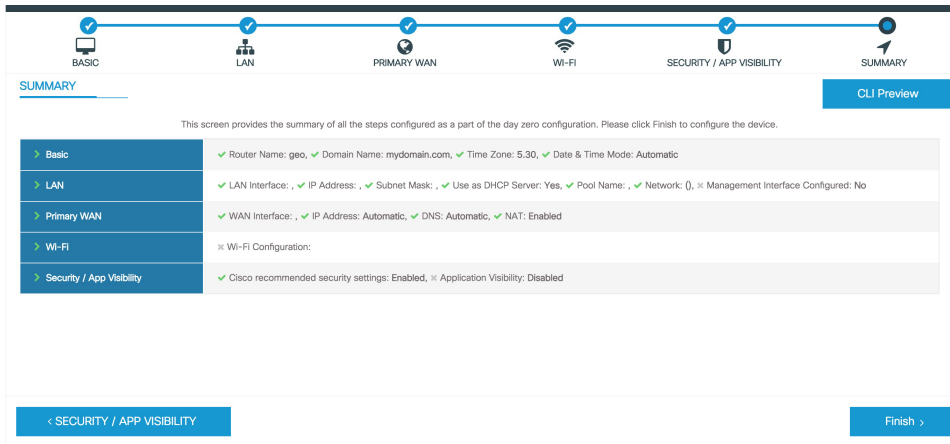
## Configure Secondary WAN Settings

For advanced configuration, you should configure the secondary WAN connection.

- Step 1** Select the secondary WAN type. You can configure Serial, 3G/4G, Ethernet, or Broadband (xDSL) as a secondary WAN depending on the WAN types supported by the router.
- Step 2** Select the interface from the drop-down list.
- Step 3** Check the **Get DNS Server info directly from ISP** check box to get the DNS server information directly from the service provider. You can also manually enter the Primary DNS and Secondary DNS.
- Step 4** Check the **Get IP automatically from ISP** check box to get the IP address information directly from the service provider. You can also manually enter the IP address and subnet mask.
- Step 5** Check the **Enable NAT** check box to enable NAT. It is recommended to enable NAT.
- Step 6** Check the **Enable PPPOE** check box to enable PPPoE. If you have enabled PPPoE, select the required authentication mode. The options are **PAP** and **CHAP**.
- Step 7** Enter the user name and password provided by the service provider.
- Step 8** Click **Security / APP Visibility WAN Settings**.

## Configure Security Settings

- Step 1** Check the **Enable Cisco Recommended Security Settings** check box to ensure that all passwords are not shown in plain text. The passwords are encrypted.
- Step 2** Click **Day 0 Config Summary**.
- Step 3** To preview the configuration, click **CLI Preview** to preview the configuration.
- Step 4** Click **Finish** to complete the Day Zero setup.



## Using Web User Interface for Day One Setup

To configure the Web user interface:

- Step 1** Configure the HTTP server. By default, the HTTP server configuration should be present on the device. Ensure the configuration by checking if the **ip http server** and **ip http secure-server** commands are present in the running configuration.

```
Device #configure terminal
Device (config)#ip http server
Device (config)#ip http secure-server
```

- Step 2** Set up the authentication options to log into Web UI. You can use one of these methods to authenticate:

- a) You can authenticate using local database. To use a local database for Web UI authentication, ensure to have the **ip http authentication local** command in the running configuration. This command is preconfigured on the device. If the command is not present, configure the device as shown in this example:

```
Device #configure terminal
Device (config)#ip http authentication local
```

**Note** You need a user with privilege 15 to access the configuration screens on Web UI. If the privilege is less than 15, you can access only the Dashboard and Monitoring screens on Web UI.

To create a user account, use the **username <username> privilege <privilege> password 0 <passwordtext>**

```
Device #configure terminal
Device (config)# username <username> privilege <privilege> password 0 <passwordtext>
```

- b) Authenticate using AAA options. To use AAA authentication for Web UI, ensure to configure 'ip http authentication aaa' on the device. Also, ensure that the required AAA server configuration is present on the device.

```
Device #configure terminal
Device (config)#ip http authentication local
```

- Step 3** Launch the browser. In the address bar, type the IP address of the device. For a secure connection, type `https://ip-address`.
- Step 4** Enter the default username (cisco) and password provided with the device
- Step 5** Click **Log In**.

## Monitor and Troubleshoot Device Plug and Play (PnP) Onboarding using WebUI

Table 18: Feature History

Feature Name	Release Information	Description
Monitor and Troubleshoot Device PnP Onboarding using WebUI	Cisco IOS XE Catalyst SD-WAN Release 17.5.1a	You can now monitor and troubleshoot your Day-0 device onboarding using WebUI through PnP onboarding. If the automated PnP onboarding fails, you can manually onboard your device.

A device can be automatically onboarded to Cisco vManage through either Zero Touch Provisioning (ZTP) or the Plug and Play (PnP) process. This section describes the procedure to monitor and troubleshoot device onboarding through the PnP method. This feature on WebUI enables you to monitor and troubleshoot the PnP onboarding process, and also see its real-time status. If this onboarding is stuck or fails, you can terminate the process and onboard your device manually.

### Prerequisites

- Your device (a computer that can run a web browser) running the WebUI and the device you are onboarding must be connected through an L2 switch port (NIM) on the device.
- The DHCP client-identifier on your device must be set to string “webui”.
- Your device must support Cisco SD-WAN Day-0 device onboarding on WebUI.

### Troubleshoot Device PnP Onboarding

To troubleshoot device onboarding through PnP in controller mode:

1. Enter the controller mode in WebUI:

- Switching from autonomous mode to controller mode:

Usually, when you boot your device for the first time it is in autonomous mode. Go to the URL <https://192.168.1.1/webui/> and log in using the default credentials— webui/cisco. If your device supports Cisco SD-WAN Day-0 device onboarding on WebUI, you can switch to the controller mode by selecting **Controller Mode**. A dialogue box appears, asking if you want to continue. Click **Yes**. Your device reloads to switch to controller mode.

- Booting your device in controller mode:

If your device is already in the controller mode, you do not have to make any changes to the mode. Go to the URL <https://192.168.1.1> or <https://192.168.1.1/webui>. If your device supports Cisco



SD-WAN Day-0 device onboarding on WebUI, the URL is redirected to <https://192.168.1.1/ciscosdwan/> and you can log in using the default credentials for Cisco IOS XE SD-WAN devices - admin/admin.



---

**Note** If the device does not have start-up configuration at the time of PnP onboarding, the WebUI is enabled by default on supported devices.

---

2. On the **Welcome to Cisco SDWAN Onboarding Wizard** page, click **Reset Default Password**.



---

**Note** The default password of your Day-0 device is weak. Therefore, for a secure log in, you must reset the password when you first log in to the device on WebUI. The WebUI configuration is automatically deleted after the device is onboarded successfully. In rare cases where the template configuration for your device on Cisco vManage has the WebUI configuration, it is not deleted even after a successful device onboarding.

---

3. You are redirected to the Device hardware and software details page. Enter your password and click **Submit**.
4. The next page displays the onboarding progress and lists statuses of different components of the PnP Connect Portal and Cisco SD-WAN controllers. If the PnP IPv4 component fails, it indicates that the device PnP onboarding has failed.  
  
To view and download logs for the onboarding process, click the information icon on the right hand side of the SDWAN Onboarding Progress bar.
5. If the automated PnP onboarding fails, click **Terminate Automated Onboarding**. This allows you to onboard your device manually.
6. A dialogue box appears. To continue with the termination, click **Yes**. It might take a few minutes for the termination to complete.
7. On the Bootstrap Configuration page click **Select File** and choose the bootstrap file for your device. This file can be either a generic bootstrap file (common platform-specific file) or a full configuration bootstrap file that you can download from Cisco SD-WAN Manager. This file must contain details such as the vBond number, UUID, WAN interface, root CA and configuration.
8. Click **Upload**.
9. After your file is successfully uploaded, click **Submit**.
10. You can see the SDWAN Onboarding Progress page again with statuses of the Cisco SD-WAN controllers. To open the Controller Connection History table click the information icon on the right hand side of the SDWAN Control Connections bar. In this table you can see the state of your onboarded device. After the onboarding is complete, the state of your device changes to **connect**.





## CHAPTER 7

# Console Port, Telnet, and SSH Handling

This chapter includes the following sections:

- [Notes and Restrictions for Console Port, Telnet, and SSH, on page 89](#)
- [Console Port Overview, on page 89](#)
- [Console Port Handling Overview, on page 90](#)
- [Configuring a Console Port Transport Map, on page 90](#)
- [Viewing Console Port and SSH Handling Configurations, on page 92](#)

## Notes and Restrictions for Console Port, Telnet, and SSH

- Telnet and Secure Shell (SSH) settings configured in the transport map override any other Telnet or SSH settings when the transport map is applied to the Ethernet management interface.
- Only local usernames and passwords can be used to authenticate users entering a Ethernet management interface. AAA authentication is not available for users accessing the device through a Ethernet management interface using persistent Telnet or persistent SSH.
- Applying a transport map to a Ethernet management interface with active Telnet or SSH sessions can disconnect the active sessions. Removing a transport map from an interface, however, does not disconnect any active Telnet or SSH session.
- Configuring the diagnostic and wait banners is optional, but recommended. The banners are especially useful as indicators to users about the status of their Telnet or SSH attempts.

## Console Port Overview

The console port on the device is an EIA/TIA-232 asynchronous, serial connection with no flow control and an RJ-45 connector. The console port is used to access the device and is located on the front panel of the Route Processor.

For information on accessing the device using the console port, see [Using Cisco IOS XE Software, on page 25](#).

# Console Port Handling Overview

If you are using the console port to access the router, you are automatically directed to the Cisco IOS command-line interface (CLI).

If you are trying to access the router through the console port and send a break signal (by entering **Ctrl-C** or **Ctrl-Shift-6**, or by entering the **send break** command at the Telnet prompt) before connecting to the CLI, you are directed to a diagnostic mode if the non-RPIOS subpackages are accessible. These settings can be changed by configuring a transport map for the console port and applying that transport map to the console interface.

## Configuring a Console Port Transport Map

This task describes how to configure a transport map for a console port interface on the device.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **transport-map type console** *transport-map-name*
4. **connection wait** [**allow** [**interruptible**] | **none** [**disconnect**]]
5. (Optional) **banner** [**diagnostic** | **wait**] *banner-message*
6. **exit**
7. **transport type console** *console-line-number* **input** *transport-map-name*

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b> <b>Example:</b>  Router> <b>enable</b>	Enables privileged EXEC mode.  Enter your password if prompted.
Step 2	<b>configure terminal</b> <b>Example:</b>  Router# <b>configure terminal</b>	Enters global configuration mode.
Step 3	<b>transport-map type console</b> <i>transport-map-name</i> <b>Example:</b>  Router(config)# <b>transport-map type console</b> <b>consolehandler</b>	Creates and names a transport map for handling console connections, and enters transport map configuration mode.
Step 4	<b>connection wait</b> [ <b>allow</b> [ <b>interruptible</b> ]   <b>none</b> [ <b>disconnect</b> ]]	Specifies how a console connection will be handled using this transport map.

	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>Router(config-tmap)# connection wait none</pre>	<ul style="list-style-type: none"> <li>• <b>allow interruptible</b>—The console connection waits for a Cisco IOS VTY line to become available, and also allows users to enter diagnostic mode by interrupting a console connection that is waiting for a Cisco IOS VTY line to become available. This is the default setting.</li> <li>• <b>none</b>—The console connection immediately enters diagnostic mode.</li> </ul> <p><b>Note</b> Users can interrupt a waiting connection by entering <b>Ctrl-C</b> or <b>Ctrl-Shift-6</b>.</p>
<b>Step 5</b>	<p>(Optional) <b>banner</b> [<b>diagnostic</b>   <b>wait</b>] <i>banner-message</i></p> <p><b>Example:</b></p> <pre>Router(config-tmap)# banner diagnostic X Enter TEXT message. End with the character 'X'. --Welcome to Diagnostic Mode-- X Router(config-tmap)#</pre>	<p>(Optional) Creates a banner message that will be seen by users entering diagnostic mode or waiting for the Cisco IOS VTY line because of the console transport map configuration.</p> <ul style="list-style-type: none"> <li>• <b>diagnostic</b>—Creates a banner message seen by users directed to diagnostic mode because of the console transport map configuration.</li> <li>• <b>wait</b>—Creates a banner message seen by users waiting for Cisco IOS VTY to become available.</li> <li>• <i>banner-message</i>—Banner message, which begins and ends with the same delimiting character.</li> </ul> <p><b>Note</b> Users can interrupt a waiting connection by entering <b>Ctrl-C</b> or <b>Ctrl-Shift-6</b>.</p>
<b>Step 6</b>	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>Router(config-tmap)# exit</pre>	<p>Exits transport map configuration mode to re-enter global configuration mode.</p>
<b>Step 7</b>	<p><b>transport type console</b> <i>console-line-number</i> <b>input</b> <i>transport-map-name</i></p> <p><b>Example:</b></p> <pre>Router(config)# transport type console 0 input consolehandler</pre>	<p>Applies the settings defined in the transport map to the console interface.</p> <p>The <i>transport-map-name</i> for this command must match the <i>transport-map-name</i> defined in the <b>transport-map type console</b> command.</p>

**Examples**

The following example shows how to create a transport map to set console port access policies and attach to console port 0:

```
Router(config)# transport-map type console consolehandler
Router(config-tmap)# connection wait allow interruptible
Router(config-tmap)# banner diagnostic X
```

```

Enter TEXT message. End with the character 'X'.
--Welcome to diagnostic mode--
X
Router(config-tmap)# banner wait X
Enter TEXT message. End with the character 'X'.
Waiting for IOS vty line
X
Router(config-tmap)# exit
Router(config)# transport type console 0 input consolehandler

```

## Viewing Console Port and SSH Handling Configurations

Use the following commands to view console port, SSH, and Telnet handling configurations:

- **show transport-map**
- **show platform software configuration access policy**

Use the **show transport-map** command to view transport map configurations.

**show transport-map** [**all** | **name** *transport-map-name* | **type** [**console** [**ssh** ]]

This command can be used either in user EXEC mode or privileged EXEC mode.

### Example

The following example shows transport maps that are configured on the device: a console port (*consolehandler*), persistent SSH (*sshhandler*), and persistent Telnet transport (*telnethandler*):

```

Router# show transport-map all
Transport Map:
Name: consolehandler
Type: Console Transport

Connection:
Wait option: Wait Allow Interruptable
Wait banner:

Waiting for the IOS CLI

bshell banner:

Welcome to Diagnostic Mode

Transport Map:
Name: sshhandler
Type: Persistent SSH Transport

Interface:
GigabitEthernet0/0/0

Connection:
Wait option: Wait Allow Interruptable
Wait banner:

Waiting for IOS prompt

Bshell banner:
Welcome to Diagnostic Mode

```

```
Router# show transport-map type console
```

```
Transport Map:
```

```
Name: consolehandler
```

```
Type: Console Transport
```

```
Connection:
```

```
Wait option: Wait Allow Interruptable
```

```
Wait banner:
```

```
Waiting for the IOS CLI
```

```
Bshell banner:
```

```
Welcome to Diagnostic Mode
```

```
Router# show transport-map type persistent ssh
```

```
Transport Map:
```

```
Name: sshhandler
```

```
Type: Persistent SSH Transport
```

```
Interface:
```

```
GigabitEthernet0
```

```
Connection:
```

```
Wait option: Wait Allow Interruptable
```

```
Wait banner:
```

```
Waiting for IOS prompt
```

```
Bshell banner:
```

```
Welcome to Diagnostic Mode
```

```
SSH:
```

```
Timeout: 120
```

```
Authentication retries: 5
```

```
RSA keypair: sshkeys
```

```
Router# show transport-map name consolehandler
```

```
Transport Map:
```

```
Name: consolehandler
```

```
Type: Console Transport
```

```
Connection:
```

```
Wait option: Wait Allow Interruptable
```

```
Wait banner:
```

```
Waiting for the IOS CLI
```

```
Bshell banner:
```

```
Welcome to Diagnostic Mode
```

Use the **show platform software configuration access policy** command to view the current configurations for handling the incoming console port, SSH, and Telnet connections. The output of this command provides the current wait policy for each type of connection (Telnet, SSH, and console), as well as information on the currently configured banners.

Unlike the **show transport-map** command, the **show platform software configuration access policy** command is available in diagnostic mode so that it can be entered in scenarios where you need transport map configuration information, but cannot access the Cisco IOS CLI.

### Example

```
Router# show platform software configuration access policy
The current access-policies

Method : telnet
Rule : wait
Shell banner:
Wait banner :

Method : ssh
Rule : wait
Shell banner:
Wait banner :

Method : console
Rule : wait with interrupt
Shell banner:
Wait banner :
```

### Example

The following example shows the **show platform software configuration access policy** command being issued both before and after a new transport map for SSH are configured. During the configuration, the connection policy and banners are set for a persistent SSH transport map, and the transport map for SSH is enabled.

```
Router# show platform software configuration access policy
The current access-policies

Method : telnet
Rule : wait with interrupt
Shell banner:
Welcome to Diagnostic Mode

Wait banner :
Waiting for IOS Process

Method : ssh
Rule : wait
Shell banner:
Wait banner :

Method : console
Rule : wait with interrupt
Shell banner:
Wait banner :

Router# configure terminal
```



```
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# transport-map type persistent ssh sshhandler
Router(config-tmap)# connection wait allow interruptible
Router(config-tmap)# banner diagnostic X
Enter TEXT message. End with the character 'X'.
Welcome to Diag Mode
X
Router(config-tmap)# banner wait X
Enter TEXT message. End with the character 'X'.
Waiting for IOS
X
Router(config-tmap)# rsa keypair-name sshkeys
Router(config-tmap)# transport interface gigabitethernet 1
Router(config-tmap)# exit
Router(config)# transport type persistent ssh input sshhandler
Router(config)# exit

Router# show platform software configuration access policy
The current access-policies

Method : telnet
Rule : wait with interrupt
Shell banner:
Welcome to Diagnostic Mode

Wait banner :
Waiting for IOS process

Method : ssh
Rule : wait with interrupt
Shell banner:
Welcome to Diag Mode

Wait banner :
Waiting for IOS

Method : console
Rule : wait with interrupt
Shell banner:
Wait banner :
```





## CHAPTER 8

# Installing the Software

This chapter includes the following sections:

- [Overview, on page 97](#)
- [ROMMON Images, on page 98](#)
- [Provisioning Files, on page 98](#)
- [File Systems, on page 98](#)
- [Autogenerated File Directories and Files, on page 99](#)
- [Flash Storage, on page 100](#)
- [Configuring the Configuration Register for Autoboot, on page 100](#)
- [How to Install and Upgrade the Software, on page 101](#)
- [Installing the Software Using install Commands, on page 106](#)
- [Managing and Configuring a Device to Run Using Individual Packages, on page 129](#)
- [Upgrading the Firmware on NIMs, on page 136](#)
- [Installing a Firmware Subpackage, on page 145](#)
- [Configuring No Service Password-Recovery, on page 151](#)

## Overview

Installing software on the router involves installing a consolidated package (bootable image). This consists of a bundle of subpackages (modular software units), with each subpackage controlling a different set of functions.

These are the two main methods to install the software:

- [Managing and Configuring a Device to Run Using a Consolidated Package, on page 101](#)—This method allows for individual upgrade of subpackages and generally has reduced boot times compared to the method below. Use this method if you want to individually upgrade a module's software.
- [Managing and Configuring a Device to Run Using Individual Packages, on page 129](#)—This a simple method that is similar to a typical Cisco router image installation and management that is supported across Cisco routers.

It is better to upgrade software in a planned period of maintenance when an interruption in service is acceptable. The router needs to be rebooted for a software upgrade to take effect.

## ROMMON Images

A ROMMON image is a software package used by ROM Monitor (ROMMON) software on a router. The software package is separate from the consolidated package normally used to boot the router. For more information on ROMMON, see [Hardware Installation Guide for the Cisco Catalyst 8000 Series Edge Platforms](#).

An independent ROMMON image (software package) may occasionally be released and the router can be upgraded with the new ROMMON software. For detailed instructions, see the documentation that accompanies the ROMMON image.




---

**Note** A new version of the ROMMON image is not necessarily released at the same time as a consolidated package for a router.

---

## Provisioning Files

This section provides background information about the files and processes used in [Managing and Configuring a Device to Run Using Individual Packages](#), on page 129.

The consolidated package on a device consists of a collection of subpackages and a provisioning file titled `packages.conf`. To run the software, the usual method used is to boot the consolidated package, which is copied into memory, expanded, mounted, and run within memory. The provisioning file's name can be renamed but subpackage file's names cannot be renamed. The provisioning file and subpackage files must be kept in the same directory. The provisioning file does not work properly if any individual subpackage file is contained within a different directory.




---

**Note** An exception to this is that if a new or upgraded module firmware package is subsequently installed, it need not be in the same directory as the provisioning file.

---

Configuring a device to boot, using the provisioning file `packages.conf`, is beneficial because no changes have to be made to the boot statement after the Cisco IOS XE software is upgraded.

## File Systems

The following table provides a list of file systems that can be seen on the Cisco Catalyst 8000 Series Edge Platform.

**Table 19: Device File Systems**

File System	Description
bootflash:	Boot flash memory file system.
flash:	Alias to the boot flash memory file system above.

File System	Description
harddisk:	Hard disk file system (NVME-M2-600G or USB-M2-16G or USB-M2-32G with the CLI command harddisk).
cns:	Cisco Networking Services file directory.
nvrnram:	Device NVRAM. You can copy the startup configuration to NVRAM or from NVRAM.
obfl:	File system for Onboard Failure Logging (OBFL) files.
system:	System memory file system, which includes the running configuration.
tar:	Archive file system.
tmpsys:	Temporary system files file system.
usb0: USB 3.0 Type-A usb1: USB 3.0 Type-B	The Universal Serial Bus (USB) flash drive file systems. <b>Note</b> The USB flash drive file system is visible only if a USB drive is installed in usb0: or usb1: ports.

Use the ? help option, or use the **copy** command in command reference guides, if you find a file system that is not listed in the table above.

## Autogenerated File Directories and Files

This section discusses the autogenerated files and directories that can be created, and how the files in these directories can be managed.

**Table 20: Autogenerated Files**

File or Directory	Description
crashinfo files	Crashinfo files may appear in the bootflash: file system. These files provide descriptive information of a crash and may be useful for tuning or troubleshooting purposes. However, the files are not part of device operations, and can be erased without impacting the functioning of the device.
core directory	The storage area for .core files. If this directory is erased, it will automatically regenerate itself at bootup. The .core files in this directory can be erased without impacting any device 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 device.

File or Directory	Description
tracelogs directory	<p>The storage area for trace files.</p> <p>Trace files are useful for troubleshooting. If the Cisco IOS process fails, for instance, users or troubleshooting personnel can access trace files using diagnostic mode to gather information related to the Cisco IOS failure.</p> <p>Trace files, however, are not a part of device operations, and can be erased without impacting the device's performance.</p>

### Important Notes About Autogenerated Directories

Important information about autogenerated directories include:

- Autogenerated files on the bootflash: directory should not be deleted, renamed, moved, or altered in any way unless directed by Cisco customer support.



**Note** Altering autogenerating files on the bootflash: may have unpredictable consequences for system performance.

- Crashinfo, core, and trace files can be deleted.

## Flash Storage

Subpackages are installed to local media storage, such as flash. For flash storage, use the **dir bootflash:** command to list the file names.



**Note** Flash storage is required for successful operation of a device.

## Configuring the Configuration Register for Autoboot

The configuration register can be used to change behavior. This includes controlling how the device boots. Set the configuration register to 0x0 to boot into ROM, by using one of the following commands:

- In Cisco IOS configuration mode, use the **config-reg 0x0** command.
- From the ROMMON prompt, use the **confreg 0x0** command.

For more information about the configuration register, see [Use of the Configuration Register on All Cisco Routers](#).



**Note** Setting the configuration register to 0x2102 will set the device to autoboot the Cisco IOS XE software.



**Note** The console baud rate is set to 9600 after changing the **confreg** to 0x2102 or 0x0. If you cannot establish a console session after setting **confreg**, or garbage output appears, change the setting on your terminal emulation software to 9600.

## How to Install and Upgrade the Software

To install or upgrade the software, use one of the following methods to use the software from a consolidated package or an individual package. Also see the overview section.

- [Managing and Configuring a Device to Run Using a Consolidated Package, on page 101](#)
- [Managing and Configuring a Device to Run Using Individual Packages, on page 129](#)

## Managing and Configuring a Device to Run Using a Consolidated Package



**Note** Do not use these procedures if you also need to install any optional subpackages or plan to upgrade individual subpackages. See [Managing and Configuring a Device to Run Using Individual Packages, on page 129](#).

- [Managing and Configuring a Consolidated Package Using Copy and Boot Commands, on page 101](#)
- [Configuring a Device to Boot the Consolidated Package via TFTP Using the Boot Command: Example, on page 103](#)

## Managing and Configuring a Consolidated Package Using Copy and Boot Commands

To upgrade a consolidated package, copy the consolidated package to the **bootflash:** directory on the router using the **copy** command. After making this copy of the consolidated package, configure the router to boot using the consolidated package file.

The following example shows the consolidated package file being copied to the **bootflash:** file system via TFTP. The config register is then set to boot using **boot system** commands, and the **boot system** commands instruct the router to boot using the consolidated package stored in the **bootflash:** file system. The new configuration is then saved using the **copy running-config startup-config** command, and the system is then reloaded to complete the process.

```
Router# dir bootflash:
Directory of bootflash:/

81921   drwx           237568   Jul  8 2020 11:17:27 -07:00  tracelogs
98305   drwx           4096     Jun 24 2020 17:26:48 -07:00  license_evlog
237569  drwx           4096     Jun 24 2020 17:26:48 -07:00  core
131073  drwx           4096     Jun 24 2020 17:26:45 -07:00  onep
16      -rw-            30      Jun 24 2020 17:26:38 -07:00  throughput_monitor_params
13      -rw-          134458   Jun 24 2020 17:26:37 -07:00  memleak.tcl
401409  drwx           4096     Jun 24 2020 17:26:23 -07:00  .dbpersist
15      -rwx           1314    Jun 24 2020 17:26:21 -07:00  trustidrootx3_ca.ca
14      -rw-          20109   Jun 24 2020 17:26:21 -07:00  ios_core.p7b
73729   drwx           4096     Jun 24 2020 17:26:19 -07:00  gs_script
```





```
[OK]
Router# reload
```

## Configuring a Device to Boot the Consolidated Package via TFTP Using the Boot Command: Example

```
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#boot system
tftp://10.81.116.4/auto/cebu-tftpboot/test/release/rommon/bin/test-17-3-2r
Router(config)#config-register 0x2102
Router(config)#exit
Router#
*Jul  7 01:43:52.098: %SYS-5-CONFIG_I: Configured from console by console
Router#show run | include boot
boot-start-marker
boot system bootflash:c8000be-universalk9.17.03.01prd14.SPA.bin
boot system tftp://10.81.116.4/auto/mcebu-tftpboot/test/release/rommon/bin/test-17-3-1r
boot-end-marker
license boot level network-essentials
diagnostic bootup level minimal
Router#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Router#reload
Proceed with reload? [confirm]

*Jul  7 01:55:28.639: %SYS-5-RELOAD:
Reload requested by console. Reload Reason: Reload Command.Jul  7 01:55:36.715:
%PMAN-5-EXITACvp: Process manager is exiting: process exit with reload chassis code
Initializing Hardware ...

Checking for PCIe device presence...done
System integrity status: 0x610
Rom image verified correctly

System Bootstrap, Version 1RU-20191104, DEVELOPMENT SOFTWARE
Copyright (c) 1994-2019 by cisco Systems, Inc.

Current image running: Boot ROM1

Last reset cause: LocalSoft
C8300-1N1S-6T platform with 8388608 Kbytes of main memory

.....
Located c8000be-universalk9.17.03.01prd14.SPA.bin

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

Package header rev 3 structure detected
IsoSize = 655712256
```

```
Calculating SHA-1 hash...Validate package: SHA-1 hash:
  calculated DF67D179:DAB875C9:D61FB9E7:2E25B30B:48E86BFC
  expected   DF67D179:DAB875C9:D61FB9E7:2E25B30B:48E86BFC
RSA Signed RELEASE Image Signature Verification Successful.
Image validated
```

```
RSA Signed RELEASE Image Signature Verification Successful.
Image validated
Jul  7 01:58:19.327: %BOOT-5-OPMODE_LOG: R0/0: bins: System booted in AUTONOMOUS mode
```

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Cisco Systems, Inc.  
170 West Tasman Drive  
San Jose, California 95134-1706

```
Cisco IOS Software [Amsterdam], c8000be Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version
  17.3.lprd8, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2020 by Cisco Systems, Inc.
Compiled Tue 19-May-20 12:00 by mcpre
```

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```
All TCP AO KDF Tests Pass
cisco C8300-1N1S-6T (1RU) processor with 3763047K/6147K bytes of memory.
Processor board ID FDO2320A0CF
Router operating mode: Autonomous
6 Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
```

```

8388608K bytes of physical memory.
7090175K bytes of flash memory at bootflash:.
28884992K bytes of M.2 USB at harddisk:.

  Dspfarm profile 7 :: No resource, check voice card or dspfarm service is not configured
Press RETURN to get started!
Router>show version
Cisco IOS XE Software, Version 17.03.01prd8
Cisco IOS Software [Amsterdam], c8000be Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version
  17.3.1prd8, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2020 by Cisco Systems, Inc.
Compiled Tue 19-May-20 12:00 by mcpre

```

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ROM: (c)

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A summary of U.S. laws governing Cisco cryptographic products may be found at: <http://www.cisco.com/wvl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to [export@cisco.com](mailto:export@cisco.com).

Technology Package License Information:

Technology Package License Information:

```

-----
Technology      Type          Technology-package Current  Technology-package Next Reboot
-----
Smart License  Perpetual    network-essentials network-essentials
Smart License  Subscription None                None

```

The current crypto throughput level is 1000000 kbps

```

cisco C8300-1N1S-6T (1RU) processor with 3763047K/6147K bytes of memory.
Processor board ID FDO2320ACF
Router operating mode: Autonomous
6 Gigabit Ethernet interfaces

```

```
32768K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
7090175K bytes of flash memory at bootflash:.
28884992K bytes of M.2 USB at harddisk:.
```

```
Configuration register is 0x2102
```

## Installing the Software Using install Commands

From Cisco IOS XE Cupertino 17.7.1a, Cisco Catalyst 8000 Edge platforms are shipped in install mode by default. Users can boot the platform, and upgrade or downgrade to Cisco IOS XE software versions using a set of **install** commands.

## Restrictions for Installing the Software Using install Commands

- 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 Cupertino 17.7.1a 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 Catalyst 8000 Edge platforms.

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

**Table 21: 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. <b>Note</b> 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: #boot system file <filename>	CLI: #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 <b>install</b> 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.

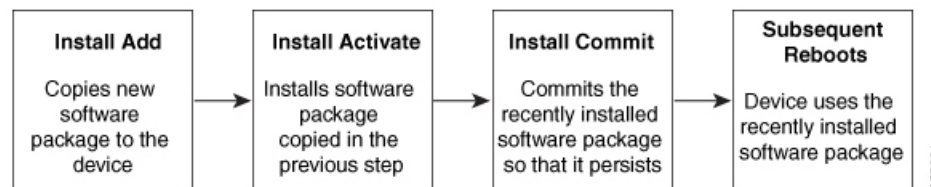
Bundle Mode	Install Mode
Rollback: Rollback to the previous image with multiple Software Maintenance Updates (SMUs) may require multiple reloads.	Rollback: Enables rollback to an earlier version of Cisco IOS XE software, including multiple patches in single reload.

## 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 following flow chart explains the install process with **install** commands:

Process with Install Commit



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.

The following set of install commands is available:

Table 22: List of install Commands

Command	Syntax	Purpose
<b>install add</b>	<b>install add file</b> <i>location:filename.bin</i>	<p>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:</p> <ul style="list-style-type: none"> <li>• Validates the file-checksum, platform compatibility checks, and so on.</li> <li>• Extracts individual components of the package into subpackages and packages.conf</li> <li>• Copies the image into the local inventory and makes it available for the next steps.</li> </ul>
<b>install activate</b>	<b>install activate</b>	<p>Activates the package added using the <b>install add</b> command.</p> <ul style="list-style-type: none"> <li>• Use the <b>show install summary</b> command to see which image is inactive. This image will get activated.</li> <li>• System reloads on executing this command. Confirm if you want to proceed with the activation. Use this command with the <b>prompt-level none</b> keyword to automatically ignore any confirmation prompts.</li> </ul>

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

Command	Syntax	Purpose
<b>install abort</b>	<b>install abort</b>	<p>Terminates the installation and returns the system to the last-committed state.</p> <ul style="list-style-type: none"> <li>• This command is applicable only when the package is in activated status (uncommitted state).</li> <li>• If you have already committed the image using the <b>install commit</b> command, use the <b>install rollback to</b> command to return to the preferred version.</li> </ul>
<b>install remove</b>	<b>install remove {file &lt;filename&gt;   inactive}</b>	<p>Deletes inactive packages from the platform repository. Use this command to free up space.</p> <ul style="list-style-type: none"> <li>• <b>file</b>: Removes specified files.</li> <li>• <b>inactive</b>: Removes all the inactive files.</li> </ul>
<b>install rollback to</b>	<b>install rollback to {base   label   committed   id}</b>	<p>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:</p> <ul style="list-style-type: none"> <li>• Requires reload.</li> <li>• Is applicable only when the package is in committed state.</li> <li>• Use this command with the <b>prompt-level none</b> keyword to automatically ignore any confirmation prompts.</li> </ul> <p><b>Note</b> 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.</p>



Command	Syntax	Purpose
<b>install deactivate</b>	<b>install deactivate file</b> <filename>	Removes a package from the platform repository. This command is supported only for SMUs. <ul style="list-style-type: none"> <li>Use this command with the <b>prompt-level none</b> keyword to automatically ignore any confirmation prompts.</li> </ul>

The following show commands are also available:

**Table 23: List of show Commands**

Command	Syntax	Purpose
<b>show install log</b>	<b>show install log</b>	Provides the history and details of all install operations that have been performed since the platform was booted.
<b>show install package</b>	<b>show install package</b> <filename>	Provides details about the .pkg/.bin file that is specified.
<b>show install summary</b>	<b>show install summary</b>	Provides an overview of the image versions and their corresponding install states for all the FRUs. <ul style="list-style-type: none"> <li>The table that is displayed will state for which FRUs this information is applicable.</li> <li>If all the FRUs are in sync in terms of the images present and their state, only one table is displayed.</li> <li>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.</li> </ul>
<b>show install active</b>	<b>show install active</b>	Provides information about the active packages for all the FRUs. 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
<b>show install inactive</b>	<b>show install inactive</b>	Provides information about the inactive packages, if any, for all the FRUs.  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.
<b>show install committed</b>	<b>show install committed</b>	Provides information about the committed packages for all the FRUs.  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.
<b>show install uncommitted</b>	<b>show install uncommitted</b>	Provides information about uncommitted packages, if any, for all the FRUs.  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.
<b>show install rollback</b>	<b>show install rollback {point-id   label}</b>	Displays the package associated with a saved installation point.
<b>show version</b>	<b>show version [rp-slot] [installed   user-interface]   provisioned   running]</b>	Displays information about the current package, along with hardware and platform information.

## Booting 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

	Command or Action	Purpose
Step 1	<b>enable</b> <b>Example:</b> Device>enable	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	<b>install add file location: <i>filename</i> [activate commit]</b> <b>Example:</b> Device#install add file boot flash:c8000e-universalk9_HDD_V17_THR0TTL_LATEST_20211021_031123_V17_7_0_117.SSA.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.  The platform reloads after this command is run.
Step 3	<b>exit</b> <b>Example:</b> 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

	Command or Action	Purpose
Step 1	<b>enable</b> <b>Example:</b> Device>enable	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	<b>install add file location:</b> <i>filename</i> <b>Example:</b> Device#install add file bootflash:c8000e-universalk9-ED_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.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	<b>show install summary</b> <b>Example:</b> 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	<b>install activate</b> [ <b>auto-abort-timer</b> <time>] <b>Example:</b> Device# install activate auto-abort-timer 120	Activates the previously added package and reloads the platform. <ul style="list-style-type: none"> <li>• When doing a full software install, do not provide a package filename.</li> <li>• In the three-step variant, <b>auto-abort-timer</b> starts automatically with the <b>install activate</b> command; the default for the timer is 120 minutes. If the <b>install commit</b> 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.</li> </ul>
Step 5	<b>install abort</b> <b>Example:</b> Device#install abort	(Optional) Terminates the software install activation and returns the platform to the last committed version. <ul style="list-style-type: none"> <li>• Use this command only when the image is in activated state, and not when the image is in committed state.</li> </ul>
Step 6	<b>install commit</b> <b>Example:</b> Device#install commit	Commits the new package installation and makes the changes persistent over reloads.
Step 7	<b>install rollback to committed</b> <b>Example:</b> Device#install rollback to committed	(Optional) Rolls back the platform to the last committed state.
Step 8	<b>install remove</b> {file filesystem: filename   inactive} <b>Example:</b> Device#install remove inactive	(Optional) Deletes software installation files. <ul style="list-style-type: none"> <li>• <b>file</b>: Deletes a specific file</li> <li>• <b>inactive</b>: Deletes all the unused and inactive installation files.</li> </ul>
Step 9	<b>show install summary</b> <b>Example:</b> Device#show install summary	(Optional) Displays information about the current state of the system. The output of this command varies according to the <b>install</b> commands run prior to this command.
Step 10	<b>exit</b> <b>Example:</b> Device#exit	Exits privileged EXEC mode and returns to user EXEC mode.

## Upgrading in Install Mode

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

## Downgrading 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.

## Terminating 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

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

```
Router# install add file
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bin
  activate commit
install_add_activate_commit: START Thu Oct 28 21:57:21 UTC 2021

System configuration has been modified.
Press Yes(y) to save the configuration and proceed.
Press No(n) for proceeding without saving the configuration.
Press Quit(q) to exit, you may save configuration and re-enter the command. [y/n/q]y
Building configuration...

[OK]Modified configuration has been saved

*Oct 28 21:57:39.818: %SYS-6-PRIVCFG_ENCRYPT_SUCCESS: Successfully encrypted private config
file
*Oct 28 21:57:39.925: %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started install
one-shot
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bininstall_add_activate_commit:
Adding PACKAGE
install_add_activate_commit: Checking whether new add is allowed ....

--- Starting Add ---
Performing Add on Active/Standby
```

```

[1] Add package(s) on R0
[1] Finished Add on R0
Checking status of Add on [R0]
Add: Passed on [R0]
Finished Add

Image added. Version: 17.07.01.0.1515
install_add_activate_commit: Activating PACKAGE
Following packages shall be activated:
/bootflash/c8000be-rpboot.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-mono-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_sm_nim_adpt.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_sm_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_sm_async.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_sm_lt3e3.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_sm_10g.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_xdsl.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_ssd.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_shdsl.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_cwan.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_bri_st_fw.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_nim_async.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_ngwic_tle1.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_dsp_tilegx.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_dsp_analogbri.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
/bootflash/c8000be-firmware_dreamliner.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg

This operation may require a reload of the system. Do you want to proceed? [y/n]
--- Starting Activate ---
Performing Activate on Active/Standby

*Oct 28 22:05:49.484: %INSTALL-5-INSTALL_AUTO_ABORT_TIMER_PROGRESS: R0/0: rollback_timer:
Install auto abort timer will expire in 7200 seconds [1] Activate package(s) on R0
[1] Finished Activate on R0
Checking status of Activate on [R0]
Activate: Passed on [R0]
Finished Activate

--- Starting Commit ---
Performing Commit on Active/Standby
[1] Commit package(s) on R0

Building configuration...
[1] Finished Commit on R0
Checking status of Commit on [R0]
Commit: Passed on [R0]
Finished Commit

[OK]
*Oct 28 22:06:55.375: %SYS-6-PRIVCFG_ENCRYPT_SUCCESS: Successfully encrypted private config
fileSend model notification for install_add_activate_commit before reload
Install will reload the system now!
SUCCESS: install_add_activate_commit Thu Oct 28 22:07:22 UTC 2021

Router#
*Oct 28 22:07:22.661: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install one-shot PACKAGE
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.binOct
28 22:07:26.864: %PMAN-5-EXITACTION: R0/0: pvp: Process manager is exiting: reload action
requested

```

□

Press RETURN to get started!

The following is an example of the three-step installation:

```
Router# install add file
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bin

install_add: START Thu Oct 28 22:36:43 UTC 2021

*Oct 28 22:36:44.526: %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started install
add
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bininstall_add:
Adding PACKAGE
install_add: Checking whether new add is allowed ....

--- Starting Add ---
Performing Add on Active/Standby
  [1] Add package(s) on R0
  [1] Finished Add on R0
Checking status of Add on [R0]
Add: Passed on [R0]
Finished Add

Image added. Version: 17.07.01.0.1601
SUCCESS: install_add Thu Oct 28 22:40:25 UTC 2021

Router#
*Oct 28 22:40:25.971: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install add PACKAGE
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bin

Router# 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
[0|install_op_boot(INFO, )]: cleanup_trap remote_invocation 0 operation install_op_boot
.. 0 .. 0
[1|display_install_log]: START Thu Oct 28 22:12:11 UTC 2021
[2|install_add]: START Thu Oct 28 22:36:43 UTC 2021
[2|install_add(INFO, )]: Set INSTALL_TYPE to PACKAGE
[2|install_add(CONSOLE, )]: Adding PACKAGE
[2|install_add(CONSOLE, )]: Checking whether new add is allowed ....
[2|install_add(INFO, )]: check_add_op_allowed: Install type PACKAGE
[remote|install_add]: START Thu Oct 28 22:37:12 UTC 2021
[remote|install_add]: END SUCCESS Thu Oct 28 22:40:10 UTC 2021
[remote|install_add(INFO, )]: cleanup_trap remote_invocation 1 operation install_add .. 0
.. 0
[2|install_add(INFO, )]: Remote output from R0
[2|install_add(INFO, )]: install_add: START Thu Oct 28 22:37:12 UTC 2021
Expanding image file:
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bin
Verifying parameters
Expanding superpackage
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.bin
... parameters verified
Validating package type
... package type validated
Copying package files
c8000be-firmware_dreamliner.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
```



```

c8000be-firmware_dsp_analogbri.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_dsp_tilegx.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_ngwic_tle1.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_nim_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

c8000be-firmware_nim_bri_st_fw.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_nim_cwan.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_nim_shdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

c8000be-firmware_nim_ssd.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_nim_xdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_sm_10g.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_sm_1t3e3.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_sm_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

c8000be-firmware_sm_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-firmware_sm_nim_adpt.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

c8000be-mono-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
c8000be-rpboot.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
WARNING: A different version of provisioning file packages.conf already exists in bootflash:

WARNING: The provisioning file from the expanded bundle will be saved as
WARNING: bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211027_0.conf
... package files copied
SUCCESS: Finished expanding all-in-one software package.
Image file expanded
SUCCESS: install_add Thu Oct 28 22:40:10 UTC 2021
[2|install_add]: END SUCCESS Thu Oct 28 22:40:25 UTC 2021
[2|install_add(INFO, )]: cleanup_trap remote_invocation 0 operation install_add .. 0 .. 0
[3|COMP_CHECK]: START Thu Oct 28 22:40:26 UTC 2021
[3|COMP_CHECK]: END FAILED exit(1) Thu Oct 28 22:40:27 UTC 2021
[3|COMP_CHECK(INFO, )]: cleanup_trap remote_invocation 0 operation COMP_CHECK .. 1 .. 1
[4|install_activate]: START Thu Oct 28 22:42:53 UTC 2021
[4|install_activate(INFO, require user prompt)]: install_cli
[4|install_activate(CONSOLE, )]: Activating PACKAGE
[4|install_activate(INFO, )]: Acquiring transaction lock...
[4|install_activate(INFO, )]: global_trans_lock:
/bootflash/.installer/install_global_trans_lock
[4|install_activate(INFO, )]: tmp_global_trans_lock: /tmp/tmp_install_global_trans_lock
[4|install_activate(INFO, )]: tmp lock does not exist: /tmp/tmp_install_global_trans_lock
[4|install_activate(INFO, )]: global_trans_lock:
/bootflash/.installer/install_global_trans_lock
[4|install_activate(INFO, )]: tmp_global_trans_lock: /tmp/tmp_install_global_trans_lock
[4|install_activate(INFO, )]: local_trans_lock: /bootflash/.installer/install_local_trans_lock
[4|install_activate(INFO, )]: global_trans_lock:
/bootflash/.installer/install_global_trans_lock
[4|install_activate(INFO, )]: validate_lock: lock_duration is 7200
[4|install_activate(INFO, )]: install type stored in lock PACKAGE, install type PACKAGE,
install operation install_activate
[4|install_activate(INFO, )]: lock duration: 7200
[4|install_activate(INFO, )]: extend trans lock done.
/bootflash/.installer/install_global_trans_lock
[4|install_activate(INFO, require user prompt)]: install_cli

```

```
[4|install_activate( FATAL)]: Cannot proceed activate because of user input
[4|install_activate(INFO, )]: cleanup_trap remote_invocation 0 operation install_activate
.. 6 .. 0
[5|install_add]: START Thu Oct 28 22:45:48 UTC 2021
[5|install_add(INFO, )]: Set INSTALL_TYPE to PACKAGE
[5|install_add(CONSOLE, )]: Adding PACKAGE
[5|install_add(CONSOLE, )]: Checking whether new add is allowed ....
[5|install_add(INFO, )]: check_add_op_allowed: Install type PACKAGE
[5|install_add( FATAL)]: Super package already added. Add operation not allowed. install
remove inactive can be used to discard added packages
```

```
Router# install activate
install_activate: START Thu Oct 28 23:57:57 UTC 2021
install_activate: Activating PACKAGE
```

```
*Oct 28 23:57:57.823: %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started install
activateFollowing packages shall be activated:
/bootflash/c8000be-rpboot.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-mono-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_sm_nim_adpt.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_sm_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_sm_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_sm_lt3e3.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_sm_10g.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_xdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_ssd.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_shdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_cwan.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_bri_st_fw.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_nim_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_ngwic_tle1.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_dsp_tilegx.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_dsp_analogbri.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
/bootflash/c8000be-firmware_dreamliner.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
```

```
This operation may require a reload of the system. Do you want to proceed? [y/n]
--- Starting Activate ---
Performing Activate on Active/Standby
```

```
*Oct 29 00:04:19.400: %INSTALL-5-INSTALL_AUTO_ABORT_TIMER_PROGRESS: R0/0: rollback_timer:
Install auto abort timer will expire in 7200 seconds [1] Activate package(s) on R0
--- Starting list of software package changes ---
Old files list:
Modified
c8000be-firmware_dreamliner.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_dsp_analogbri.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_dsp_tilegx.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_ngwic_tle1.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_nim_async.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_nim_bri_st_fw.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_nim_cwan.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
```

```
Modified
c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_nim_shdsl.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_nim_ssd.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_nim_xdsl.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_sm_10g.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_sm_1t3e3.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_sm_async.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-firmware_sm_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg

Modified
c8000be-firmware_sm_nim_adpt.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified
c8000be-mono-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Modified c8000be-rpboot.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
New files list:
Added
c8000be-firmware_dreamliner.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_dsp_analogbri.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

Added
c8000be-firmware_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_dsp_tilegx.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_ngwic_t1e1.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_nim_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_nim_bri_st_fw.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

Added
c8000be-firmware_nim_cwan.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_nim_shdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_nim_ssd.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_nim_xdsl.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_sm_10g.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_sm_1t3e3.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_sm_async.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
Added
c8000be-firmware_sm_dsp_sp2700.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg

Added
c8000be-firmware_sm_nim_adpt.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
```

```

    Added
c8000be-mono-universalk9.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
    Added c8000be-rpboot.BLD_V177_THROTTLE_LATEST_20211027_030841_V17_7_0_120.SSA.pkg
    Finished list of software package changes
[1] Finished Activate on R0
Checking status of Activate on [R0]
Activate: Passed on [R0]
Finished Activate

Send model notification for install_activate before reload
Install will reload the system now!
SUCCESS: install_activate  Fri Oct 29 00:05:09 UTC 2021

Router#
*Oct 29 00:05:09.504: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install activate PACKAGEOct 29 00:05:14.494: %PMAN-5-EXITACTION: R0/0: pvp: Process manager
is exiting: reload action requested

Initializing Hardware ...

Checking for PCIe device presence...done
System integrity status: 0x610

System Bootstrap, Version 17.3(4.1r), RELEASE SOFTWARE
Copyright (c) 1994-2021 by cisco Systems, Inc.

Current image running   : Boot ROM1
Last reset cause       : LocalSoft
C8300-2N2S-6T platform with 8388608 Kbytes of main memory

□

Press RETURN to get started!

□

Router# install commit
install_commit: START Fri Oct 29 00:13:58 UTC 2021
install_commit: Committing PACKAGE

--- Starting Commit ---
Performing Commit on Active/Standby

*Oct 29 00:13:59.552: %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started install
commit [1] Commit package(s) on R0
[1] Finished Commit on R0
Checking status of Commit on [R0]
Commit: Passed on [R0]
Finished Commit

SUCCESS: install_commit  Fri Oct 29 00:14:03 UTC 2021

Router#
*Oct 29 00:14:03.712: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install commit PACKAGE

```

The following is an example of downgrading in install mode:

```

ROUTER# install activate file bootflash:c8000be-universalk9.17.06.01a.SPA.bin activate
commit

install_add_activate_commit: START Fri Dec 10 18:07:17 GMT 2021

```

```

*Dec 10 18:07:18.405 GMT: %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started
install one-shot bootflash:c8000be-universalk9.17.06.01a.SPA.bininstall_add_activate_commit:
  Adding PACKAGE
install_add_activate_commit: Checking whether new add is allowed ....

--- Starting Add ---
Performing Add on Active/Standby
  [1] Add package(s) on R0
  [1] Finished Add on R0
Checking status of Add on [R0]
Add: Passed on [R0]
Finished Add

Image added. Version: 17.06.01a.0.298
install_add_activate_commit: Activating PACKAGE
Following packages shall be activated:
/bootflash/c8000be-rpboot.17.06.01a.SPA.pkg
/bootflash/c8000be-mono-universalk9.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_sm_nim_adpt.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_sm_dsp_sp2700.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_sm_async.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_sm_lt3e3.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_sm_10g.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_prince.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_xdsl.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_ssd.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_shdsl.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_ge.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_cwan.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_bri_st_fw.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_nim_async.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_ngwic_tle1.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_dsp_tilegx.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_dsp_sp2700.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_dsp_analogbri.17.06.01a.SPA.pkg
/bootflash/c8000be-firmware_dreamliner.17.06.01a.SPA.pkg

This operation may require a reload of the system. Do you want to proceed? [y/n]
--- Starting Activate ---
Performing Activate on Active/Standby
  [1] Activate package(s) on R0
  [1] Finished Activate on R0
Checking status of Activate on [R0]
Activate: Passed on [R0]
Finished Activate

--- Starting Commit ---
Performing Commit on Active/Standby
  [1] Commit package(s) on R0
Building configuration...

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

[OK]
*Dec 10 18:14:57.782 GMT: %SYS-6-PRIVCFG_ENCRYPT_SUCCESS: Successfully encrypted private
config fileSend model notification for install_add_activate_commit before reload
/usr/binos/conf/install_util.sh: line 164: /bootflash/.prst_sync/reload_info: No such file
or directory
/usr/binos/conf/install_util.sh: line 168: /bootflash/.prst_sync/reload_info: No such file
or directory
cat: /bootflash/.prst_sync/reload_info: No such file or directory

```

```

Install will reload the system now!
SUCCESS: install_add_activate_commit  Fri Dec 10 18:15:23 GMT 2021

ROUTER#
*Dec 10 18:15:23.955 GMT: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install one-shot PACKAGE bootflash:c8000be-universalk9.17.06.01a.SPA.binDec 10 18:15:27.708:
%PMAN-5-EXITACTION: R0/0: pvp: Process manager is exiting: reload action requested

Initializing Hardware ...

Checking for PCIe device presence...done
System integrity status: 0x610
Rom image verified correctly

System Bootstrap, Version 17.3(5r), RELEASE SOFTWARE
Copyright (c) 1994-2021 by cisco Systems, Inc.

Current image running: Boot ROM0

Last reset cause: LocalSoft
ROUTER platform with 8388608 Kbytes of main memory

□

Press RETURN to get started!

□

ROUTER#
ROUTER# show version
Cisco IOS XE Software, Version 17.06.01a
Cisco IOS Software [Bengaluru], c8000be Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version
17.6.1a, RELEASE SOFTWARE (fc2)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2021 by Cisco Systems, Inc.
Compiled Sat 21-Aug-21 03:27 by mcpre

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software code licensed under GPL Version 2.0 is free software that comes
with ABSOLUTELY NO WARRANTY. You can redistribute and/or modify such
GPL code under the terms of GPL Version 2.0. For more details, see the
documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
software.

ROM: 17.3(5r)

ROUTER uptime is 0 minutes
Uptime for this control processor is 2 minutes
System returned to ROM by LocalSoft
System image file is "bootflash:packages.conf"
Last reload reason: LocalSoft

This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

```

A summary of U.S. laws governing Cisco cryptographic products may be found at:  
<http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to  
[export@cisco.com](mailto:export@cisco.com).

Technology Package License Information:

```

-----
Technology      Type           Technology-package Current  Technology-package Next Reboot
-----
Smart License   Perpetual      None                    None
Smart License   Subscription   None                    None

```

The current crypto throughput level is 250000 kbps

Smart Licensing Status: Registration Not Applicable/Not Applicable

```

cisco ROUTER (1RU) processor with 3747220K/6147K bytes of memory.
Processor board ID FDO2521M27S
Router operating mode: Autonomous
5 Gigabit Ethernet interfaces
2 2.5 Gigabit Ethernet interfaces
2 Cellular interfaces
32768K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
7573503K bytes of flash memory at bootflash:.
1875361792K bytes of NVMe SSD at harddisk:.
16789568K bytes of USB flash at usb0:.

```

Configuration register is 0x2102

The following is an example of terminating a software installation:

```

Router# install abort
install_abort: START Fri Oct 29 02:42:51 UTC 2021

This install abort would require a reload. Do you want to proceed? [y/n]
*Oct 29 02:42:52.789:
  %INSTALL-5-INSTALL_START_INFO: R0/0: install_engine: Started install aborty
--- Starting Abort ---
Performing Abort on Active/Standby

  [1] Abort package(s) on R0
  [1] Finished Abort on R0
Checking status of Abort on [R0]
Abort: Passed on [R0]
Finished Abort

Send model notification for install_abort before reload
Install will reload the system now!
SUCCESS: install_abort  Fri Oct 29 02:44:47 UTC 2021

Router#
*Oct 29 02:44:47.866: %INSTALL-5-INSTALL_COMPLETED_INFO: R0/0: install_engine: Completed
install abort PACKAGEOct 29 02:44:51.577: %PMAN-5-EXITACTION: R0/0: pvp: Process manager
is exiting: reload action requested

Initializing Hardware ...

Checking for PCIe device presence...done

```

```

System integrity status: 0x610

System Bootstrap, Version 17.3(4.1r), RELEASE SOFTWARE
Copyright (c) 1994-2021 by cisco Systems, Inc.

Current image running   : Boot ROM1
Last reset cause       : LocalSoft
C8300-2N2S-6T platform with 8388608 Kbytes of main memory

□

Press RETURN to get started!

□

```

The following 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   17.07.01.0.1515
-----
Auto abort timer: inactive
-----

```

### show install package *filesystem: filename*

```

Device# show install package
bootflash:c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bin
Package: c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bin
Size: 831447859
Timestamp: 2021-10-23 17:08:14 UTC
Canonical path:
/bootflash/c8000be-universalk9.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.bin

```

```

Raw disk-file SHA1sum:
 5c4e7617a6c71ffbcc73dcd034ab58bf76605e3f
Header size:      1192 bytes
Package type:     30000
Package flags:    0
Header version:   3

```

```

Internal package information:
Name: rp_super
BuildTime: 2021-10-21_13.00
ReleaseDate: 2021-10-21_03.11
BootArchitecture: i686
RouteProcessor: radium

```



```

Platform: C8000BE
User: mcpre
PackageName: universalk9
Build: BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117
CardTypes:

```

```

Package is bootable from media and tftp.
Package contents:

```

```

Package:
c8000be-firmware_nim_ge.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Size: 2966620
Timestamp: 2021-10-21 20:10:44 UTC

```

```

Raw disk-file SHA1sum:
 501d59d5f152ca00084a0da8217bf6f6b95dddb1
Header size:      1116 bytes
Package type:    40000
Package flags:   0
Header version:  3

```

```

Internal package information:
Name: firmware_nim_ge
BuildTime: 2021-10-21_13.00
ReleaseDate: 2021-10-21_03.11
BootArchitecture: none
RouteProcessor: radium
Platform: C8000BE
User: mcpre
PackageName: firmware_nim_ge
Build: BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117
CardTypes:

```

```

Package is not bootable.

```

```

Package:
c8000be-firmware_prince.BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117.SSA.pkg
Size: 10204252
Timestamp: 2021-10-21 20:10:43 UTC

```

```

Raw disk-file SHA1sum:
 a57bed4ddecfd08af3b456f69d11aaeb962865ea
Header size:      1116 bytes
Package type:    40000
Package flags:   0
Header version:  3

```

```

Internal package information:
Name: firmware_prince
BuildTime: 2021-10-21_13.00
ReleaseDate: 2021-10-21_03.11
BootArchitecture: none
RouteProcessor: radium
Platform: C8000BE
User: mcpre
PackageName: firmware_prince
Build: BLD_V177_THROTTLE_LATEST_20211021_031123_V17_7_0_117
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   17.07.01.0.1515
-----
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   17.07.01.0.1515
-----
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

```

## Troubleshooting Software Installation Using install Commands

**Problem** Troubleshooting the software installation

**Solution** Use the following 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 the following 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.

## Managing and Configuring a Device to Run Using Individual Packages

To choose between running individual packages or a consolidated package, see [Overview](#) section.

The following topics are included in this section:

- [Installing Subpackages from a Consolidated Package, on page 129](#)
- [Installing a Firmware Subpackage, on page 145](#)
- [Installing Subpackages from a Consolidated Package on a Flash Drive, on page 135](#)

## Installing Subpackages from a Consolidated Package

Perform the following procedure to obtain the consolidated package from a TFTP server.

Another variation of this procedure obtains the consolidated package from a USB flash drive. This is described in [Installing Subpackages from a Consolidated Package on a Flash Drive](#).

### Before you begin

Copy the consolidated package to the TFTP server.

### SUMMARY STEPS

1. **show version**
2. **dir bootflash:**
3. **show platform**
4. **mkdir bootflash:** *URL-to-directory-name*
5. **request platform software package expand file** *URL-to-consolidated-package* **to** *URL-to-directory-name*
6. **reload**
7. **boot** *URL-to-directory-name/packages.conf*
8. **show version installed**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>show version</b> <b>Example:</b> <pre>Router# show version Cisco IOS Software, IOS-XE Software Step 1 (X86_64_LINUX_IOSD-UNIVERSALK9-M), Experimental Version 15.3(20120627:221639) [build_151722_111] Copyright (c) 1986-2012 by Cisco Systems, Inc. Compiled Thu 28-Jun-12 15:17 by mcpre . . .</pre>	Shows the version of software running on the router. This can later be compared with the version of software to be installed.
<b>Step 2</b>	<b>dir bootflash:</b> <b>Example:</b> <pre>Router# dir bootflash:</pre>	Displays the previous version of software and that a package is present.
<b>Step 3</b>	<b>show platform</b> <b>Example:</b> <pre>Router# show platform Chassis type: c8000be/K9</pre>	Displays the inventory.
<b>Step 4</b>	<b>mkdir bootflash: <i>URL-to-directory-name</i></b> <b>Example:</b> <pre>Router# mkdir bootflash:mydir</pre>	Creates a directory to save the expanded software image. You can use the same name as the image to name the directory.
<b>Step 5</b>	<b>request platform software package expand file <i>URL-to-consolidated-package</i> to <i>URL-to-directory-name</i></b> <b>Example:</b> <pre>Router# request platform software package expand file bootflash:c8000be-universalk9-NIM.bin to bootflash:mydir</pre>	Expands the software image from the TFTP server ( <i>URL-to-consolidated-package</i> ) into the directory used to save the image ( <i>URL-to-directory-name</i> ), which was created in Step 4.
<b>Step 6</b>	<b>reload</b> <b>Example:</b> <pre>Router# reload rommon &gt;</pre>	Enables ROMMON mode, which allows the software in the consolidated file to be activated.
<b>Step 7</b>	<b>boot <i>URL-to-directory-name/packages.conf</i></b> <b>Example:</b> <pre>rommon 1 &gt; boot bootflash:mydir/packages.conf</pre>	Boots the consolidated package, by specifying the path and name of the provisioning file: packages.conf.
<b>Step 8</b>	<b>show version installed</b> <b>Example:</b>	Displays the version of the newly installed software.

	Command or Action	Purpose
	Router# <b>show version installed</b> Package: Provisioning File, version: n/a, status: active	

## Examples

The initial part of the example shows the consolidated package, `c8000be-universalk9.17.03.01prd14.SPA.bin`, being copied to the TFTP server. This is a prerequisite step. The remaining part of the example shows the consolidated file, `packages.conf`, being booted.

```
Router# copy tftp:c8000be-universalk9.17.03.01prd14.SPA.bin bootflash:
address or name of remote host []? 203.0.113.6
Destination filename [c8000be-universalk9.17.03.01prd14.SPA.bin]
Accessing tftp://203.0.113.6/c8000be/ic8000be-universalk9.17.03.01prd8.SPA.bin...
Loading c8000be/c8000be-universalk9.17.03.01prd14.SPA.bin from 192.0.2.4 (via
GigabitEthernet0): !!!!!!!!
[OK - 410506248 bytes]

410506248 bytes copied in 338.556 secs (1212521 bytes/sec)

Router# show version
Cisco IOS XE Software, Version 17.03.01prd14
Cisco IOS Software [Amsterdam], c8000be Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version
 17.3.1prd14, RELEASE SOFTWARE (fc1)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2020 by Cisco Systems, Inc.
Compiled Tue 16-Jun-20 23:44 by mcpre

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licensed under the GNU General Public License ("GPL") Version 2.0. The
software code licensed under GPL Version 2.0 is free software that comes
with ABSOLUTELY NO WARRANTY. You can redistribute and/or modify such
GPL code under the terms of GPL Version 2.0. For more details, see the
documentation or "License Notice" file accompanying the IOS-XE software,
or the applicable URL provided on the flyer accompanying the IOS-XE
software.

ROM: 17.3(1r)

C8300-Router uptime is 15 minutes
Uptime for this control processor is 16 minutes
System returned to ROM by Reload Command
System image file is "bootflash:c8000be-universalk9.17.03.01prd14.SPA.bin"
Last reload reason: Reload Command

This product contains cryptographic features and is subject to United
States and local country laws governing import, export, transfer and
use. Delivery of Cisco cryptographic products does not imply
third-party authority to import, export, distribute or use encryption.
Importers, exporters, distributors and users are responsible for
compliance with U.S. and local country laws. By using this product you
agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.
```

A summary of U.S. laws governing Cisco cryptographic products may be found at:  
<http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to  
[export@cisco.com](mailto:export@cisco.com).

Technology Package License Information:

```
-----
Technology      Type           Technology-package Current  Technology-package Next Reboot
-----
Smart License   Perpetual      None
Smart License   Subscription    None
-----
```

The current crypto throughput level is 250000 kbps

Smart Licensing Status: UNREGISTERED/No Licenses in Use

```
cisco C8300-1N1S-4T2X (1RU) processor with 3763577K/6147K bytes of memory.
Processor board ID FDO2401A038
Router operating mode: Autonomous
1 Virtual Ethernet interface
20 Gigabit Ethernet interfaces
4 2.5 Gigabit Ethernet interfaces
5 Ten Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
7573503K bytes of flash memory at bootflash:.
15253504K bytes of M.2 USB at harddisk:.
7819328K bytes of USB flash at usb0:.
```

Configuration register is 0x2102

Router# **dir bootflash:**

Directory of bootflash:/

```
106497 drwx          16384 Jul 8 2020 12:01:57 -07:00  tracelogs
360449 drwx          4096 Jul 8 2020 11:51:37 -07:00  license_evlog
212993 drwx          4096 Jul 8 2020 11:51:37 -07:00  core
262145 drwx          4096 Jul 8 2020 11:51:35 -07:00  onep
16      -rw-         30      Jul 8 2020 11:51:27 -07:00  throughput_monitor_params
13      -rw-        134458 Jul 8 2020 11:51:27 -07:00  memleak.tcl
311297 drwx          4096 Jul 8 2020 11:51:12 -07:00  .dbpersist
15      -rwx         1314 Jul 8 2020 11:51:10 -07:00  trustidrootx3_ca.ca
14      -rw-        20109 Jul 8 2020 11:51:10 -07:00  ios_core.p7b
327681 drwx          4096 Jul 8 2020 11:51:08 -07:00  gs_script
12      -rw-         182 Jul 8 2020 11:51:08 -07:00  mode_event_log
237569 drwx          4096 Jul 8 2020 11:51:02 -07:00  .prst_sync
114689 drwx          4096 Jul 8 2020 11:50:48 -07:00  .ssh
368641 drwx          4096 Jul 8 2020 11:50:44 -07:00  .rollback_timer
401409 drwx          4096 Jul 8 2020 11:50:44 -07:00  .installer
458753 drwx          4096 Jul 8 2020 11:50:36 -07:00  sysboot
11      -rw-        696368193 Jul 8 2020 11:34:28 -07:00  c8000be-universalk9.17.03.01prd14.SPA.bin
```

7693897728 bytes total (5945937920 bytes free)

Router# **show platform**

Chassis type: C8300-1N1S-4T2X

Slot	Type	State	Insert time (ago)
0	C8300-1N1S-4T2X	ok	00:18:53
0/0	4x1G-2xSFP+	ok	00:18:03
0/1	C-NIM-1X	ok	00:18:03
1	C8300-1N1S-4T2X	ok	00:18:53
1/0	C-SM-X-16G4M2X	ok	00:18:03
R0	C8300-1N1S-4T2X	ok, active	00:18:53
F0	C8300-1N1S-4T2X	ok, active	00:18:53
P0	PWR-CC1-250WAC	ok	00:18:30
P1	Unknown	empty	never
P2	C8300-FAN-1R	ok	00:18:30

Slot	CPLD Version	Firmware Version
0	20011540	17.3(1r)
1	20011540	17.3(1r)
R0	20011540	17.3(1r)
F0	20011540	17.3(1r)

```
Router# mkdir bootflash:c8000be-universalk9.17.03.01.dir1
Create directory filename [c8000be-universalk9.17.03.01.dir1]?
Created dir bootflash:/c8000be-universalk9.17.03.01.dir1
Router# request platform software package expand file
bootflash:c8000be-universalk9.17.03.01.NIM.bin
to bootflash:c8000be-universalk9.17.03.01.dir1
Verifying parameters
Validating package type
Copying package files
SUCCESS: Finished expanding all-in-one software package.
```

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

```
*Jul 13 19:39:06.354: %SYS-5-RELOAD: Reload requested by console.Reload Reason: Reload
Command.
```

```
rommon 1 > boot bootflash:c8000be-universalk9.17.03.01.dir1/packages.conf
```

```
File size is 0x00002836
Located c8000be-universalk9.17.03.01.dir1/packages.conf
Image size 10294 inode num 324484, bks cnt 3 blk size 8*512
#
File is comprised of 1 fragments (33%)

is_valid_shalhash: SHA-1 hash:
calculated 62f6235a:fc98eb3a:85ce183e:834f1cb3:8a1f71d1
expected 62f6235a:fc98eb3a:85ce183e:834f1cb3:8a1f71d1
File size is 0x04b3dc00
Located
c8000be-universalk9.17.03.01.dir1/c8000be-mono-universalk9.17.03.01-build_164422SSA.pkg
Image size 78896128 inode num 324491, bks cnt 19262 blk size 8*512
#####
File is comprised of 21 fragments (0%)
.....
```

```
Router# show version installed
Package: Provisioning File, version: n/a, status: active
Role: provisioning file
File: bootflash:sysboot/packages.conf, on: RP0
Built: n/a, by: n/a
```

```
File SHA1 checksum: d86dda7aeb6f8bade683712734932e5dd4c2587b

Package: mono-universalk9, version: 17.03.01prd14, status: active
Role: rp_base
File: bootflash:sysboot/c8000be-mono-universalk9.17.03.01prd14.SPA.pkg, on: RP0
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: 5621bed407a53fcbefe5e3dc567c073e0728d541

Package: rpboot, version: 17.03.01prd14, status: active
Role: rp_boot
File: bootflash:sysboot/c8000be-rpboot.17.03.01prd14.SPA.pkg, on: RP0
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: n/a

Package: firmware_dreamliner, version: 17.03.01prd14, status: active
Role: firmware_dreamliner
File: bootflash:sysboot/c8000be-firmware_dreamliner.17.03.01prd14.SPA.pkg, on: RP0/0
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: 1ce360c1e100f86a37fd707461ea2495f8a50abd

Package: firmware_dsp_analogbri, version: 17.03.01prd14, status: active
Role: firmware_dsp_analogbri
File: bootflash:sysboot/c8000be-firmware_dsp_analogbri.17.03.01prd14.SPA.pkg, on: RP0/0
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: 33e13705ab791cb466ed2f4e787e978d40af27da

Package: firmware_dsp_sp2700, version: 17.03.01prd14, status: active
Role: firmware_dsp_sp2700
File: bootflash:sysboot/c8000be-firmware_dsp_sp2700.17.03.01prd14.SPA.pkg, on: RP0/0
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: cdefc7b39e8383be190fca59c9a01286dc2a2842

Package: mono-universalk9, version: 17.03.01prd14, status: n/a
Role: rp_security
File: bootflash:sysboot/c8000be-mono-universalk9.17.03.01prd14.SPA.pkg, on: RP1/1
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: 5621bed407a53fcbefe5e3dc567c073e0728d541

Package: mono-universalk9, version: 17.03.01prd14, status: n/a
Role: rp_webui
File: bootflash:sysboot/c8000be-mono-universalk9.17.03.01prd14.SPA.pkg, on: RP1/1
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: 5621bed407a53fcbefe5e3dc567c073e0728d541

Package: mono-universalk9, version: 17.03.01prd14, status: active
Role: fp
File: bootflash:sysboot/c8000be-mono-universalk9.17.03.01prd14.SPA.pkg, on: ESP0
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: 5621bed407a53fcbefe5e3dc567c073e0728d541

Package: fp, version: unknown, status: n/a
Role: fp
File: unknown, on: ESP1
Built: unknown, by: unknown
File SHA1 checksum: unknown

Package: mono-universalk9, version: 17.03.01prd14, status: active
Role: cc_spa
File: bootflash:sysboot/c8000be-mono-universalk9.17.03.01prd14.SPA.pkg, on: SIP0
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: 5621bed407a53fcbefe5e3dc567c073e0728d541

Package: mono-universalk9, version: 17.03.01prd14, status: active
Role: cc
```



```

File: bootflash:sysboot/c8000be-mono-universalk9.17.03.01prd14.SPA.pkg, on: SIP0/0
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: 5621bed407a53fcbefe5e3dc567c073e0728d541

Package: mono-universalk9, version: 17.03.01prd14, status: active
Role: cc
File: bootflash:sysboot/c8000be-mono-universalk9.17.03.01prd14.SPA.pkg, on: SIP0/1
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: 5621bed407a53fcbefe5e3dc567c073e0728d541

Package: cc, version: unknown, status: n/a
Role: cc
File: unknown, on: SIP0/2
Built: unknown, by: unknown
File SHA1 checksum: unknown

Package: cc, version: unknown, status: n/a
Role: cc
File: unknown, on: SIP0/3
Built: unknown, by: unknown
File SHA1 checksum: unknown

Package: cc, version: unknown, status: n/a
Role: cc
File: unknown, on: SIP0/4
Built: unknown, by: unknown
File SHA1 checksum: unknown

Package: cc, version: unknown, status: n/a
Role: cc
File: unknown, on: SIP0/5
Built: unknown, by: unknown
File SHA1 checksum: unknown

Package: mono-universalk9, version: 17.03.01prd14, status: active
Role: cc_spa
File: bootflash:sysboot/c8000be-mono-universalk9.17.03.01prd14.SPA.pkg, on: SIP1
Built: 2020-06-17_00.17, by: mcpre
File SHA1 checksum: 5621bed407a53fcbefe5e3dc567c073e0728d541

```

## Installing Subpackages from a Consolidated Package on a Flash Drive

The steps for installing subpackages from a consolidated package on a USB flash drive are similar to those described in Installing Subpackages from a Consolidated Package section .

- 
- Step 1**    **show version**
  - Step 2**    **dir usb:**
  - Step 3**    **show platform**
  - Step 4**    **mkdir bootflash:*URL-to-directory-name***
  - Step 5**    **request platform software package expand fileusb: *package-name to URL-to-directory-name***
  - Step 6**    **reload**
  - Step 7**    **boot *URL-to-directory-name/packages.conf***
  - Step 8**    **show version installed**
-

# Upgrading the Firmware on NIMs

To upgrade the firmware on a Network Interface Module (NIM), perform these steps:

## Before you begin

When you boot the device in `packages.conf` mode with the Cisco IOS XE image (super package) during the installation period, you can upgrade or downgrade the firmware without reloading the device. You need to follow the steps described in `Installing a Firmware Subpackage` section before proceeding with the firmware upgrade.

If you do not boot the device in `packages.conf` mode with the Cisco IOS XE image, you need to follow the below prerequisites before proceeding with the firmware upgrade:

- Copy the firmware subpackage (NIM firmware) into `bootflash:/mydir`.
- Send a request to the platform software package expand file `boot flash:/mydir/<IOS-XE image>` to expand the super package.
- Reload the hardware module subslot to boot the module with the new firmware.
- Verify that the module is booted up with the new firmware using the **show platform software subslot x/y module firmware** command.

## SUMMARY STEPS

1. copy Cisco IOS XE image into bootflash: **mydir**.
2. **request platform software package expand file** `bootflash:/mydir /<IOS-XE image>` to expand super package.
3. **reload**.
4. **boot bootflash:mydir/ /packages.conf**.
5. copy NIM firmware subpackage to the folder **bootflash:mydir/**.
6. **request platform software package install** `rp 0 file bootflash:/mydir/<firmware subpackage>`.
7. **hw-module subslot x/y reload** to boot the module with the new firmware.
8. **show platform software subslot 0/2 module firmware** to verify that the module is booted up with the new firmware.

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	copy Cisco IOS XE image into bootflash: <b>mydir</b> .  <b>Example:</b> Router# <code>mkdir bootflash:mydir</code>	Creates a directory to save the expanded software image.  You can use the same name as the image to name the directory.
<b>Step 2</b>	<b>request platform software package expand file</b> <code>bootflash:/mydir /&lt;IOS-XE image&gt;</code> to expand super package.  <b>Example:</b>	Expands the platform software package to super package.

	Command or Action	Purpose
	<pre>Router# request platform software package expand file bootflash:/mydir/c8000be-universalk9.03.14.00.S.155-1.S-std.SPA.bin</pre>	
<b>Step 3</b>	<p><b>reload.</b></p> <p><b>Example:</b></p> <pre>Router# reload rommon &gt;</pre>	Enables ROMMON mode, which allows the software in the super package file to be activated.
<b>Step 4</b>	<p><b>boot bootflash:mydir/ /packages.conf.</b></p> <p><b>Example:</b></p> <pre>rommon 1 &gt; boot bootflash:mydir/packages.conf</pre>	Boots the super package by specifying the path and name of the provisioning file: packages.conf.
<b>Step 5</b>	<p><b>copy</b> NIM firmware subpackage to the folder <b>bootflash:mydir/.</b></p> <p><b>Example:</b></p> <pre>Router#copy bootflash:c8000be-firmware_nim_xdsl.2020-07-01_11.05_39n.SSA.pkg bootflash:mydir/</pre>	Copies the NIM firmware subpackage into bootflash:mydir.
<b>Step 6</b>	<p><b>request platform software package install</b> <i>rp 0 file bootflash:/mydir/&lt;firmware subpackage&gt;.</i></p> <p><b>Example:</b></p> <pre>Router#request platform software package install rp 0 file bootflash:mydir/c8000be-firmware_nim_xdsl.2020-07-01_11.05_39n.SSA.pkg</pre>	Installs the software package.
<b>Step 7</b>	<p><b>hw-module subslot x/y reload</b> to boot the module with the new firmware.</p> <p><b>Example:</b></p> <pre>Router#hw-module subslot 0/2 reload</pre>	Reloads the hardware module subslot and boots the module with the new firmware.
<b>Step 8</b>	<p><b>show platform software subslot 0/2 module firmware</b> to verify that the module is booted up with the new firmware.</p> <p><b>Example:</b></p> <pre>Router# show platform software subslot 0/2 module firmware Pe</pre>	Displays the version of the newly installed firmware.

### Examples

The following example shows how to perform firmware upgrade in a device module:

```
Router#mkdir bootflash:mydir
Create directory filename [mydir]?
Created dir bootflash:/mydir
Router#c
```

```

Router#copy bootflash:c8000be-universalk9.17.03.01prd14.S-std.SPA.bin bootflash:mydir/
Destination filename [mydir/c8000be-universalk9.17.03.01prd14.S-std.SPA.bin]?
Copy in progress...CC
CC
CC
CC
CCCC
696368193 bytes copied in 478.600 secs (1455011 bytes/sec)
Router#
Router#
Router#dir bootflash:mydir
Directory of bootflash:/mydir/

632738  -rw-          425288648  Dec 12 2014 09:16:42 +00:00
c8000be-universalk9.17.03.01prd14.S-std.SPA.bin

7451738112 bytes total (474025984 bytes free)
Router#

Router#request platform software package
expand file bootflash:/mydir/c8000be-universalk9.17.03.01prd14.S-std.SPA.bin.S-std.SPA.bin
Verifying parameters
Validating package type
Copying package files
SUCCESS: Finished expanding all-in-one software package.

Router#reload
Proceed with reload? [confirm]

Proceed with reload? [confirm]

*Jul  8 11:48:30.917 PDT: %SYS-5-RELOAD: Reload requested by console. Reload Reason: Reload
Command.
*Jul  8 11:48:32.768 PDT: %IOSXE_INFRA-3-RELOAD_INFO_SAVE_FAIL: Unable to save reload
information: 23: Invalid argument.
Jul  8 11:48:38.652: %PMAN-TACTION: R0/0: pvp: Process manager is exiting: process exit
with reload chassis code

Initializing Hardware ...

Checking for PCIe device presence...done
System integrity status: 0x610
Rom image verified correctly

System Bootstrap, Version 17.3(1r), RELEASE SOFTWARE
Copyright (c) 1994-2020 by cisco Systems, Inc.

Current image running: Boot ROM0

Last reset cause: LocalSoft
C8300-1N1S-4T2X platform with 8388608 Kbytes of main memory

rommon 1  boot bootflash:mydir/packages.conf

File size is 0x000028f1
Located mydir/packages.conf
Image size
10481 inode num 632741, bks cnt 3 blk size 8*512

```

```
#
File size is 0x150ae3cc
Located mydir/c8000be-universalk9.17.03.01prd14.S-std.SPA.pkg
Image size 353035212 inode num 356929, bks cnt 86191 blk size 8*512
#####
#####
Boot image size = 353035212 (0x150ae3cc) bytes

Package header rev 1 structure detected
Calculating SHA-1 hash...done
validate_package: SHA-1 hash:
  calculated 8e966678:8afb08f4:8a88bb8f:fe591121:8bddf4b3
  expected   8e966678:8afb08f4:8a88bb8f:fe591121:8bddf4b3

RSA Signed RELEASE Image Signature Verification Successful.
Package Load Test Latency : 3799 msec
Image validated
Dec 12 09:28:50.338 R0/0: %FLASH_CHECK-3-DISK_QUOTA: Flash disk quota exceeded
[free space is 61864 kB] - Please clean up files on bootflash.
```

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San Jose, California 95134-1706

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Compiled Tue 16-Jun-20 23:44 by mcpre

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```
cisco c8000be1-X/K9 (2RU) processor with 1681388K/6147K bytes of memory.
Processor board ID FTX1736AJUT
2 Ethernet interfaces
4 Gigabit Ethernet interfaces
2 ATM interfaces
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
7393215K bytes of flash memory at bootflash:.
```

Press RETURN to get started!

```
*Dec 12 09:28:58.922:
%IOS_LICENSE_IMAGE_APPLICATION-6-LICENSE_LEVEL:
Module name = esg Next reboot level = appxk9 and License = appxk9
*Dec 12 09:28:58.943:
%IOS_LICENSE_IMAGE_APPLICATION-6-LICENSE_LEVEL:
Module name = esg Next reboot level = ipbasek9 and License = ipbasek9
*Dec 12 09:28:58.981:
  %Cat_THROUGHPUT-6-LEVEL: Throughput level has been set to 1000000 kbps
*Dec 12 09:29:13.302: %SPANTREE-5-EXTENDED_SYSID: Extended SysId enabled for type vlan
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface Lsmpi0, changed state to up
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface EOBC0, changed state to up
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface GigabitEthernet0, changed state to down
*Dec 12 09:29:14.142: %LINK-3-UPDOWN: Interface LIIN0, changed state to up
*Dec 12 09:28:51.438: %CMRP-3-PFU_MISSING:cmand: The platform does not detect a power
supply in slot 1
*Dec 12 09:29:01.256: %CMLIB-6-THROUGHPUT_VALUE:cmand: Throughput license found, throughput
set to 1000000 kbps
*Dec 12 09:29:03.223: %CPPHA-7-START:cpp_ha: CPP 0 preparing ucode
*Dec 12 09:29:03.238: %CPPHA-7-START:cpp_ha: CPP 0 startup init
*Dec 12 09:29:11.335: %CPPHA-7-START:cpp_ha: CPP 0 running init
*Dec 12 09:29:11.645: %CPPHA-7-READY:cpp_ha: CPP 0 loading and initialization complete
*Dec 12 09:29:11.711: %IOSXE-6-PLATFORM:cpp_cp:
Process CPP_PFILTER_EA_EVENT_API_CALL_REGISTER
*Dec 12 09:29:16.280:
%IOSXE_MGMTVRF-6-CREATE_SUCCESS_INFO:
Management vrf Mgmt-intf created with ID 1, ipv4 table-id 0x1, ipv6 table-id 0x1E000001
*Dec 12 09:29:16.330:
%LINEPROTO-5-UPDOWN: Line protocol on Interface Lsmpi0, changed state to up
*Dec 12 09:29:16.330:
%LINEPROTO-5-UPDOWN: Line protocol on Interface EOBC0, changed state to up
*Dec 12 09:29:16.330:
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0, changed state to down
*Dec 12 09:29:16.330:
%LINEPROTO-5-UPDOWN: Line protocol on Interface LIIN0, changed state to up
*Dec 12 09:29:17.521: %SYS-5-LOG_CONFIG_CHANGE: Buffer logging disabled
*Dec 12 09:29:18.867: %SYS-5-CONFIG_I: Configured from memory by console
*Dec 12 09:29:18.870:
%IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/0, interfaces disabled
*Dec 12 09:29:18.870:
%IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/1, interfaces disabled
*Dec 12 09:29:18.871:
%IOSXE_OIR-6-REMSPA: SPA removed from subslot 0/2, interfaces disabled
*Dec 12 09:29:18.873:
%SPA_OIR-6-OFFLINECARD: SPA (c8000be-X-4x1GE) offline in subslot 0/0
*Dec 12 09:29:18.874: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VA-B) offline in subslot 0/1
*Dec 12 09:29:18.874: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VAB-A) offline in subslot 0/2
*Dec 12 09:29:18.876: %IOSXE_OIR-6-INSCARD: Card (fp) inserted in slot F0
```

```

*Dec 12 09:29:18.876: %IOSXE_OIR-6-ONLINECARD: Card (fp) online in slot F0
*Dec 12 09:29:18.882: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/0
*Dec 12 09:29:18.884: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/1
*Dec 12 09:29:18.884: %IOSXE_OIR-6-INSSPA: SPA inserted in subslot 0/2
*Dec 12 09:29:18.935: %SYS-5-RESTART: System restarted --
Cisco IOS Software, c8000be Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version 15.5(1)S,
RELEASE SOFTWARE (fc5)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2014 by Cisco Systems, Inc.
Compiled Thu 20-Nov-14 18:28 by mcpre
*Dec 12 09:29:18.895: %SPA-3-ENVMON_NOT_MONITORED:iomd: Environmental monitoring
is not enabled for c8000be-X-4x1GE[0/0]
*Dec 12 09:29:19.878: %LINK-5-CHANGED: Interface GigabitEthernet0,

changed state to administratively down
*Dec 12 09:29:22.419: %SPA_OIR-6-ONLINECARD: SPA (c8000be-X-4x1GE) online in subslot 0/0
*Dec 12 09:29:22.610: %SYS-6-BOOTTIME: Time taken to reboot after reload = 194 seconds
*Dec 12 09:29:24.354: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0,
changed state to down
*Dec 12 09:29:24.415: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/2,
changed state to down
*Dec 12 09:29:24.417: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/3,
changed state to down
*Dec 12 09:29:30.919: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/0,
changed state to up
*Dec 12 09:29:30.925: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/2,
changed state to up
*Dec 12 09:29:30.936: %LINK-3-UPDOWN: Interface GigabitEthernet0/0/3,
changed state to up
*Dec 12 09:29:31.919: %LINEPROTO-5-UPDOWN: Line protocol on Interface
GigabitEthernet0/0/0, changed state to up
*Dec 12 09:29:31.930: %LINEPROTO-5-UPDOWN: Line protocol on
Interface GigabitEthernet0/0/2, changed state to up
*Dec 12 09:29:31.936: %LINEPROTO-5-UPDOWN: Line protocol on
Interface GigabitEthernet0/0/3, changed state to up
*Dec 12 09:29:34.147: %SSH-5-ENABLED: SSH 1.99 has been enabled
*Dec 12 09:30:29.152: %SPA_OIR-6-ONLINECARD: SPA (NIM-VA-B) online in subslot 0/1
*Dec 12 09:30:29.470: %SPA_OIR-6-ONLINECARD: SPA (NIM-VAB-A) online in subslot 0/2
*Dec 12 09:30:31.152: %LINK-3-UPDOWN: Interface Ethernet0/1/0, changed state to down
*Dec 12 09:30:31.152: %LINK-3-UPDOWN: Interface ATM0/1/0, changed state to down
*Dec 12 09:30:31.470: %LINK-3-UPDOWN: Interface Ethernet0/2/0, changed state to down
*Dec 12 09:30:31.470: %LINK-3-UPDOWN: Interface ATM0/2/0, changed state to down
*Dec 12 09:31:03.074: %CONTROLLER-5-UPDOWN: Controller VDSL 0/2/0, changed state to up
*Dec 12 09:31:05.075: %LINK-3-UPDOWN: Interface Ethernet0/2/0, changed state to up
*Dec 12 09:31:06.076: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0/2/0,
changed state to up
*Dec 12 09:31:12.559: %CONTROLLER-5-UPDOWN: Controller VDSL 0/1/0, changed state to up
*Dec 12 09:31:20.188: %LINK-3-UPDOWN: Interface ATM0/1/0, changed state to up
*Dec 12 09:31:21.188: %LINEPROTO-5-UPDOWN: Line protocol on Interface ATM0/1/0,
changed state to up
Router>
Router>en
Password:
Router#
Router#show controller vdsl 0/2/0
Controller VDSL 0/2/0 is UP

Daemon Status: UP

XTU-R (DS) XTU-C (US)
Chip Vendor ID: 'BDCM' 'BDCM'
Chip Vendor Specific: 0x0000 0xA41B
Chip Vendor Country: 0xB500 0xB500
Modem Vendor ID: 'CSCO' ' '

```

```

Modem Vendor Specific: 0x4602    0x0000
Modem Vendor Country: 0xB500    0x0000
Serial Number Far:
Modem Version Near:    15.5(1)S
Modem Version Far:    0xa41b

Modem Status(L1): TC Sync (Showtime!)
DSL Config Mode: VDSL2
Trained Mode(L1): G.993.2 (VDSL2) Profile 30a

TC Mode: PTM
Selftest Result: 0x00
DELT configuration: disabled
DELT state: not running

Failed full inits: 0
Short inits: 0
Failed short inits: 0

Modem FW Version: 4.14L.04
Modem PHY Version: A2pv6F039h.d24o_rc1

Line 1:

    XTU-R (DS)  XTU-C (US)
Trellis:      ON    ON
SRA:          disabled  disabled
SRA count:    0     0
Bit swap:     enabled  enabled
Bit swap count: 9     0
Profile 30a:  enabled
Line Attenuation: 3.5 dB    0.0 dB
Signal Attenuation: 0.0 dB    0.0 dB
Noise Margin: 30.9 dB  12.4 dB
Attainable Rate: 200000 kbits/s  121186 kbits/s
Actual Power: 13.3 dBm  7.2 dBm
Per Band Status:      D1 D2 D3 U0 U1 U2 U3
Line Attenuation(dB): 0.9 1.5 5.5 N/A 0.1 0.9 3.8
Signal Attenuation(dB): 0.8 1.5 5.5 N/A 0.0 0.2 3.2
Noise Margin(dB):     31.1 31.0 30.9 N/A 12.3 12.4 12.5
Total FECC: 0     0
Total ES: 0     0
Total SES: 0     0
Total LOSS: 0     0
Total UAS: 51    51
Total LPRS: 0     0
Total LOFS: 0     0
Total LOLS: 0     0

    DS Channel1  DS Channel0 US Channel1  US Channel0
Speed (kbps):   NA          100014  NA          100014
SRA Previous Speed: NA          0  NA          0
Previous Speed: NA          0  NA          0
Reed-Solomon EC: NA          0  NA          0
CRC Errors:     NA          0  NA          0
Header Errors:  NA          0  NA          0
Interleave (ms): NA          9.00  NA          0.00
Actual INP:     NA          4.00  NA          0.00

Training Log : Stopped
Training Log Filename : flash:vdsllog.bin

Router#

```



```
Router#

Router#copy bootflash:c8000be-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg
bootflash:mydir/
Destination filename [mydir/c8000be-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg]?
Copy in progress...CC
CC
6640604 bytes copied in 1.365 secs (4864911 bytes/sec)
Router#

Router#request platform software package install rp 0 file
bootflash:mydir/c8000be-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg
--- Starting local lock acquisition on R0 ---
Finished local lock acquisition on R0

--- Starting file path checking ---
Finished file path checking

--- Starting image file verification ---
Checking image file names
Locating image files and validating name syntax
  Found c8000be-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg
Verifying image file locations
Inspecting image file types
Processing image file constraints
Creating candidate provisioning file
Finished image file verification

--- Starting candidate package set construction ---
Verifying existing software set
Processing candidate provisioning file
Constructing working set for candidate package set
Constructing working set for running package set
Checking command output
Constructing merge of running and candidate packages
Checking if resulting candidate package set would be complete
Finished candidate package set construction

--- Starting ISSU compatibility verification ---
Verifying image type compatibility
Checking IPC compatibility with running software
Checking candidate package set infrastructure compatibility
Checking infrastructure compatibility with running software
Checking package specific compatibility
Finished ISSU compatibility verification

--- Starting impact testing ---
Checking operational impact of change
Finished impact testing

--- Starting list of software package changes ---
Old files list:
  Removed c8000be-firmware_nim_xdsl.03.14.00.S.155-1.S-std.SPA.pkg
New files list:
  Added c8000be-firmware_nim_xdsl.2014-11-17_11.05_39n.SSA.pkg
Finished list of software package changes

--- Starting commit of software changes ---
Updating provisioning rollback files
Creating pending provisioning file
Committing provisioning file
Finished commit of software changes

--- Starting analysis of software changes ---
```

```

Finished analysis of software changes

--- Starting update running software ---
Blocking peer synchronization of operating information
Creating the command set placeholder directory
  Finding latest command set
  Finding latest command shortlist lookup file
  Finding latest command shortlist file
  Assembling CLI output libraries
  Assembling CLI input libraries
Skipping soft links for firmware upgrade
Skipping soft links for firmware upgrade
  Assembling Dynamic configuration files
  Applying interim IPC and database definitions
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error:
error in socket IO (code 10) at /auto/mcpbuilds19/
release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104) [sender=2.6.9]
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error:
error in socket IO (code 10) at /auto/mcpbuilds19/
release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104) [sender=2.6.9]
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error:
error in socket IO (code 10) at /auto/mcpbuilds19
/release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104) [sender=2.6.9]
  Replacing running software
  Replacing CLI software
  Restarting software
  Applying final IPC and database definitions
rsync: getaddrinfo: cc2-0 873: Name or service not known rsync error:
error in socket IO (code 10) at /auto/mcpbuilds19/
release/03.14.00.S/BLD-V03_14_00_S_FC5/contrib/rsync/clientserver.c(104) [sender=2.6.9]
  Generating software version information
  Notifying running software of updates
  Unblocking peer synchronization of operating information
Unmounting old packages
Cleaning temporary installation files
  Finished update running software

SUCCESS: Finished installing software.
Router#
Router#show platform software subslot 0/2 module firmware
Avg Load info
-----
1.83 1.78 1.44 3/45 607

Kernel distribution info
-----
Linux version 3.4.11-rt19 (sapanwar@blr-atg-001) (gcc version 4.6.2
(Buildroot 2011.11) ) #3 SMP PREEMPT Fri Nov 7 09:26:19 IST 2014

Module firmware versions
-----
Modem Fw Version: 4.14L.04
Modem Phy Version: A2pv6F039h.d24o_rc1

Boot Loader: Secondary
-----
Version: 1.1

Modem Up time
-----
0D 0H 25M 38S

Router#

```

```

Router#hw-module subslot 0/2 reload
Proceed with reload of module? [confirm]
Router#
*Dec 12 09:55:59.645: %IOSXE_OIR-6-SOFT_RELOADSPA: SPA(NIM-VAB-A)
reloaded on subslot 0/2
*Dec 12 09:55:59.646: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VAB-A) offline in subslot 0/2
*Dec 12 09:55:59.647: %CONTROLLER-5-UPDOWN: Controller VDSL 0/2/0, changed state to down
*Dec 12 09:57:22.514: new extended attributes received from iomd(slot 0 bay 2 board 0)
*Dec 12 09:57:22.514: %IOSXE_OIR-6-SOFT_RELOADSPA: SPA(NIM-VAB-A)
reloaded on subslot 0/2
*Dec 12 09:57:22.515: %SPA_OIR-6-OFFLINECARD: SPA (NIM-VAB-A) offline in subslot 0/2
Router#
Router#
Router#
*Dec 12 09:58:35.471: %SPA_OIR-6-ONLINECARD: SPA (NIM-VAB-A) online in subslot 0/2
*Dec 12 09:58:37.470: %LINK-3-UPDOWN: Interface Ethernet0/2/0, changed state to down
*Dec 12 09:58:37.470: %LINK-3-UPDOWN: Interface ATM0/2/0, changed state to down
Router#

Router#show platform software subslot 0/2 module firmware
Avg Load info
-----
0.84 0.23 0.08 1/45 598

Kernel distribution info
-----
Linux version 3.4.11-rt19 (sapanwar@blr-atg-001) (gcc version 4.6.2 (Buildroot 2011.11) )
#6 SMP PREEMPT Mon Nov 17 10:51:41 IST 2014

Module firmware versions
-----
Modem Fw Version: 4.14L.04
Modem Phy Version: A2pv6F039n.d24o_rc1

Boot Loader: Seondry
-----
Version: 1.1

Modem Up time
-----
0D 0H 0M 42S

Router#

```

## Installing a Firmware Subpackage

### Before you begin

Obtain a consolidated package that contains your required firmware package and expand the package. (See [Managing and Configuring a Device to Run Using Individual Packages, on page 129](#).) Make a note of the location and name of the firmware package and use this information in the steps below for *URL-to-package-name*.

You can install a firmware subpackage if the device has been configured using, for example, [Managing and Configuring a Device to Run Using Individual Packages, on page 129](#).

Firmware subpackages are not released individually. You can select a firmware package from within a consolidated package after expanding the consolidated package. The firmware package can then be installed as shown in the procedure below.



**Note** Read the Release Notes document pertaining to the consolidated package to verify that the firmware within the consolidated package is compatible with the version of Cisco IOS XE software that is currently installed on a device.

## SUMMARY STEPS

1. **show version**
2. **dir bootflash:**
3. **show platform**
4. **mkdir bootflash:** *URL-to-directory-name*
5. **request platform software package expand file** *URL-to-consolidated-package* **to** *URL-to-directory-name*
6. **reload**
7. **boot** *URL-to-directory-name* **/packages.conf**
8. **show version installed**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>show version</b> <b>Example:</b> <pre>Router# show version Cisco IOS Software, IOS-XE Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Experimental Version 15.3(20120627:221639) [build_151722_111] Copyright (c) 1986-2012 by Cisco Systems, Inc. Compiled Thu 28-Jun-12 15:17 by mcpre . . .</pre>	Shows the version of software running on the device. This can later be compared with the version of software to be installed.
<b>Step 2</b>	<b>dir bootflash:</b> <b>Example:</b> <pre>Router# dir bootflash:</pre>	Displays the previous version of software and that a package is present.
<b>Step 3</b>	<b>show platform</b> <b>Example:</b> <pre>Router# show platform Chassis type: c8000be/K9</pre>	Checks the inventory.  Also see the example in Installing Subpackages from a Consolidated Package section.
<b>Step 4</b>	<b>mkdir bootflash:</b> <i>URL-to-directory-name</i> <b>Example:</b> <pre>Router# mkdir bootflash:mydir</pre>	Creates a directory to save the expanded software image.  You can use the same name as the image to name the directory.
<b>Step 5</b>	<b>request platform software package expand file</b> <i>URL-to-consolidated-package</i> <b>to</b> <i>URL-to-directory-name</i>	Expands the software image from the TFTP server ( <i>URL-to-consolidated-package</i> ) into the directory used to

	Command or Action	Purpose
	<b>Example:</b> Router# <b>request platform software package expand file</b> <b>bootflash:c8000be-universalk9-NIM.bin to bootflash:mydir</b>	save the image ( <i>URL-to-directory-name</i> ), which was created in the Step 4.
<b>Step 6</b>	<b>reload</b> <b>Example:</b> Router# <b>reload</b> rommon >	Enables ROMMON mode, which allows the software in the consolidated file to be activated.
<b>Step 7</b>	<b>boot <i>URL-to-directory-name</i> /packages.conf</b> <b>Example:</b> rommon 1 > <b>boot bootflash:mydir/packages.conf</b>	Boots the consolidated package by specifying the path and name of the provisioning file: packages.conf.
<b>Step 8</b>	<b>show version installed</b> <b>Example:</b> Router# <b>show version installed</b> Package: Provisioning File, version: n/a, status: active	Displays the version of the newly installed software.

### Examples

The initial part of the following example shows the consolidated package, c8000be-universalk9.164422SSA.bin, being copied to the TFTP server. This is a prerequisite step. The remaining part of the example shows the consolidated file, packages.conf, being booted.

```
Router# tftp:c8000be/c8000be-universalk9.164422SSA.bin bootflash:
Address or name of remote host []? 192.0.2.1
Destination filename [c8000be-universalk9.164422SSA.bin]?
Accessing tftp://192.0.2.1/c8000be/c8000be-universalk9.164422SSA.bin...
Loading c8000be/c8000be-universalk9.164422SSA.bin from 192.0.2.1 (via GigabitEthernet0):
!!!!!!!!!!
[OK - 410506248 bytes]

410506248 bytes copied in 338.556 secs (1212521 bytes/sec)

Router# show version
Cisco IOS Software, IOS-XE Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Experimental Version
15.3(20120627:221639) [build_151722_111]
Copyright (c) 1986-2012 by Cisco Systems, Inc.
Compiled Thu 28-Jun-12 15:17 by mcpre

IOS XE Version: 2012-06-28_15.31_mcpre

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documentation or "License Notice" file accompanying the IOS-XE software,
```

or the applicable URL provided on the flyer accompanying the IOS-XE software.

ROM: IOS-XE ROMMON

```
Router uptime is 0 minutes
Uptime for this control processor is 3 minutes
System returned to ROM by reload
System image file is "tftp:c8000be/c8000be.bin"
Last reload reason: Reload Command
```

This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at: <http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to [export@cisco.com](mailto:export@cisco.com).

```
License Level: adventerprise
License Type: EvalRightToUse
Next reload license Level: adventerprise
cisco c8000be/K9 (2RU) processor with 1136676K/6147K bytes of memory.
Processor board ID FGL161611AB
4 Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
4194304K bytes of physical memory.
7393215K bytes of Compact flash at bootflash:.
```

Configuration register is 0x8000

Router# **dir bootflash:**

Directory of bootflash:/

```
11 drwx 16384 May 3 2012 19:58:37 +00:00 lost+found
178465 drwx 4096 Jun 6 2012 15:20:20 +00:00 core
584065 drwx 4096 Jul 13 2012 19:19:00 +00:00 .prst_sync
405601 drwx 4096 May 3 2012 19:59:30 +00:00 .rollback_timer
113569 drwx 40960 Jul 13 2012 19:19:32 +00:00 tracelogs
64897 drwx 4096 May 3 2012 19:59:42 +00:00 .installer
13 -rw- 1305 May 7 2012 17:43:42 +00:00 startup-config
14 -rw- 1305 May 7 2012 17:43:55 +00:00 running-config
15 -r-- 1541 Jun 4 2012 18:32:41 +00:00 debug.conf
16 -rw- 1252 May 22 2012 19:58:39 +00:00 running-config-20120522
519169 drwx 4096 Jun 4 2012 15:29:01 +00:00 vman_fdb

7451738112 bytes total (7067635712 bytes free)
```

Router# **show platform**

Chassis type: c8000be/K9

Slot Type State Insert time (ago)

-----  
0 c8000be/K9 ok 15:57:33

```

0/0 c8000be-6X1GE ok 15:55:24
1 Ic8000be/K9 ok 15:57:33
1/0 SM-1T3/E3 ok 15:55:24
2 c8000be/K9 ok 15:57:33
2/0 SM-1T3/E3 ok 15:55:24
R0 c8000be/K9 ok, active 15:57:33
F0 c8000be-FP ok, active 15:57:33
P0 Unknown ps, fail never
P1 XXX-XXXX-XX ok 15:56:58
P2 ACS-4450-FANASSY ok 15:56:58

Slot CPLD Version Firmware Version
-----
0 12090323 15.3(01r)S [ciscouser-c8000beRO...
1 12090323 15.3(01r)S [ciscouser-c8000beRO...
2 12090323 15.3(01r)S [ciscouser-c8000beRO...
R0 12090323 15.3(01r)S [ciscouser-c8000beRO...
F0 12090323 15.3(01r)S [ciscouser-c8000beRO...

Router# mkdir bootflash:c8000be-universalk9.dir1
Create directory filename [c8000be-universalk9.dir1]?
Created dir bootflash:/c8000be-universalk9.dir1
Router# request platform software package expand file bootflash:c8000be-universalk9.NIM.bin
to
bootflash:c8000be-universalk9.dir1
Verifying parameters
Validating package type
Copying package files
SUCCESS: Finished expanding all-in-one software package.

Router# reload
Proceed with reload? [confirm]

*Jul 13 19:39:06.354: %SYS-5-RELOAD: Reload requested by console. Reload Reason: Reload
Command.

rommon 1 > boot bootflash:c8000be-universalk9.dir1/packages.conf

File size is 0x00002836
Located c8000be-universalk9.dir1/packages.conf
Image size 10294 inode num 324484, bks cnt 3 blk size 8*512
#
File is comprised of 1 fragments (33%)

is_valid_shalhash: SHA-1 hash:
calculated 62f6235a:fc98eb3a:85ce183e:834f1cb3:8alf71d1
expected 62f6235a:fc98eb3a:85ce183e:834f1cb3:8alf71d1
File size is 0x04b3dc00
Located c8000be-universalk9.dir1/c8000be-mono-universalk9-build_164422SSA.pkg
Image size 78896128 inode num 324491, bks cnt 19262 blk size 8*512
#####
File is comprised of 21 fragments (0%)
.....

Router# show version installed
Package: Provisioning File, version: n/a, status: active
File: bootflash:c8000be-universalk9.dir1/packages.conf, on: RP0
Built: n/a, by: n/a
File SHA1 checksum: ad09affd3f8820f4844f27acc1add502e0b8f459

Package: rpbase, version: 2012-07-10_16.22_mcpred, status: active
File: bootflash:c8000be-universalk9.dir1/c8000be-mono-universalk9-build_164422SSA.pkg, on:

```

```

RP0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 5e95c9cbc4eaf5a4a5a1ac846ee2d0f41d1a026b

Package: firmware_attributes, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:c8000be-universalk9.dir1/c8000be-firmware_attributes_164422SSA.pkg, on:
RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 71614f2d9cbe7f96d3c6e99b67d514bd108c6c99

Package: firmware_dsp_sp2700, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:c8000be-universalk9.dir1/c8000be-firmware_dsp_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 8334565edf7843fe246783b1d5c6ed933d96d79e
Package: firmware_fpge, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:c8000be-universalk9.dir1/c8000be-firmware_fpge_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: eb72900ab32c1c50652888ff486cf370ac901dd7

Package: firmware_sm_lt3e3, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:c8000be-universalk9.dir1/c8000be-firmware_sm_lt3e3_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 803005f15d8ea71ab088647e2766727ac2269871

Package: rpcontrol, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:c8000be-universalk9.dir1/c8000be-mono-universalk9_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 980fd58fe581e9346c44417b451d1c09ebb640c2

Package: rpios-universalk9, version: dir1, status: active
File: bootflash:c8000be-universalk9.dir1/c8000be-mono-universalk9_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.23, by: mcpre
File SHA1 checksum: 27084f7e30ald69d45a33e05d1b00345040799fb
Package: rpaccess, version: 2012-07-10_16.22_mcpre, status: active
File: bootflash:c8000be-universalk9.dir1/c8000be-mono-universalk9_164422SSA.pkg, on: RP0/0
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 0119802deda2da91c38473c47a998fb3ed423448

Package: rpcontrol, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:c8000be-universalk9.dir1/c8000be-rpcontrol-BLD-BLD_MCP_DEV_LATEST_20120710_
164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 980fd58fe581e9346c44417b451d1c09ebb640c2

Package: rpios-universalk9, version: 2012-07-10_16.23_mcpre, status: n/a
File: bootflash:c8000be-universalk9.dir1/c8000be-rpios-universalk9-BLD-BLD_MCP_DEV_LATEST_
20120710_164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.23, by: mcpre
File SHA1 checksum: 27084f7e30ald69d45a33e05d1b00345040799fb

Package: rpaccess, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:c8000be-universalk9.dir1/c8000be-rpaccess-BLD-BLD_MCP_DEV_LATEST_20120710_
164422SSA.pkg, on: RP0/1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 0119802deda2da91c38473c47a998fb3ed423448

Package: rpbase, version: 2012-07-10_16.22_mcpre, status: n/a
File: bootflash:c8000be-universalk9.dir1/c8000be-rpbase-BLD-BLD_MCP_DEV_LATEST_20120710_
164422SSA.pkg, on: RP1
Built: 2012-07-10_16.22, by: mcpre
File SHA1 checksum: 5e95c9cbc4eaf5a4a5a1ac846ee2d0f41d1a026b

Package: firmware_fpge, version: 2012-07-10_16.22_mcpre, status: n/a

```



# Configuring No Service Password-Recovery

The Cisco IOS password recovery procedure allows you to gain access, using the console, to the ROMMON mode by using the Break key during system startup and reload. When the device software is loaded from ROMMON mode, the configuration is updated with the new password. The password recovery procedure makes anyone with console access have the ability to access the device and its network.

The No Service Password-Recovery feature is designed to prevent the service password-recovery procedure from being used to gain access to the device and network.

## Configuration Registers and System Boot Configuration

The lowest four bits of the configuration register (bits 3, 2, 1, and 0) form the boot field. The boot field determines if the device boots manually from ROM or automatically from flash or the network. For example, when the configuration register boot field value is set to any value from 0x2 to 0xF, the device uses the register boot field value to form a default boot filename for autobooting from a network server.

Bit 8, when set to 1, ignores the startup configuration. Bit 6, when set to 1, enables break key detection. You must set the configuration register to autoboot to enable this feature. Any other configuration register setting will prevent the feature from being enabled.



---

**Note** By default, the no confirm prompt and messages are not displayed after reloads.

---

## How to Enable No Service Password-Recovery

You can enable the No Service Password-Recovery in the following two ways:

- Using the **no service password-recovery** command. This option allows password recovery once it is enabled.
- Using the **no service password-recovery strict** command. This option does not allow for device recovery once it is enabled.



---

**Note** As a precaution, a valid Cisco IOS image should reside in the bootflash: before this feature is enabled.

---

If you plan to enter the no service password-recovery command, Cisco recommends that you save a copy of the system configuration file in a location away from the device.

Before you begin, ensure that this feature is disabled before making any change to the device regardless of the significance of the change—such as a configuration, module, software version, or ROMMON version change.

The configuration register boot bit must be enabled to load the startup configuration by setting bit-8 to 0, to ignore the break key in Cisco IOS XE by setting bit-6 to 0, and to auto boot a Cisco IOS XE image by setting the lowest four bits 3-0, to any value from 0x2 to 0xF. Changes to the configuration register are not saved after the No Service Password-Recovery feature is enabled.




---

**Note** If Bit-8 is set to 1, the startup configuration is ignored. If Bit-6 is set to 1, break key detection is enabled in Cisco IOS XE. If both Bit-6 and Bit-8 are set to 0, the No Service Password-Recovery feature is enabled.

---

This example shows how to enable the No Service Password-Recovery feature:

```
Router> enable
Router# show version
Router# configure terminal
Router(config)# config-register 0x2012
Router(config)# no service password-recovery
Router(config)# exit
```

### Recovering a Device with the No Service Password-Recovery Feature Enabled

To recover a device after the no service password-recovery feature is enabled using the **no service password-recovery** command, look out for the following message that appears during the boot: “PASSWORD RECOVERY FUNCTIONALITY IS DISABLED.” As soon as “..” appears, press the Break key. You are then prompted to confirm the Break key action:

- If you confirm the action, the startup configuration is erased and the device boots with the factory default configuration with the No Service Password-Recovery enabled.
- If you do not confirm the Break key action, the device boots normally with the No Service Password-Recovery feature enabled.




---

**Note** You cannot recover a device if the No Service Password-Recovery feature was enabled using the **no service password-recovery strict** command.

---

This example shows a Break key action being entered during boot up, followed by confirmation of the break key action. The startup configuration is erased and the device then boots with the factory default configuration with the No Service Password-Recovery feature enabled.

```
Initializing Hardware ...

Checking for PCIe device presence...done
System integrity status: 0x610
Rom image verified correctly

System Bootstrap, Version 17.3(1r), RELEASE SOFTWARE
Copyright (c) 1994-2020 by cisco Systems, Inc.

Current image running: Boot ROM0

Last reset cause: LocalSoft
C8300-1N1S-4T2X platform with 8388608 Kbytes of main memory

PASSWORD RECOVERY FUNCTIONALITY IS DISABLED

..

telnet> send brk
```

```

..

PASSWORD RECOVERY IS DISABLED.

Do you want to reset the router to the factory default
configuration and proceed [y/n] ? y

Router clearing configuration. Please wait for ROMMON prompt...

File size is 0x17938a80

Located c8000be-universalk9.BLD_V153_3_S_XE310_THROTTLE_LATEST_20130623_234109.SSA.bin

Image size 395545216 inode num 26, bks cnt 96569 blk size 8*512

This example shows a Break key action being entered during boot up, followed by the non-confirmation of
the break key action. The device then boots normally with the No Service Password-Recovery feature enabled.

Checking for PCIe device presence...done
System integrity status: 0x610
Rom image verified correctly

System Bootstrap, Version 17.3(1r), RELEASE SOFTWARE
Copyright (c) 1994-2020 by cisco Systems, Inc.

Current image running: Boot ROM0

Last reset cause: LocalSoft
C8300-1N1S-4T2X platform with 8388608 Kbytes of main memory

PASSWORD RECOVERY FUNCTIONALITY IS DISABLED

..

telnet> send brk

...

PASSWORD RECOVERY IS DISABLED.

Do you want to reset the router to the factory default
configuration and proceed [y/n] ? n

Router continuing with existing configuration...

File size is 0x17938a80

Located c8000be-universalk9.BLD_V153_3_S_XE310_THROTTLE_LATEST_20130623_234109.SSA.bin

Image size 395545216 inode num 26, bks cnt 96569 blk size 8*512

##### ...

```

### Configuration Examples for No Service Password-Recovery

The following example shows how to obtain the configuration register setting (which is set to autoboot), disable password recovery capability, and then verify that the configuration persists through a system reload:

```

Router# show version

Cisco Internetwork Operating System Software

```

```
IOS (tm) 5300 Software (C7200-P-M), Version 12.3(8)YA, RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Copyright (c) 1986-2004 by Cisco Systems, Inc.
Compiled Wed 05-Mar-04 10:16 by xxx
Image text-base: 0x60008954, data-base: 0x61964000
ROM: System Bootstrap, Version 12.3(8)YA, RELEASE SOFTWARE (fc1)
...
125440K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x2102
Router# configure terminal
Router(config)# no service password-recovery
WARNING:
Executing this command will disable the password recovery mechanism.
Do not execute this command without another plan for password recovery.
Are you sure you want to continue? [yes]: yes
...
Router(config)# exit
Router#
Router# reload
Proceed with reload? [confirm] yes
00:01:54: %SYS-5-RELOAD: Reload requested
System Bootstrap, Version 12.3...
Copyright (c) 1994-2004 by cisco Systems, Inc.
C7400 platform with 262144 Kbytes of main memory
PASSWORD RECOVERY FUNCTIONALITY IS DISABLED
...
```

The following example shows how to disable password recovery capability using the no service password-recovery strict command:

```
Router# configure terminal
Router(config)# no service password-recovery strict
WARNING:
Do not execute this command without another plan for password recovery.
```

```
Are you sure you want to continue? [yes]: yes
```

```
..
```





## CHAPTER 9

# Slot and Subslot Configuration

This chapter contains information on slots and subslots. Slots specify the chassis slot number in your device and subslots specify the slot where the service modules are installed.

For further information on the slots and subslots, see the “About Slots and Interfaces” sections:

- [Hardware Installation Guide for Cisco Catalyst 8300 Series Edge Platforms](#)
- [Hardware Installation Guide for Cisco Catalyst 8200 Series Edge Platforms](#)

The following section is included in this chapter:

- [Configuring the Interfaces, on page 157](#)

## Configuring the Interfaces

The following sections describe how to configure Gigabit interfaces and also provide examples of configuring the router interfaces:

- [Configuring Gigabit Ethernet Interfaces, on page 157](#)
- [Configuring the Interfaces: Example, on page 159](#)
- [Viewing a List of All Interfaces: Example, on page 159](#)
- [Viewing Information About an Interface: Example, on page 160](#)

## Configuring Gigabit Ethernet Interfaces

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface GigabitEthernet *slot/subslot/port***
4. **ip address *ip-address mask* [secondary] dhcp pool**
5. **negotiation auto**
6. **end**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> <pre>Router&gt; enable</pre>	Enables privileged EXEC mode. Enter your password if prompted.
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> <pre>Router# configure terminal</pre>	Enters global configuration mode.
<b>Step 3</b>	<b>interface GigabitEthernet slot/subslot/port</b> <b>Example:</b> <pre>Router(config)# interface GigabitEthernet 0/0/1</pre>	Configures a GigabitEthernet interface. <ul style="list-style-type: none"> <li>• <b>GigabitEthernet</b>—Type of interface.</li> <li>• <i>slot</i>—Chassis slot number.</li> <li>• <i>/subslot</i>—Secondary slot number. The slash (/) is required.</li> <li>• <i>/port</i>—Port or interface number. The slash (/) is required.</li> </ul>
<b>Step 4</b>	<b>ip address ip-address mask [secondary] dhcp pool</b> <b>Example:</b> <pre>Router(config-if)# ip address 10.0.0.1 255.255.255.0 dhcp pool</pre>	Assigns an IP address to the GigabitEthernet <ul style="list-style-type: none"> <li>• <b>ip address ip-address</b>—IP address for the interface.</li> <li>• <i>mask</i>—Mask for the associated IP subnet.</li> <li>• <b>secondary</b> (optional)—Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.</li> <li>• <b>dhcp</b>—IP address negotiated via DHCP.</li> <li>• <b>pool</b>—IP address autoconfigured from a local DHCP pool.</li> </ul>
<b>Step 5</b>	<b>negotiation auto</b> <b>Example:</b> <pre>Router(config-if)# negotiation auto</pre>	Selects the negotiation mode. <ul style="list-style-type: none"> <li>• <b>auto</b>—Performs link autonegotiation.</li> </ul>
<b>Step 6</b>	<b>end</b> <b>Example:</b> <pre>Router(config-if)# end</pre>	Ends the current configuration session and returns to privileged EXEC mode.



## Configuring the Interfaces: Example

The following example shows the **interface gigabitEthernet** command being used to add the interface and set the IP address. **0/0/0** is the slot/subslot/port. The ports are numbered 0 to 5.

```
Router# show running-config interface gigabitEthernet 0/0/0
Building configuration...
Current configuration : 71 bytes
!
interface gigabitEthernet0/0/0
no ip address
negotiation auto
end

Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface gigabitEthernet 0/0/0
```

## Viewing a List of All Interfaces: Example

In this example, the **show platform software interface summary**, **show interfaces summary**, and **show platform software status control-process brief** commands are used to display all the interfaces:

```
Router# show platform software interface summary
Interface                IHQ  IQD  OHQ  OQD  RXBS  RXPS  TXBS  TXPS  TRTL
-----
* GigabitEthernet0/0/0    0    0    0    0    0    0    0    0    0
* GigabitEthernet0/0/1    0    0    0    0    0    0    0    0    0
* GigabitEthernet0/0/2    0    0    0    0    0    0    0    0    0
* GigabitEthernet0/0/3    0    0    0    0    0    0    0    0    0
* Te0/0/4                  0    0    0    0    0    0    0    0    0
* Te0/0/5                  0    0    0    0    0    0    0    0    0
```

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

```
Interface                IHQ  IQD  OHQ  OQD  RXBS  RXPS  TXBS  TXPS  TRTL
-----
* GigabitEthernet0/0/0  0    0    0    0    0    0    0    0    0
* GigabitEthernet0/0/1  0    0    0    0    0    0    0    0    0
* GigabitEthernet0/0/2  0    0    0    0    0    0    0    0    0
* GigabitEthernet0/0/3  0    0    0    0    0    0    0    0    0
* Te0/0/4                0    0    0    0    0    0    0    0    0
* Te0/0/5                0    0    0    0    0    0    0    0    0
```

```
Router#show platform software status control-process brief
Load Average
Slot  Status  1-Min  5-Min  15-Min
RP0  Healthy  0.83   0.91   0.91
```

```
Memory (kB)
Slot  Status  Total    Used (Pct)    Free (Pct)  Committed (Pct)
RP0  Healthy  7768456  2654936 (34%)  5113520 (66%)  3115212 (40%)
```

```
CPU Utilization
```

## Viewing Information About an Interface: Example

Slot	CPU	User	System	Nice	Idle	IRQ	SIRQ	IOWait
RPO	0	2.70	1.70	0.00	95.59	0.00	0.00	0.00
	1	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	2	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	3	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	4	2.40	1.40	0.00	96.19	0.00	0.00	0.00
	5	0.80	1.60	0.00	97.59	0.00	0.00	0.00
	6	12.40	12.30	0.00	75.30	0.00	0.00	0.00
	7	11.20	12.40	0.00	76.40	0.00	0.00	0.00
	8	2.80	1.80	0.00	95.40	0.00	0.00	0.00
	9	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	10	0.00	0.00	0.00	100.00	0.00	0.00	0.00
	11	0.00	0.00	0.00	100.00	0.00	0.00	0.00

## Viewing Information About an Interface: Example

The following example shows how to display a brief summary of an interface's IP information and status, including the virtual interface bundle information, by using the **show ip interface brief** command:

```
Router# show ip interface brief
GigabitEthernet0/0/0    10.10.3.1           YES NVRAM  up           up
GigabitEthernet0/0/1    192.0.5.2           YES NVRAM  up           up
GigabitEthernet0/0/2    192.0.2.5           YES NVRAM  down        down
GigabitEthernet0/0/3    unassigned          YES NVRAM  down        down
Te0/0/4                 unassigned          YES NVRAM  down        down
Te0/0/5                 10.20.4.8           YES NVRAM  down        down
Te0/1/0                 unassigned          YES NVRAM  down        down
```



## CHAPTER 10

# Support for Security-Enhanced Linux

---

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

- [Overview, on page 161](#)
- [Prerequisites for SELinux, on page 161](#)
- [Restrictions for SELinux, on page 161](#)
- [Information About SELinux, on page 161](#)
- [Configuring SELinux, on page 162](#)
- [Verifying SELinux Enablement, on page 164](#)
- [Troubleshooting SELinux, on page 165](#)

## 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.

From Cisco IOS XE 17.13.1a, 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.

## Supported Platforms

From Cisco IOS XE 17.13.1a, SELinux is enabled on the following platforms:

- Cisco 1000 Series Aggregation Services Routers
- Cisco 1000 Series Integrated Services Routers
- Cisco 4000 Series Integrated Services Routers
- Cisco Catalyst 8000v Edge Software
- Cisco Catalyst 8200 Series Edge Platforms
- Cisco Catalyst 8300 Series Edge Platforms
- Cisco Catalyst 8500 and 8500L Series Edge Platforms
- Cisco VG Series Gateways: VG400, VG410, VG420, and VG450
- Cisco 1100 Terminal Services Gateway

## Configuring SELinux

There 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

<b>Facility-Severity-Mnemonic</b>	<b>%SELINUX-1-VIOLATION</b>
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
Recommended Action	<p>Contact Cisco TAC with the following relevant information as attachments:</p> <ul style="list-style-type: none"> <li>• The exact message as it appears on the console or in the system</li> <li>• Output of the <b>show tech-support</b> command (text file)</li> <li>• Archive of Btrace files from the box using the following command: <b>request platform software trace archive target &lt;URL&gt;</b></li> <li>• Output of the <b>show platform software selinux</b> command</li> </ul>

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 11

# 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:

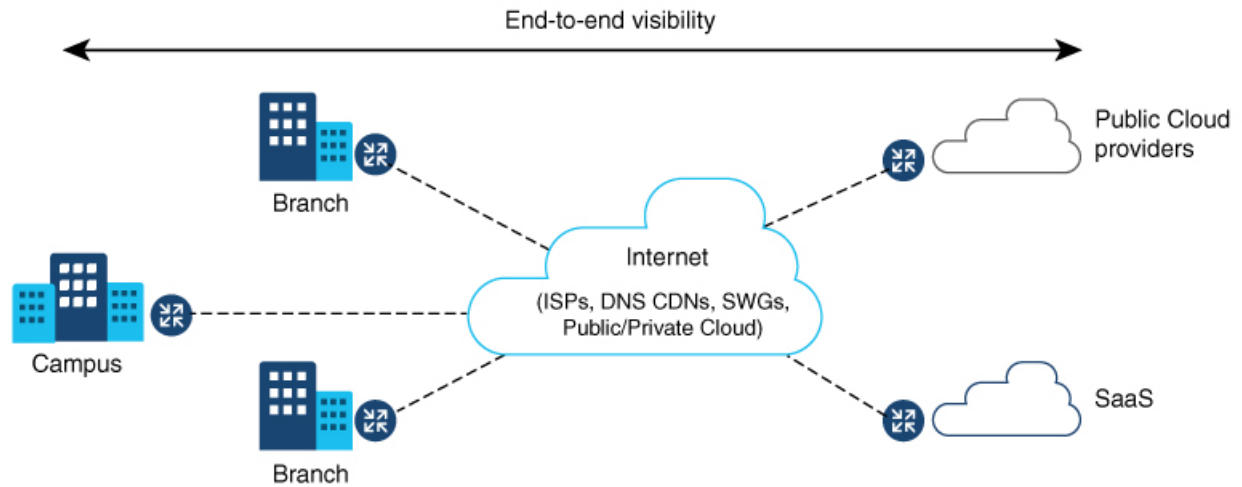
- [Cisco ThousandEyes Enterprise Agent Application Hosting, on page 167](#)
- [Supported Platforms and System Requirements, on page 168](#)
- [Workflow to Install and Run the Cisco ThousandEyes Application, on page 169](#)
- [Modifying the Agent Parameters, on page 173](#)
- [Uninstalling the Application, on page 173](#)
- [Troubleshooting the Cisco ThousandEyes Application, on page 174](#)

## 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, Cisco 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 17.6.1, you can use application-hosting capabilities to deploy the Cisco ThousandEyes Enterprise Agent as a container application on Cisco Catalyst 8300 and Catalyst 8200 Series Edge Platforms. 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 3: 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](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

Table 24: Feature Information for ThousandEyes Enterprise Agent Application Hosting

Feature Name	Releases	Feature Information
Cisco ThousandEyes Enterprise Agent Application Hosting	Cisco IOS XE 17.7.1a	The Cisco ThousandEyes Enterprise Agent Application introduces the functionality to inherit the Domain Name Server (DNS) information from the device. With this enhancement, the DNS field in the vManage ThousandEyes feature template is an optional parameter.
Cisco ThousandEyes Enterprise Agent Application Hosting	Cisco IOS XE 17.6.1	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.

Table 25: Supported Platforms and System Requirements

Platforms	Bootflash	FRU Storage	DRAM
Catalyst 8300 Series Edge Platforms			
C8300-1N1S-6T	8 GB	16 GB M.2 USB (Default)	8 GB
C8300-1N1S-4T2X	8 GB	16 GB M.2 USB (Default)	8 GB
C8300-2N2S-6T	8 GB	16 GB M.2 USB (Default)	8 GB
C8300-2N2S-4T2X	8 GB	16 GB M.2 USB (Default)	8 GB
Catalyst 8200 Series Edge Platforms			
C8200-1N-4T	8 GB	16 GB M.2 USB (Default)	8 GB
C8200L-1N-4T	8 GB	16 GB M.2 USB (Recommended)	8 GB



**Note** The minimum DRAM and 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 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:

- 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 4.0.2.
- 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 17.6.1 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. If you see a message stating that your token is invalid and you want to troubleshoot the issue, see [Troubleshooting the Cisco ThousandEyes Application, on page 174](#).



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

**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) 192.0.2.8      : Running
IOx service (HA)                : Not Supported
IOx service (IOxman)            : Running
IOx service (Sec storage)       : Not Supported
Libvirt 1.3.4                   : Running
```

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

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

```
interface VirtualPortGroup 0
  ip address 192.0.2.22 255.255.255.0
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 192.0.2.22 netmask 255.255.255.0
app-default-gateway 192.0.2.22 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 192.0.2.10  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** 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 8** 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.

## Downloading and Copying the Image to the Device

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

**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 tel1000 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 'tel1000'.
```

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: tel1000
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: tel1000 started
successfully Current state is RUNNING
```

```
Device#show app-hosting detail appid tel1000 ( Details of Application)
```

```
App id          : tel1000
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>
```

## Connecting 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.

---

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*).

---

## Modifying the Agent Parameters

To modify the agent parameters, perform these actions:

- 
- 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 the 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.
- 

## Uninstalling the Application

To uninstall the application, perform these steps:

- 
- 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.
-

# Troubleshooting 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 */etc/te-agent.cfg*.
3. View the logs in */var/log/agent/te-agent.log*. You can use these logs to troubleshoot the configuration.

## Checking 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 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 scl.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.

---





## CHAPTER 12

# Process Health Monitoring

---

This chapter describes how to manage and monitor the health of various components of your device. It contains the following sections:

- [Monitoring Control Plane Resources, on page 175](#)
- [Monitoring Hardware Using Alarms, on page 179](#)

## Monitoring Control Plane Resources

The following sections explain the of memory and CPU monitoring from the perspective of the Cisco IOS process and the overall control plane:

- [Avoiding Problems Through Regular Monitoring, on page 175](#)
- [Cisco IOS Process Resources, on page 176](#)
- [Overall Control Plane Resources, on page 177](#)

## Avoiding Problems Through Regular Monitoring

Processes should provide monitoring and notification of their status/health to ensure correct operation. When a process fails, a syslog error message is displayed and either the process is restarted or the device is rebooted. A syslog error message is displayed when a monitor detects that a process is stuck or has crashed. If the process can be restarted, it is restarted; else, the device is restarted.

Monitoring system resources enables you to detect potential problems before they occur, thus avoiding outages. The following are the advantages of regular monitoring:

- Lack of memory on line cards that are in operation for a few years can lead to major outages. Monitoring memory usage helps to identify memory issues in the line cards and enables you to prevent an outage.
- Regular monitoring establishes a baseline for a normal system load. You can use this information as a basis for comparison when you upgrade hardware or software—to see if the upgrade has affected resource usage.

## Cisco IOS Process Resources

You can view CPU utilization statistics on active processes and see the amount of memory being used in these processes using the **show memory** command and the **show process cpu** command. These commands provide a representation of memory and CPU utilization from the perspective of only the Cisco IOS process; they do not include information for resources on the entire platform. For example, when the **show memory** command is used in a system with 8 GB RAM running a single Cisco IOS process, the following memory usage is displayed:

```
Router# show memory
Tracekey : 1#08d3ff66f05826cb63fb2b7325fcbcd0

          Head      Total (b)      Used (b)      Free (b)      Lowest (b)      Largest (b)
Processor 7FB733EC4048 3853903068 193512428 3660390640 707918492 3145727908
reserve P 7FB733EC40A0 102404      92          102312      102312      102312
lsmapi_io 7FB7320C11A8 6295128    6294304    824         824         412
Dynamic heap limit(MB) 3000      Use(MB) 0
```

The **show process cpu** command displays Cisco IOS CPU utilization average:

```
Router# show process cpu
CPU utilization for five seconds: 1%/0%; one minute: 1%; five minutes: 1%
PID Runtime(ms)      Invoked      uSecs      5Sec      1Min      5Min TTY Process
  1         1         14          71 0.00% 0.00% 0.00% 0 Chunk Manager
  2        127         872         145 0.00% 0.00% 0.00% 0 Load Meter
  3         0          1           0 0.00% 0.00% 0.00% 0 Policy bind Proc
  4         0          1           0 0.00% 0.00% 0.00% 0 Retransmission o
  5         0          1           0 0.00% 0.00% 0.00% 0 IPC ISSU Dispatc
  6         11         13          846 0.00% 0.00% 0.00% 0 RF Slave Main Th
  7         0          1           0 0.00% 0.00% 0.00% 0 EDDRI_MAIN
  8         0          1           0 0.00% 0.00% 0.00% 0 RO Notify Timers
  9        1092         597         1829 0.00% 0.01% 0.00% 0 Check heaps
 10         8          73          109 0.00% 0.00% 0.00% 0 Pool Manager
 11         0          1           0 0.00% 0.00% 0.00% 0 DiscardQ Backgro
 12         0          2           0 0.00% 0.00% 0.00% 0 Timers
 13         0          32           0 0.00% 0.00% 0.00% 0 WATCH_AFS
 14         0          1           0 0.00% 0.00% 0.00% 0 MEMLEAK PROCESS
 15        1227        40758         30 0.00% 0.02% 0.00% 0 ARP Input
 16         41         4568         8 0.00% 0.00% 0.00% 0 ARP Background
 17         0          2           0 0.00% 0.00% 0.00% 0 ATM Idle Timer
 18         0          1           0 0.00% 0.00% 0.00% 0 ATM ASYNC PROC
 19         0          1           0 0.00% 0.00% 0.00% 0 CEF MIB API
 20         0          1           0 0.00% 0.00% 0.00% 0 AAA_SERVER_DEADT
 21         0          1           0 0.00% 0.00% 0.00% 0 Policy Manager
 22         0          2           0 0.00% 0.00% 0.00% 0 DDR Timers
 23         60         23         2608 0.00% 0.00% 0.00% 0 Entity MIB API
 24         43         45          955 0.00% 0.00% 0.00% 0 PrstVbl
 25         0          2           0 0.00% 0.00% 0.00% 0 Serial Backgroun
 26         0          1           0 0.00% 0.00% 0.00% 0 RMI RM Notify Wa
 27         0          2           0 0.00% 0.00% 0.00% 0 ATM AutoVC Perio
 28         0          2           0 0.00% 0.00% 0.00% 0 ATM VC Auto Crea
 29         30         2181         13 0.00% 0.00% 0.00% 0 IOSXE heartbeat
 30         1          9          111 0.00% 0.00% 0.00% 0 Btrace time base
 31         5         182         27 0.00% 0.00% 0.00% 0 DB Lock Manager
 32         16        4356         3 0.00% 0.00% 0.00% 0 GraphIt
 33         0          1           0 0.00% 0.00% 0.00% 0 DB Notification
 34         0          1           0 0.00% 0.00% 0.00% 0 IPC Apps Task
 35         0          1           0 0.00% 0.00% 0.00% 0 ifIndex Receive
 36         4         873         4 0.00% 0.00% 0.00% 0 IPC Event Notifi
 37         49        4259         11 0.00% 0.00% 0.00% 0 IPC Mcast Pendlin
 38         0          1           0 0.00% 0.00% 0.00% 0 Platform appsess
 39         2          73         27 0.00% 0.00% 0.00% 0 IPC Dynamic Cach
 40         5         873         5 0.00% 0.00% 0.00% 0 IPC Service NonC
```

41	0	1	0	0.00%	0.00%	0.00%	0	IPC Zone Manager
42	38	4259	8	0.00%	0.00%	0.00%	0	IPC Periodic Tim
43	18	4259	4	0.00%	0.00%	0.00%	0	IPC Deferred Por
44	0	1	0	0.00%	0.00%	0.00%	0	IPC Process leve
45	0	1	0	0.00%	0.00%	0.00%	0	IPC Seat Manager
46	3	250	12	0.00%	0.00%	0.00%	0	IPC Check Queue
47	0	1	0	0.00%	0.00%	0.00%	0	IPC Seat RX Cont
48	0	1	0	0.00%	0.00%	0.00%	0	IPC Seat TX Cont
49	22	437	50	0.00%	0.00%	0.00%	0	IPC Keep Alive M
50	25	873	28	0.00%	0.00%	0.00%	0	IPC Loadometer
51	0	1	0	0.00%	0.00%	0.00%	0	IPC Session Deta
52	0	1	0	0.00%	0.00%	0.00%	0	SENSOR-MGR event
53	2	437	4	0.00%	0.00%	0.00%	0	Compute SRP rate

## Overall Control Plane Resources

Control plane memory and CPU utilization on each control processor allows you to keep a tab on the overall control plane resources. You can use the **show platform resources** command to monitor the overall system health and resource usage for the IOS XE platforms. Also, you can use the **show platform software status control-processor brief** command (summary view) or the **show platform software status control-processor** command (detailed view) to view control plane memory and CPU utilization information.

All control processors should show status, Healthy. Other possible status values are Warning and Critical. Warning indicates that the device is operational, but that the operating level should be reviewed. Critical implies that the device is nearing failure.

If you see a Warning or Critical status, take the following actions:

- Reduce the static and dynamic loads on the system by reducing the number of elements in the configuration or by limiting the capacity for dynamic services.
- Reduce the number of routes and adjacencies, limit the number of ACLs and other rules, reduce the number of VLANs, and so on.

The following sections describe the fields in the **show platform software status control-processor** command output.

### Load Average

Load average represents the process queue or process contention for CPU resources. For example, on a single-core processor, an instantaneous load of 7 would mean that seven processes are ready to run, one of which is currently running. On a dual-core processor, a load of 7 would mean that seven processes are ready to run, two of which are currently running.

### Memory Utilization

Memory utilization is represented by the following fields:

- Total—Total line card memory
- Used—Consumed memory
- Free—Available memory
- Committed—Virtual memory committed to processes

## CPU Utilization

CPU utilization is an indication of the percentage of time the CPU is busy, and is represented by the following fields:

- CPU—Allocated processor
- User—Non-Linux kernel processes
- System—Linux kernel process
- Nice—Low-priority processes
- Idle—Percentage of time the CPU was inactive
- IRQ—Interrupts
- SIRQ—System Interrupts
- IOWait—Percentage of time CPU was waiting for I/O

### Example: show platform software status control-processor Command

The following are some examples of using the **show platform software status control-processor** command:

```
Router# show platform software status control-processor
RP0: online, statistics updated 3 seconds ago
RP0: online, statistics updated 5 seconds ago
Load Average: healthy
  1-Min: 1.35, status: healthy, under 9.30
  5-Min: 1.06, status: healthy, under 9.30
 15-Min: 1.02, status: healthy, under 9.30
Memory (kb): healthy
  Total: 7768456
  Used: 2572568 (33%), status: healthy
  Free: 5195888 (67%)
  Committed: 3112968 (40%), under 90%
Per-core Statistics
CPU0: CPU Utilization (percentage of time spent)
  User: 3.00, System: 2.40, Nice: 0.00, Idle: 94.60
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU1: CPU Utilization (percentage of time spent)
  User: 0.00, System: 0.00, Nice: 0.00, Idle:100.00
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU2: CPU Utilization (percentage of time spent)
  User: 0.00, System: 0.00, Nice: 0.00, Idle:100.00
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU3: CPU Utilization (percentage of time spent)
  User: 0.00, System: 0.00, Nice: 0.00, Idle:100.00
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU4: CPU Utilization (percentage of time spent)
  User: 7.30, System: 1.70, Nice: 0.00, Idle: 91.00
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU5: CPU Utilization (percentage of time spent)
  User: 3.30, System: 1.50, Nice: 0.00, Idle: 95.20
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU6: CPU Utilization (percentage of time spent)
  User: 17.91, System: 11.81, Nice: 0.00, Idle: 70.27
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU7: CPU Utilization (percentage of time spent)
  User: 11.91, System: 13.31, Nice: 0.00, Idle: 74.77
```

```

IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU8: CPU Utilization (percentage of time spent)
  User: 2.70, System: 2.00, Nice: 0.00, Idle: 95.30
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU9: CPU Utilization (percentage of time spent)
  User: 0.00, System: 0.00, Nice: 0.00, Idle:100.00
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU10: CPU Utilization (percentage of time spent)
  User: 0.00, System: 0.00, Nice: 0.00, Idle:100.00
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU11: CPU Utilization (percentage of time spent)
  User: 0.00, System: 0.00, Nice: 0.00, Idle:100.00
  IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00

```

```
Router# show platform software status control-processor brief
```

```
Load Average
Slot Status 1-Min 5-Min 15-Min
RP0 Healthy 1.14 1.07 1.02
```

```
Memory (kB)
Slot Status Total Used (Pct) Free (Pct) Committed (Pct)
RP0 Healthy 7768456 2573416 (33%) 5195040 (67%) 3115096 (40%)
```

```
CPU Utilization
Slot CPU User System Nice Idle IRQ SIRQ IOWait
RP0 0 2.80 1.80 0.00 95.39 0.00 0.00 0.00
  1 0.00 0.00 0.00 100.00 0.00 0.00 0.00
  2 0.00 0.00 0.00 100.00 0.00 0.00 0.00
  3 0.00 0.00 0.00 100.00 0.00 0.00 0.00
  4 6.80 1.80 0.00 91.39 0.00 0.00 0.00
  5 3.20 1.60 0.00 95.19 0.00 0.00 0.00
  6 16.30 12.60 0.00 71.10 0.00 0.00 0.00
  7 12.40 13.70 0.00 73.90 0.00 0.00 0.00
  8 2.40 2.40 0.00 95.19 0.00 0.00 0.00
  9 0.00 0.00 0.00 100.00 0.00 0.00 0.00
 10 0.00 0.00 0.00 100.00 0.00 0.00 0.00
 11 0.00 0.00 0.00 100.00 0.00 0.00 0.00
```

## Monitoring Hardware Using Alarms

- [Device Design and Monitoring Hardware, on page 179](#)
- [BootFlash Disk Monitoring, on page 180](#)
- [Approaches for Monitoring Hardware Alarms, on page 180](#)

## Device Design and Monitoring Hardware

The router sends alarm notifications when problems are detected, allowing you to monitor the network remotely. You do not need to use **show** commands to poll devices on a routine basis; however, you can perform onsite monitoring if you choose.

## BootFlash Disk Monitoring

The bootflash disk must have enough free space to store two core dumps. This condition is monitored, and if the bootflash disk is too small to store two core dumps, a syslog alarm is generated, as shown in the following example:

```
Aug 22 13:40:41.038 R0/0: %FLASH_CHECK-3-DISK_QUOTA: Flash disk quota exceeded
[free space is 7084440 kB] - Please clean up files on bootflash.
```

The size of the bootflash disk must be at least of the same size as that of the physical memory installed on the device. If this condition is not met, a syslog alarm is generated as shown in the following example:

```
%IOSXEBOOT-2-FLASH_SIZE_CHECK: (rp/0): Flash capacity (8 GB) is insufficient for fault
analysis based on
installed memory of RP (16 GB)
%IOSXEBOOT-2-FLASH_SIZE_CHECK: (rp/0): Please increase the size of installed flash to at
least 16 GB (same as
physical memory size)
```

## Approaches for Monitoring Hardware Alarms

- [Onsite Network Administrator Responds to Audible or Visual Alarms, on page 180](#)
- [Viewing the Console or Syslog for Alarm Messages, on page 181](#)
- [Network Management System Alerts a Network Administrator when an Alarm is Reported Through SNMP, on page 183](#)

## Onsite Network Administrator Responds to Audible or Visual Alarms

- [About Audible and Visual Alarms, on page 180](#)
- [Clearing an Audible Alarm, on page 180](#)
- [Clearing a Visual Alarm, on page 181](#)

### About Audible and Visual Alarms

An external element can be connected to a power supply using the DB-25 alarm connector on the power supply. The external element is a DC light bulb for a visual alarm and a bell for an audible alarm.

If an alarm illuminates the CRIT, MIN, or MAJ LED on the faceplate of the device, and a visual or audible alarm is wired, the alarm also activates an alarm relay in the power supply DB-25 connector, and either the bell rings or the light bulb flashes.

### Clearing an Audible Alarm

To clear an audible alarm, perform one of the following tasks:

- Press the **Audible Cut Off** button on the faceplate.
- Enter the **clear facility-alarm** command.

## Clearing a Visual Alarm

To clear a visual alarm, you must resolve the alarm condition. The **clear facility-alarm** command does not clear an alarm LED on the faceplate or turn off the DC light bulb. For example, if a critical alarm LED is illuminated because an active module was removed without a graceful deactivation, the only way to resolve that alarm is to replace the module.

## Viewing the Console or Syslog for Alarm Messages

The network administrator can monitor alarm messages by reviewing alarm messages sent to the system console or to a system message log (syslog).

- [Enabling the logging alarm Command, on page 181](#)
- [Examples of Alarm Messages, on page 181](#)
- [Reviewing and Analyzing Alarm Messages, on page 183](#)

### Enabling the logging alarm Command

The **logging alarm** command must be enabled for the system to send alarm messages to a logging device, such as the console or a syslog. This command is not enabled by default.

You can specify the severity level of the alarms to be logged. All the alarms at and above the specified threshold generate alarm messages. For example, the following command sends only critical alarm messages to logging devices:

```
Router(config)# logging alarm critical
```

If alarm severity is not specified, alarm messages for all severity levels are sent to logging devices.

### Examples of Alarm Messages

The following are examples of alarm messages that are sent to the console when a module is removed before performing a graceful deactivation. The alarm is cleared when the module is reinserted.

#### Module Removed

```
*Aug 22 13:27:33.774: %C-SM-X-16G4M2X: Module removed from subslot 1/1, interfaces disabled
*Aug 22 13:27:33.775: %SPA_OIR-6-OFFLINECARD: Module (SPA-4XT-SERIAL) offline in subslot
1/1
```

#### Module Reinserted

```
*Aug 22 13:32:29.447: %CC-SM-X-16G4M2X: Module inserted in subslot 1/1
*Aug 22 13:32:34.916: %SPA_OIR-6-ONLINECARD: Module (SPA-4XT-SERIAL) online in subslot 1/1
*Aug 22 13:32:35.523: %LINK-3-UPDOWN: SIP1/1: Interface EOBC1/1, changed state to up
```

#### Alarms

To view alarms, use the **show facility-alarm status** command. The following example shows a critical alarm for the power supply:

```
Router# show facility-alarm status
System Totals Critical: 1 Major: 0 Minor: 0
```

Source	Time	Severity	Description [Index]
-----	-----	-----	-----

Power Supply Bay 1 Missing [0]	Jul 08 2020 11:51:34	CRITICAL	Power Supply/FAN Module
POE Bay 0 Missing [0]	Jul 08 2020 11:51:34	INFO	Power Over Ethernet Module
POE Bay 1 Missing [0]	Jul 08 2020 11:51:34	INFO	Power Over Ethernet Module
xcvr container 0/0/4 Down [1]	Jul 08 2020 11:51:47	INFO	Transceiver Missing - Link
TenGigabitEthernet0/1/0 State Down [2]	Jul 08 2020 11:52:24	INFO	Physical Port Administrative
GigabitEthernet1/0/0 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative
GigabitEthernet1/0/1 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative
GigabitEthernet1/0/2 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative
GigabitEthernet1/0/3 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative
GigabitEthernet1/0/4 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative
GigabitEthernet1/0/5 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative
GigabitEthernet1/0/6 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative
GigabitEthernet1/0/7 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative
TwoGigabitEthernet1/0/17 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative
TwoGigabitEthernet1/0/18 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative
TwoGigabitEthernet1/0/19 State Down [2]	Jul 08 2020 11:56:35	INFO	Physical Port Administrative

To view critical alarms, use the **show facility-alarm status critical** command, as shown in the following example:

```
Router# show facility-alarm status critical
System Totals Critical: 1 Major: 0 Minor: 0
```

Source	Time	Severity	Description [Index]
-----	-----	-----	-----
Power Supply Bay 1 Missing [0]	Jul 08 2020 11:51:34	CRITICAL	Power Supply/FAN Module

To view the operational state of the major hardware components on the device, use the **show platform diag** command.



```
Router# show platform diag
Chassis type: C8300-1N1S-4T2X

Slot: 0, C8300-1N1S-4T2X
  Running state           : ok
  Internal state          : online
  Internal operational state : ok
  Physical insert detect time : 00:00:24 (01:29:20 ago)
  Software declared up time  : 00:01:01 (01:28:44 ago)
  CPLD version             : 20011540
  Firmware version         : 17.3(1r)

Sub-slot: 0/0, 4x1G-2xSFP+
  Operational status      : ok
  Internal state          : inserted
  Physical insert detect time : 00:01:14 (01:28:30 ago)
  Logical insert detect time  : 00:01:14 (01:28:30 ago)

Sub-slot: 0/1, C-NIM-1X
  Operational status      : ok
  Internal state          : inserted
  Physical insert detect time : 00:01:14 (01:28:31 ago)
  Logical insert detect time  : 00:01:14 (01:28:31 ago)

Slot: 1, C8300-1N1S-4T2X
  Running state           : ok
  Internal state          : online
  Internal operational state : ok
  Physical insert detect time : 00:00:24 (01:29:20 ago)
  Software declared up time  : 00:01:02 (01:28:43 ago)
  CPLD version             : 20011540
  Firmware version         : 17.3(1r)

Sub-slot: 1/0, C-SM-X-16G4M2X
  Operational status      : ok
  Internal state          : inserted
  Physical insert detect time : 00:01:14 (01:28:30 ago)
  Logical insert detect time  : 00:01:14 (01:28:30 ago)

Slot: R0, C8300-1N1S-4T2X
  Running state           : ok, active
```

## Reviewing and Analyzing Alarm Messages

To facilitate the review of alarm messages, you can write scripts to analyze alarm messages sent to the console or syslog. Scripts can provide reports on events such as alarms, security alerts, and interface status.

Syslog messages can also be accessed through Simple Network Management Protocol (SNMP) using the history table defined in the CISCO-SYSLOG-MIB.

## Network Management System Alerts a Network Administrator when an Alarm is Reported Through SNMP

The SNMP is an application-layer protocol that provides a standardized framework and a common language used for monitoring and managing devices in a network. Of all the approaches to monitor alarms, SNMP is the best approach to monitor more than one device in an enterprise and service provider setup.

SNMP provides notification of faults, alarms, and conditions that might affect services. It allows a network administrator to access device information through a network management system (NMS) instead of reviewing logs, polling devices, or reviewing log reports.

To use SNMP to get alarm notification, use the following MIBs:

- ENTITY-MIB, RFC 4133 (required for the CISCO-ENTITY-ALARM-MIB and CISCO-ENTITY-SENSOR-MIB to work)
- CISCO-ENTITY-ALARM-MIB
- CISCO-ENTITY-SENSOR-MIB (for transceiver environmental alarm information, which is not provided through the CISCO-ENTITY-ALARM-MIB)



# CHAPTER 13

## System Messages

System messages are saved in a log file or directed to other devices from the software running on a router. These messages are also known as syslog messages. System messages provide you with logging information for monitoring and troubleshooting purposes.

The following sections are included in this chapter:

- [Information About Process Management, on page 185](#)
- [How to Find Error Message Details, on page 185](#)

## Information About Process Management

You can access system messages by logging in to the console through Telnet protocol and monitoring your system components remotely from any workstation that supports the Telnet protocol.

Starting and monitoring software is referred to as process management. The process management infrastructure for a router is platform independent, and error messages are consistent across platforms running on Cisco IOS XE. You do not have to be directly involved in process management, but we recommend that you read the system messages that refer to process failures and other issues.

## How to Find Error Message Details

To see further details about a process management or a syslog error message, see the [System Error Messages Guide For Access and Edge Routers Guide](#).

The following are examples of the description and the recommended action displayed by the error messages.

**Error Message:** %PMAN-0-PROCESS\_NOTIFICATION : The process lifecycle notification component failed because [chars]

Explanation	Recommended Action
-------------	--------------------

The process lifecycle notification component failed, preventing proper detection of a process start and stop. This problem is likely the result of a software defect in the software subpackage.

Note the time of the message and investigate the kernel error message logs to learn more about the problem and see if it is correctable. If the problem cannot be corrected or the logs are not helpful, copy the error message exactly as it appears on the console along with the output of the **show tech-support** command and provide the gathered information to a Cisco technical support representative.

**Error Message:** %PMAN-0-PROCFAILCRIT A critical process [chars] has failed (rc [dec])

Explanation	Recommended Action
A process important to the functioning of the router has failed.	Note the time of the message and investigate the error message logs to learn more about the problem. If the problem persists, copy the message exactly as it appears on the console or in the system log. Research and attempt to resolve the issue using the tools and utilities provided at: <a href="http://www.cisco.com/tac">http://www.cisco.com/tac</a> . With some messages, these tools and utilities will supply clarifying information. Search for resolved software issues using the Bug Search Tool at: <a href="http://www.cisco.com/cisco/psn/bssprt/bss">http://www.cisco.com/cisco/psn/bssprt/bss</a> . If you still require assistance, open a case with the Technical Assistance Center at: <a href="http://tools.cisco.com/ServiceRequestTool/create/">http://tools.cisco.com/ServiceRequestTool/create/</a> , or contact your Cisco technical support representative and provide the representative with the information you have gathered. Attach the following information to your case in nonzipped, plain-text (.txt) format: the output of the <b>show logging</b> and <b>show tech-support</b> commands and your pertinent troubleshooting logs.

**Error Message:** %PMAN-3-PROCFAILOPT An optional process [chars] has failed (rc [dec])

Explanation	Recommended Action
-------------	--------------------

A process that does not affect the forwarding of traffic has failed.

Note the time of the message and investigate the kernel error message logs to learn more about the problem. Although traffic will still be forwarded after receiving this message, certain functions on the router may be disabled because of this message and the error should be investigated. If the logs are not helpful or indicate a problem you cannot correct, copy the message exactly as it appears on the console or in the system log. Research and attempt to resolve the issue using the tools and utilities provided at <http://www.cisco.com/tac>. With some messages, these tools and utilities will supply clarifying information. Search for resolved software issues using the Bug Search Tool at: <http://www.cisco.com/cisco/psn/bssprt/bss>. If you still require assistance, open a case with the Technical Assistance Center at: <http://tools.cisco.com/ServiceRequestTool/create/>, or contact your Cisco technical support representative and provide the representative with the information you have gathered. Attach the following information to your case in nonzipped, plain-text (.txt) format: the output of the **show logging** and **show tech-support** commands and your pertinent troubleshooting logs.

**Error Message:** %PMAN-3-PROCFAIL The process [chars] has failed (rc [dec])

#### Explanation

The process has failed as the result of an error.

#### Recommended Action

This message will appear with other messages related to the process. Check the other messages to determine the reason for the failures and see if corrective action can be taken. If the problem persists, copy the message exactly as it appears on the console or in the system log. Research and attempt to resolve the issue using the tools and utilities provided at: <http://www.cisco.com/tac>. With some messages, these tools and utilities will supply clarifying information. Search for resolved software issues using the Bug Search Tool at: <http://www.cisco.com/cisco/psn/bssprt/bss>. If you still require assistance, open a case with the Technical Assistance Center at: <http://tools.cisco.com/ServiceRequestTool/create/>, or contact your Cisco technical support representative and provide the representative with the information you have gathered. Attach the following information to your case in nonzipped, plain-text (.txt) format: the output of the **show logging** and **show tech-support** commands and your pertinent troubleshooting logs.

**Error Message:** %PMAN-3-PROCFAIL\_IGNORE [chars] process exits and failures are being ignored due to debug settings. Normal router functionality will be affected. Critical router functions like RP switchover, router reload, FRU resets, etc. may not function properly.

Explanation	Recommended Action
A process failure is being ignored due to the user-configured debug settings.	If this behavior is desired and the debug settings are set according to a user's preference, no action is needed. If the appearance of this message is viewed as a problem, change the debug settings. The router is not expected to behave normally with this debug setting. Functionalities such as SSO switchover, router reloads, FRU resets, and so on will be affected. This setting should only be used in a debug scenario. It is not normal to run the router with this setting.

**Error Message:** %PMAN-3-PROCHOLDDOWN The process [chars] has been helddown (rc [dec])

Explanation	Recommended Action
The process was restarted too many times with repeated failures and has been placed in the hold-down state.	This message will appear with other messages related to the process. Check the other messages to determine the reason for the failures and see if corrective action can be taken. If the problem persists, copy the message exactly as it appears on the console or in the system log. Research and attempt to resolve the issue using the tools and utilities provided at: <a href="http://www.cisco.com/tac">http://www.cisco.com/tac</a> . With some messages, these tools and utilities will supply clarifying information. Search for resolved software issues using the Bug Search Tool at: <a href="http://www.cisco.com/cisco/psn/bssprt/bss">http://www.cisco.com/cisco/psn/bssprt/bss</a> . If you still require assistance, open a case with the Technical Assistance Center at: <a href="http://tools.cisco.com/ServiceRequestTool/create/">http://tools.cisco.com/ServiceRequestTool/create/</a> , or contact your Cisco technical support representative and provide the representative with the information you have gathered. Attach the following information to your case in nonzipped, plain-text (.txt) format: the output of the <b>show logging</b> and <b>show tech-support</b> commands and your pertinent troubleshooting logs.

**Error Message:** %PMAN-3-RELOAD\_RP\_SB\_NOT\_READY : Reloading: [chars]

Explanation	Recommended Action
The route processor is being reloaded because there is no ready standby instance.	Ensure that the reload is not due to an error condition.

**Error Message:** %PMAN-3-RELOAD\_RP : Reloading: [chars]

Explanation	Recommended Action
-------------	--------------------

The RP is being reloaded.

Ensure that the reload is not due to an error condition. If it is due to an error condition, collect information requested by the other log messages.

**Error Message:** %PMAN-3-RELOAD\_SYSTEM : Reloading: [chars]

Explanation	Recommended Action
The system is being reloaded.	Ensure that the reload is not due to an error condition. If it is due to an error condition, collect information requested by the other log messages.

**Error Message:** %PMAN-3-PROC\_BAD\_EXECUTABLE : Bad executable or permission problem with process [chars]

Explanation	Recommended Action
The executable file used for the process is bad or has permission problem.	Ensure that the named executable is replaced with the correct executable.

**Error Message:** %PMAN-3-PROC\_BAD\_COMMAND:Non-existent executable or bad library used for process <process name>

Explanation	Recommended Action
The executable file used for the process is missing, or a dependent library is bad.	Ensure that the named executable is present and the dependent libraries are good.

**Error Message:** %PMAN-3-PROC\_EMPTY\_EXEC\_FILE : Empty executable used for process [chars]

Explanation	Recommended Action
The executable file used for the process is empty.	Ensure that the named executable is non-zero in size.

**Error Message:** %PMAN-5-EXITACTION : Process manager is exiting: [chars]

Explanation	Recommended Action
The process manager is exiting.	Ensure that the process manager is not exiting due to an error condition. If it is due to an error condition, collect information requested by the other log messages.

**Error Message:** %PMAN-6-PROCSHUT : The process [chars] has shutdown

Explanation	Recommended Action
The process has gracefully shut down.	No user action is necessary. This message is provided for informational purposes only.

**Error Message:** %PMAN-6-PROCSTART : The process [chars] has started

Explanation	Recommended Action

The process has launched and is operating properly.	No user action is necessary. This message is provided for informational purposes only.
-----------------------------------------------------	----------------------------------------------------------------------------------------

**Error Message:** %PMAN-6-PROCSTATELESS : The process [chars] is restarting stateless

Explanation	Recommended Action
The process has requested a stateless restart.	No user action is necessary. This message is provided for informational purposes only.





## CHAPTER 14

# Trace Management

---

The following sections are included in this chapter:

- [Tracing Overview, on page 191](#)
- [How Tracing Works, on page 191](#)
- [Tracing Levels, on page 194](#)
- [Viewing a Tracing Level, on page 196](#)
- [Setting a Tracing Level, on page 197](#)
- [Viewing the Content of the Trace Buffer, on page 197](#)
- [Example: Using Packet Trace, on page 198](#)

## Tracing Overview

Tracing is a function that logs internal events. Trace files containing trace messages are automatically created and saved to the tracelogs directory on the hard disk: file system on the router, which stores tracing files in bootflash.

The contents of trace files are useful for the following purposes:

- **Troubleshooting**—Helps to locate and solve an issue with a router. The trace files can be accessed in diagnostic mode even if other system issues are occurring simultaneously.
- **Debugging**—Helps to obtain a detailed view of system actions and operations.

## How Tracing Works

Tracing logs the contents of internal events on a router. Trace files containing all the trace output pertaining to a module are periodically created and updated and stored in the tracelog directory. Trace files can be erased from this directory to recover space on the file system without impacting system performance. The files can be copied to other destinations using file transfer functions (such as FTP and TFTP) and opened using a plain text editor.



---

**Note** Tracing cannot be disabled on a router.

---

Use the following commands to view trace information and set tracing levels:

- **show logging process module**—Shows the most recent trace information for a specific module. This command can be used in privileged EXEC and diagnostic modes. When used in diagnostic mode, this command can gather trace log information during a Cisco IOS XE failure.
- **set platform software trace**—Sets a tracing level that determines the types of messages that are stored in the output. For more information on tracing levels, see [Tracing Levels, on page 194](#).

## 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

	Command or Action	Purpose
<b>Step 1</b>	<b>enable</b> <b>Example:</b> Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b> <b>Example:</b> Device# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>udf udf name header {inner   outer} {13 14} offset offset-in-bytes length length-in-bytes</b> <b>Example:</b> Router (config)# udf TEST_UDF_NAME_1 header inner 13 64 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.  The <b>inner</b> or <b>outer</b> 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.

	Command or Action	Purpose
	<pre>Router(config)# udf TEST_UDF_NAME_2 header inner 14 77 2  Router(config)# udf TEST_UDF_NAME_3 header outer 13 65 1  Router(config)# udf TEST_UDF_NAME_4 header outer 14 67 1</pre>	<p>The <b>length</b> keyword specifies, in bytes, the length from the offset. The range is from 1 to 2.</p>
<b>Step 4</b>	<p><b>udf</b> <i>udf name</i> {<b>header</b>   <b>packet-start</b>} <i>offset-base</i> <i>offset length</i></p> <p><b>Example:</b></p> <pre>Router(config)# udf TEST_UDF_NAME_5 packet-start 120 1</pre>	<ul style="list-style-type: none"> <li>• <b>header</b>—Specifies the offset base configuration.</li> <li>• <b>packet-start</b>—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, the packet-start will be layer3.</li> <li>• <b>offset</b>—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.</li> <li>• <b>length</b>—Specifies the number of bytes from the offset. Only 1 or 2 bytes are supported. To match additional bytes, you must define multiple UDFs.</li> </ul>
<b>Step 5</b>	<p><b>ip access-list extended</b> {<i>acl-name</i>   <i>acl-num</i>}</p> <p><b>Example:</b></p> <pre>Router(config)# ip access-list extended acl2</pre>	<p>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.</p>
<b>Step 6</b>	<p><b>ip access-list extended</b> { <b>deny</b>   <b>permit</b> } <b>udf</b> <i>udf-name</i> <b>value</b> <b>mask</b></p> <p><b>Example:</b></p> <pre>Router(config-acl)# permit ip any any udf TEST_UDF_NAME_5 0xD3 0xFF</pre>	<p>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.</p>
<b>Step 7</b>	<p><b>debug platform condition</b> [<b>ipv4</b>   <b>ipv6</b>] [<b>interface</b> <i>interface</i>] [<b>access-list</b> <i>access-list -name</i>   <i>ipv4-address / subnet-mask</i>   <i>ipv6-address / subnet-mask</i>] [<b>ingress</b>   <b>egress</b>   <b>both</b> ]</p> <p><b>Example:</b></p> <pre>Router# debug platform condition interface gi0/0/0 ipv4 access-list acl2 both</pre>	<p>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.</p>

	Command or Action	Purpose
<b>Step 8</b>	<b>debug platform condition start</b> <b>Example:</b> <pre>Router# debug platform condition start</pre>	Enables the specified matching criteria and starts packet tracing.
<b>Step 9</b>	<b>debug platform packet-trace packet <i>pkt-num</i> [ <b>fia-trace</b>   <b>summary-only</b> ] [ <b>circular</b> ] [ <b>data-size</b> <i>data-size</i> ]</b> <b>Example:</b> <pre>Router# debug platform packet-trace packet 1024 fia-trace data-size 2048</pre>	<p>Collects summary data for a specified number of packets. Captures feature path data by default, and optionally performs FIA trace.</p> <p><i>pkt-num</i>—Specifies the maximum number of packets maintained at a given time.</p> <p><b>fia-trace</b>—Provides detailed level of data capture, including summary data, feature-specific data. Also displays each feature entry visited during packet processing.</p> <p><b>summary-only</b>—Enables the capture of summary data with minimal details.</p> <p><b>circular</b>—Saves the data of the most recently traced packets.</p> <p><i>data-size</i>—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.</p>
<b>Step 10</b>	<b>debug platform packet-trace {<b>punt</b>   <b>inject</b> <b>copy</b>   <b>drop</b>  <b>packet</b>   <b>statistics</b>}</b> <b>Example:</b> <pre>Router# debug platform packet-trace punt</pre>	Enables tracing of punted packets from data to control plane.
<b>Step 11</b>	<b>debug platform condition stop</b> <b>Example:</b> <pre>Router# debug platform condition start</pre>	Deactivates the condition and stops packet tracing.
<b>Step 12</b>	<b>exit</b> <b>Example:</b> <pre>Router# exit</pre>	Exits the privileged EXEC mode.

## Tracing Levels

Tracing levels determine how much information should be stored about a module in the trace buffer or file.

The following table shows all the tracing levels that are available and provides descriptions of what types of messages are displayed with each tracing level.

**Table 26: Tracing Levels and Descriptions**

Tracing Level	Level Number	Description
Emergency	0	The message is regarding an issue that makes the system unusable.
Alert	1	The message is regarding an action that must be taken immediately.
Critical	2	The message is regarding a critical condition. This is the default setting for every module on the router.
Error	3	The message is regarding a system error.
Warning	4	The message is regarding a system warning.
Notice	5	The message is regarding a significant issue, but the router is still working normally.
Informational	6	The message is useful for informational purposes only.
Debug	7	The message provides debug-level output.
Verbose	8	All possible tracing messages are sent.
Noise	—	All possible trace messages pertaining to a module are logged.  The noise level is always equal to the highest possible tracing level. Even if a future enhancement to tracing introduces a higher tracing level than verbose level, the noise level will become equal to the level of the newly introduced tracing level.

If a tracing level is set, messages are collected from both lower tracing levels and from its own level.

For example, setting the tracing level to 3 (error) means that the trace file will contain output messages for levels: 0 (emergencies), 1 (alerts), 2 (critical), and 3 (error).

If you set the trace level to 4 (warning), it results in output messages for levels: 0 (emergencies), 1 (alerts), 2 (critical), 3 (error), and 4 (warning).

The default tracing level for every module on the router is 5 (notice).

A tracing level is not set in a configuration mode, which results in tracing-level settings being returned to default values after the router reloads.




---

**Caution** Setting the tracing level of a module to debug level or higher can have a negative impact on the performance.

---




---

**Caution** Setting high tracing levels on a large number of modules can severely degrade performance. If a high tracing level is required in a specific context, it is almost always preferable to set the tracing level of a single module to a higher level rather than setting multiple modules to high levels.

---

## Viewing a Tracing Level

By default, all the modules on a router are set to 5 (notice). This setting is maintained unless changed by a user.

To see the tracing level for a module on a router, enter the **show logging process** command in privileged EXEC mode or diagnostic mode.

The following example shows how the **show logging process** command is used to view the tracing levels of the forwarding manager processes on an active RP:

```
Router# showlogging process forwarding-manager rp active
Module Name                               Trace Level
-----
acl   Notice
binos                                       Notice
binos/brand                               Notice
bipc  Notice
bsignal                                    Notice
btrace                                     Notice
cce   Notice
cdllib                                     Notice
cef   Notice
chasfs                                     Notice
chasutil                                   Notice
erspan                                     Notice
ess   Notice
ether-channel                             Notice
evlib                                       Notice
evutil                                     Notice
file_alloc                                 Notice
fman_rp                                    Notice
fpm   Notice
fw  Notice
icmp  Notice
interfaces                                 Notice
iosd                                       Notice
ipc   Notice
ipclog                                     Notice
iphc                                       Notice
IPsec                                       Notice
mgmte-acl                                  Notice
mlp   Notice
```

mqipc	Notice
nat	Notice
nbar	Notice
netflow	Notice
om	Notice
peer	Notice
qos	Notice
route-map	Notice
sbc	Notice
services	Notice
sw_wdog	Notice
tdl_acl_config_type	Notice
tdl_acl_db_type	Notice
tdl_cdlcore_message	Notice
tdl_cef_config_common_type	Notice
tdl_cef_config_type	Notice
tdl_dpiddb_config_type	Notice
tdl_fman_rp_comm_type	Notice
tdl_fman_rp_message	Notice
tdl_fw_config_type	Notice
tdl_hapi_tdl_type	Notice
tdl_icmp_type	Notice
tdl_ip_options_type	Notice
tdl_ipc_ack_type	Notice
tdl_IPsec_db_type	Notice
tdl_mcp_comm_type	Notice
tdl_mlp_config_type	Notice
tdl_mlp_db_type	Notice
tdl_om_type	Notice
tdl_ui_message	Notice
tdl_ui_type	Notice
tdl_urpf_config_type	Notice
tdllib	Notice
trans_avl	Notice
uihandler	Notice
uipeer	Notice
uistatus	Notice
urpf	Notice
vista	Notice
wccp	Notice

## Setting a Tracing Level

To set a tracing level for a module on a router, or for all the modules within a process on a router, enter the **set platform software trace** command in the privileged EXEC mode or diagnostic mode.

The following example shows the tracing level for the ACL module in the Forwarding Manager of the ESP processor in slot 0 set to `info`:

```
set platform software trace forwarding-manager F0 acl info
```

## Viewing the Content of the Trace Buffer

To view the trace messages in the trace buffer or file, enter the **show logging process** command in privileged EXEC or diagnostic mode. In the following example, the trace messages for the Host Manager process in Route Processor slot 0 are viewed using the **show logging process** command:

```

Router# show logging process host-manager R0
08/23 12:09:14.408 [uipeer]: (info): Looking for a ui_req msg
08/23 12:09:14.408 [uipeer]: (info): Start of request handling for con 0x100a61c8
08/23 12:09:14.399 [uipeer]: (info): Accepted connection for 14 as 0x100a61c8
08/23 12:09:14.399 [uipeer]: (info): Received new connection 0x100a61c8 on descriptor 14
08/23 12:09:14.398 [uipeer]: (info): Accepting command connection on listen fd 7
08/23 11:53:57.440 [uipeer]: (info): Going to send a status update to the shell manager in
slot 0
08/23 11:53:47.417 [uipeer]: (info): Going to send a status update to the shell manager in
slot 0

```

## Example: Using Packet Trace

This example provides a scenario in which packet trace is used to troubleshoot packet drops for a NAT configuration on a Cisco ASR 1006 Router. 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

```

## Example: Using Packet Trace

```

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

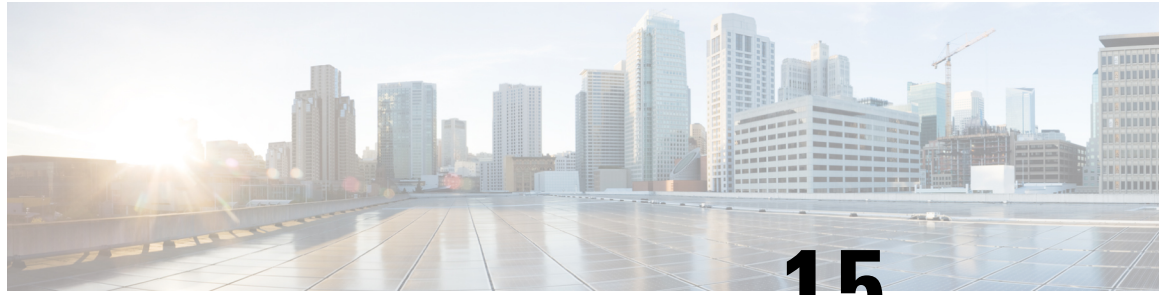
  Feature: TCP
  Pkt Direction: OUTtcp0: O SYNRCVD 198.51.100.38:22 198.51.100.55:52774 seq 3052140910
  OPTS 4 ACK 2346709419 SYN WIN 4128
Summary
  Input      : INJ.2
  Output     : GigabitEthernet1
  State      : FWD
  Timestamp
    Start    : 490928006866 ns (06/29/2020 13:31:30.807879 UTC)
    Stop     : 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#
```





## CHAPTER 15

# Environmental Monitoring and PoE Management

The Cisco Catalyst 8300 Series Edge Platform have hardware and software features that periodically monitor the router's environment. This chapter provides information on the environmental monitoring features on your router that allow you to monitor critical events and generate statistical reports on the status of various router components. This chapter includes the following sections:

- [Environmental Monitoring, on page 205](#)
- [Environmental Monitoring and Reporting Functions, on page 205](#)
- [Configuring Power Supply Mode, on page 219](#)

## Environmental Monitoring

The router provides a robust environment-monitoring system with several sensors that monitor the system temperatures. Microprocessors generate interrupts to the HOST CPU for critical events and generate a periodic status and statistics report. The following are some of the key functions of the environmental monitoring system:

- Monitoring temperature of CPUs, motherboard, and midplane
- Monitoring fan speed
- Recording abnormal events and generating notifications
- Monitoring Simple Network Management Protocol (SNMP) traps
- Generating and collecting Onboard Failure Logging (OBFL) data
- Sending call home event notifications
- Logging system error messages
- Displaying present settings and status

## Environmental Monitoring and Reporting Functions

Monitoring and reporting functions allow you to maintain normal system operation by identifying and resolving adverse conditions prior to loss of operation.

- [Environmental Monitoring Functions, on page 206](#)

- [Environmental Reporting Functions, on page 208](#)

## Environmental Monitoring Functions

Environmental monitoring functions use sensors to monitor the temperature of the cooling air as it moves through the chassis.

The local power supplies provide the ability to monitor:

- Input and output current
- Output voltage
- Input and output power
- Temperature
- Fan speed

The device is expected to meet the following environmental operating conditions:

- Operating Temperature Nominal—32°F to 104°F (0°C to 40°C)
- Operating Humidity Nominal—10% to 85% RH noncondensing
- Operating Humidity Short Term—10% to 85% RH noncondensing
- Operating Altitude—Sea level 0 ft to 10,000 ft (0 to 3000 m)
- AC Input Range—85 to 264 VAC

In addition, each power supply monitors its internal temperature and voltage. A power supply is either within tolerance (normal) or out of tolerance (critical). If an internal power supply's temperature or voltage reaches a critical level, the power supply shuts down without any interaction with the system processor.

The following table displays the levels of status conditions used by the environmental monitoring system.

**Table 27: Levels of Status Conditions Used by the Environmental Monitoring System**

Status Level	Description
Normal	All monitored parameters are within normal tolerance.
Warning	The system has exceeded a specified threshold. The system continues to operate, but operator action is recommended to bring the system back to a normal state.
Critical	An out-of-tolerance temperature or voltage condition exists. Although the system continues to operate, it is approaching shutdown. Immediate operator action is required.

The environmental monitoring system sends system messages to the console, for example, when the conditions described here are met:



### Fan Failure

When the system power is on, all the fans should be operational. Although the system continues to operate if a fan fails, the system displays the following message:

```
%IOSXE_PEM-3-FANFAIL: The fan in slot 2/0 is encountering a failure condition
```

### Sensors Out of Range

When sensors are out of range, the system displays the following message:

```
%ENVIRONMENTAL-1-ALERT: V: 1.0v PCH, Location: R0, State: Warning, Reading: 1102 mV
```

```
%ENVIRONMENTAL-1-ALERT: V: PEM Out, Location: P1, State: Warning, Reading: 0 mV
```

```
%ENVIRONMENTAL-1-ALERT: Temp: Temp 3, Location R0, State : Warning, Reading : 90C
```

### Fan Tray (Slot P2) Removed

When the fan tray for slot P2 is removed, the system displays the following message:

```
%IOSXE_PEM-6-REMPPEM_FM: PEM/FM slot P2 removed
```

### Fan Tray (Slot P2) Reinserted

When the fan tray for slot P2 is reinserted, the system displays the following message:

```
%IOSXE_PEM-6-INSPEM_FM: PEM/FM slot P2 inserted
```

### Fan Tray (Slot 2) is Working Properly

When the fan tray for slot 2 is functioning properly, the system displays the following message:

```
%IOSXE_PEM-6-PEMOK: The PEM in slot P2 is functioning properly
```

### Fan 0 in Slot 2 (Fan Tray) is Not Working

When Fan 0 in the fan tray of slot 2 is not functioning properly, the system displays the following message:

```
%IOSXE_PEM-3-FANFAIL: The fan in slot 2/0 is encountering a failure condition
```

### Fan 0 in Slot 2 (Fan Tray) is Working Properly

When Fan 0 in the fan tray of slot 2 is functioning properly, the system displays the following message:

```
%IOSXE_PEM-6-FANOK: The fan in slot 2/0 is functioning properly
```

### Main Power Supply in Slot 1 is Powered Off

When the main power supply in slot 1 is powered off, the system displays the following message:

```
%IOSXE_PEM-3-PEMFAIL: The PEM in slot 1 is switched off or encountering a failure condition.
```

### Main Power Supply is Inserted in Slot 1

When the main power supply is inserted in slot 1, the system displays the following messages:

```
%IOSXE_PEM-6-INSPEM_FM: PEM/FM slot P1 inserted
```

```
%IOSXE_PEM-6-PEMOK: The PEM in slot 1 is functioning properly
```

### Temperature and Voltage Exceed Max/Min Thresholds

The following example shows the warning messages indicating the maximum and minimum thresholds of the temperature or voltage:

```
Warnings :
-----
For all the temperature sensors (name starting with "Temp:") above,
the critical warning threshold is 100C (100C and higher)
the warning threshold is 80C (range from 80C to 99C)
the low warning threshold is 1C (range from -inf to 1C).

For all voltage sensors (names starting with "V:"),
the high warning threshold starts at that voltage +10%. (voltage + 10% is warning)
the low warning threshold starts at the voltage -10%. (voltage - 10% is warning)
```

## Environmental Reporting Functions

You can retrieve and display environmental status reports using the following commands:

- **debug environment**
- **debug platform software cman env monitor polling**
- **debug ilpower**
- **debug power [inline | main]**
- **show diag all eeprom**
- **show diag slot R0 eeprom detail**
- **show environment**
- **show environment all**
- **show inventory**
- **show platform all**
- **show platform diag**
- **show platform software status control-processor**
- **show version**
- **show power**
- **show power inline**

These commands show the current values of parameters such as temperature and voltage.

The environmental monitoring system updates the values of these parameters every 60 seconds. Brief examples of these commands are shown below:

#### debug environment: Example

```
Router# debug environment location P0
Environmental sensor Temp: Temp 1 P0 debugging is on
Environmental sensor Temp: Temp 2 P0 debugging is on
```

```

Environmental sensor Temp: Temp 3 P0 debugging is on
Environmental sensor V: PEM Out P0 debugging is on
Environmental sensor I: PEM In P0 debugging is on
Environmental sensor I: PEM Out P0 debugging is on
Environmental sensor W: In pwr P0 debugging is on
Environmental sensor W: Out pwr P0 debugging is on
Environmental sensor RPM: fan0 P0 debugging is on

*Jul 8 21:49:23.292 PDT:      Sensor: Temp: Temp 1 P0, In queue 1
*Jul 8 21:49:23.292 PDT:      State=Normal Reading=35
*Jul 8 21:49:23.292 PDT:      Rotation count=0 Poll period=20000
*Jul 8 21:49:23.292 PDT:      Sensor: Temp: Temp 1 P0 State=Normal Reading=35
*Jul 8 21:49:23.292 PDT:      Inserting into queue 1 on spoke 189.
*Jul 8 21:49:23.292 PDT:      Rotation count=20 Displacement=0
*Jul 8 21:49:23.292 PDT:      Sensor: Temp: Temp 2 P0, In queue 1
*Jul 8 21:49:23.292 PDT:      State=Normal Reading=40
*Jul 8 21:49:23.292 PDT:      Rotation count=0 Poll period=20000
*Jul 8 21:49:23.292 PDT:      Sensor: Temp: Temp 2 P0 State=Normal Reading=40
*Jul 8 21:49:23.292 PDT:      Inserting into queue 1 on spoke 189.
*Jul 8 21:49:23.292 PDT:      Rotation count=20 Displacement=0
*Jul 8 21:49:23.292 PDT:      Sensor: Temp: Temp 3 P0, In queue 1
*Jul 8 21:49:23.292 PDT:      State=Normal Reading=44
*Jul 8 21:49:23.292 PDT:      Rotation count=0 Poll period=20000
*Jul 8 21:49:23.292 PDT:      Sensor: Temp: Temp 3 P0 State=Normal Reading=44
*Jul 8 21:49:23.292 PDT:      Inserting into queue 1 on spoke 189.
*Jul 8 21:49:23.292 PDT:      Rotation count=20 Displacement=0
*Jul 8 21:49:23.292 PDT:      Sensor: V: PEM In P0, In queue 1
*Jul 8 21:49:23.292 PDT:      State=Normal Reading=118501
*Jul 8 21:49:23.292 PDT:      Rotation count=0 Poll period=20000
*Jul 8 21:49:23.293 PDT:      Sensor: V: PEM In P0 State=Normal Reading=118501
*Jul 8 21:49:23.293 PDT:      Inserting into queue 1 on spoke 189.
*Jul 8 21:49:23.293 PDT:      Rotation count=20 Displacement=0
*Jul 8 21:49:23.293 PDT:      Sensor: V: PEM Out P0, In queue 1
*Jul 8 21:49:23.293 PDT:      State=Normal Reading=12000
*Jul 8 21:49:23.293 PDT:      Rotation count=0 Poll period=20000
*Jul 8 21:49:23.293 PDT:      Sensor: V: PEM Out P0 State=Normal Reading=12000
*Jul 8 21:49:23.293 PDT:      Inserting into queue 1 on spoke 189.
*Jul 8 21:49:23.293 PDT:      Rotation count=20 Displacement=0
*Jul 8 21:49:23.293 PDT:      Sensor: I: PEM In P0, In queue 1
*Jul 8 21:49:23.293 PDT:      State=Normal Reading=820
*Jul 8 21:49:23.293 PDT:      Rotation count=0 Poll period=20000
*Jul 8 21:49:23.293 PDT:      Sensor: I: PEM In P0 State=Normal Reading=828
*Jul 8 21:49:23.293 PDT:      Inserting into queue 1 on spoke 189.
*Jul 8 21:49:23.293 PDT:      Rotation count=20 Displacement=0
*Jul 8 21:49:23.293 PDT:      Sensor: I: PEM Out P0, In queue 1
*Jul 8 21:49:23.293 PDT:      State=Normal Reading=7200
*Jul 8 21:49:23.293 PDT:      Rotation count=0 Poll period=20000
*Jul 8 21:49:23.293 PDT:      Sensor: I: PEM Out P0 State=Normal Reading=7100
*Jul 8 21:49:23.293 PDT:      Inserting into queue 1 on spoke 189.
*Jul 8 21:49:23.293 PDT:      Rotation count=20 Displacement=0
*Jul 8 21:49:23.293 PDT:      Sensor: P: In pwr P0, In queue 1
*Jul 8 21:49:23.293 PDT:      State=Normal Reading=97
*Jul 8 21:49:23.293 PDT:      Rotation count=0 Poll period=20000
*Jul 8 21:49:23.293 PDT:      Sensor: P: In pwr P0 State=Normal Reading=98
*Jul 8 21:49:23.293 PDT:      Inserting into queue 1 on spoke 189.
*Jul 8 21:49:23.293 PDT:      Rotation count=20 Displacement=0
*Jul 8 21:49:23.293 PDT:      Sensor: P: Out pwr P0, In queue 1
*Jul 8 21:49:23.293 PDT:      State=Normal Reading=87
*Jul 8 21:49:23.293 PDT:      Rotation count=0 Poll period=20000
*Jul 8 21:49:23.293 PDT:      Sensor: P: Out pwr P0 State=Normal Reading=89
*Jul 8 21:49:23.293 PDT:      Inserting into queue 1 on spoke 189.
*Jul 8 21:49:23.293 PDT:      Rotation count=20 Displacement=0
*Jul 8 21:49:23.293 PDT:      Sensor: RPM: fan0 P0, In queue 1
*Jul 8 21:49:23.293 PDT:      State=Normal Reading=5824

```

```

*Jul 8 21:49:23.293 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:49:23.293 PDT: Sensor: RPM: fan0 P0 State=Normal Reading=5824
*Jul 8 21:49:23.293 PDT: Inserting into queue 1 on spoke 189.
*Jul 8 21:49:23.293 PDT: Rotation count=20 Displacement=0
*Jul 8 21:49:43.296 PDT: Sensor: Temp: Temp 1 P0, In queue 1
*Jul 8 21:49:43.296 PDT: State=Normal Reading=35
*Jul 8 21:49:43.296 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:49:43.296 PDT: Sensor: Temp: Temp 1 P0 State=Normal Reading=35
*Jul 8 21:49:43.296 PDT: Inserting into queue 1 on spoke 209.
*Jul 8 21:49:43.296 PDT: Rotation count=20 Displacement=0
*Jul 8 21:49:43.296 PDT: Sensor: Temp: Temp 2 P0, In queue 1
*Jul 8 21:49:43.296 PDT: State=Normal Reading=40
*Jul 8 21:49:43.296 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:49:43.296 PDT: Sensor: Temp: Temp 2 P0 State=Normal Reading=40
*Jul 8 21:49:43.296 PDT: Inserting into queue 1 on spoke 209.
*Jul 8 21:49:43.296 PDT: Rotation count=20 Displacement=0
*Jul 8 21:49:43.296 PDT: Sensor: Temp: Temp 3 P0, In queue 1
*Jul 8 21:49:43.296 PDT: State=Normal Reading=44
*Jul 8 21:49:43.296 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:53:43.329 PDT: State=Normal Reading=5824
*Jul 8 21:53:43.329 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:53:43.329 PDT: Sensor: RPM: fan0 P0 State=Normal Reading=5824
*Jul 8 21:53:43.329 PDT: Inserting into queue 1 on spoke 149.
*Jul 8 21:53:43.329 PDT: Rotation count=20 Displacement=0

```

### debug platform software cman env monitor polling: Example

```

Router# debug platform software cman env monitor polling
platform software cman env monitor polling debugging is on
Router#
*Jul 8 21:56:23.351 PDT: Sensor: Temp: Temp 1 P0, In queue 1
*Jul 8 21:56:23.351 PDT: State=Normal Reading=35
*Jul 8 21:56:23.351 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:56:23.351 PDT: IOS-RP-ENVMON: sensor READ callback Temp: Temp 1, P0, 35
*Jul 8 21:56:23.351 PDT: Sensor: Temp: Temp 1 P0 State=Normal Reading=35
*Jul 8 21:56:23.351 PDT: Inserting into queue 1 on spoke 9.
*Jul 8 21:56:23.351 PDT: Rotation count=20 Displacement=0
*Jul 8 21:56:23.351 PDT: Sensor: Temp: Temp 2 P0, In queue 1
*Jul 8 21:56:23.351 PDT: State=Normal Reading=40
*Jul 8 21:56:23.351 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:56:23.351 PDT: IOS-RP-ENVMON: sensor READ callback Temp: Temp 2, P0, 40
*Jul 8 21:56:23.351 PDT: Sensor: Temp: Temp 2 P0 State=Normal Reading=40
*Jul 8 21:56:23.351 PDT: Inserting into queue 1 on spoke 9.
*Jul 8 21:56:23.351 PDT: Rotation count=20 Displacement=0
*Jul 8 21:56:23.351 PDT: Sensor: Temp: Temp 3 P0, In queue 1
*Jul 8 21:56:23.351 PDT: State=Normal Reading=44
*Jul 8 21:56:23.351 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:56:23.351 PDT: IOS-RP-ENVMON: sensor READ callback Temp: Temp 3, P0, 44
*Jul 8 21:56:23.351 PDT: Sensor: Temp: Temp 3 P0 State=Normal Reading=44
*Jul 8 21:56:23.351 PDT: Inserting into queue 1 on spoke 9.
*Jul 8 21:56:23.351 PDT: Rotation count=20 Displacement=0
*Jul 8 21:56:23.351 PDT: Sensor: V: PEM In P0, In queue 1
*Jul 8 21:56:23.351 PDT: State=Normal Reading=118501
*Jul 8 21:56:23.351 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:56:23.351 PDT: IOS-RP-ENVMON: sensor READ callback V: PEM In, P0, 118501
*Jul 8 21:56:23.351 PDT: Sensor: V: PEM In P0 State=Normal Reading=118501
*Jul 8 21:56:23.351 PDT: Inserting into queue 1 on spoke 9.
*Jul 8 21:56:23.351 PDT: Rotation count=20 Displacement=0
*Jul 8 21:56:23.351 PDT: Sensor: V: PEM Out P0, In queue 1
*Jul 8 21:56:23.351 PDT: State=Normal Reading=12100
*Jul 8 21:56:23.351 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:56:23.351 PDT: IOS-RP-ENVMON: sensor READ callback V: PEM Out, P0, 12000

```

```

*Jul 8 21:56:23.351 PDT: Sensor: V: PEM Out P0 State=Normal Reading=12000
*Jul 8 21:56:23.351 PDT: Inserting into queue 1 on spoke 9.
*Jul 8 21:56:23.351 PDT: Rotation count=20 Displacement=0
*Jul 8 21:56:23.351 PDT: Sensor: I: PEM In P0, In queue 1
*Jul 8 21:56:23.351 PDT: State=Normal Reading=820
*Jul 8 21:56:23.351 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:56:23.351 PDT: IOS-RP-ENVMON: sensor READ callback I: PEM In, P0, 828
*Jul 8 21:56:23.351 PDT: Sensor: I: PEM In P0 State=Normal Reading=828
*Jul 8 21:56:23.351 PDT: Inserting into queue 1 on spoke 9.
*Jul 8 21:56:23.351 PDT: Rotation count=20 Displacement=0
*Jul 8 21:56:23.351 PDT: Sensor: I: PEM Out P0, In queue 1
*Jul 8 21:56:23.351 PDT: State=Normal Reading=7200
*Jul 8 21:56:23.351 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:56:23.351 PDT: IOS-RP-ENVMON: sensor READ callback I: PEM Out, P0, 7100
*Jul 8 21:56:23.352 PDT: Sensor: I: PEM Out P0 State=Normal Reading=7100
*Jul 8 21:56:23.352 PDT: Inserting into queue 1 on spoke 9.
*Jul 8 21:56:23.352 PDT: Rotation count=20 Displacement=0
*Jul 8 21:56:23.352 PDT: Sensor: P: In pwr P0, In queue 1
*Jul 8 21:56:23.352 PDT: State=Normal Reading=97
*Jul 8 21:56:23.352 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback P: In pwr, P0, 98
*Jul 8 21:56:23.352 PDT: Sensor: P: In pwr P0 State=Normal Reading=98
*Jul 8 21:56:23.352 PDT: Inserting into queue 1 on spoke 9.
*Jul 8 21:56:23.352 PDT: Rotation count=20 Displacement=0
*Jul 8 21:56:23.352 PDT: Sensor: P: Out pwr P0, In queue 1
*Jul 8 21:56:23.352 PDT: State=Normal Reading=88
*Jul 8 21:56:23.352 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback P: Out pwr, P0, 88
*Jul 8 21:56:23.352 PDT: Sensor: P: Out pwr P0 State=Normal Reading=88
*Jul 8 21:56:23.352 PDT: Inserting into queue 1 on spoke 9.
*Jul 8 21:56:23.352 PDT: Rotation count=20 Displacement=0
*Jul 8 21:56:23.352 PDT: Sensor: RPM: fan0 P0, In queue 1
*Jul 8 21:56:23.352 PDT: State=Normal Reading=5888
*Jul 8 21:56:23.352 PDT: Rotation count=0 Poll period=20000
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback RPM: fan0, P0, 5888
*Jul 8 21:56:23.352 PDT: Sensor: RPM: fan0 P0 State=Normal Reading=5888
*Jul 8 21:56:23.352 PDT: Inserting into queue 1 on spoke 9.
*Jul 8 21:56:23.352 PDT: Rotation count=20 Displacement=0
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback RPM: fan0, P2, 12600
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback RPM: fan1, P2, 12840
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback RPM: fan2, P2, 12900
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback P: pwr, P2, 8
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback Temp: Inlet 1, R0, 29
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback Temp: Inlet 2, R0, 30
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback Temp: Outlet 1, R0, 35
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback Temp: Outlet 2, R0, 36
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback Temp: CP-CPU, R0, 42
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 12v, R0, 12127
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 5v, R0, 5022
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 3.3v, R0, 3308
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 3.0v, R0, 3023
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 2.5v, R0, 2490
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 1.8v, R0, 1798
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 1.2v, R0, 1203
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 1.2v_CPU, R0, 1201
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 1.05v_CPU, R0, 1052
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 1.05v, R0, 1062
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 1.0v, R0, 1002
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback V: 0.6v, R0, 593
*Jul 8 21:56:23.352 PDT: IOS-RP-ENVMON: sensor READ callback P: pwr, R0, 86
*Jul 8 21:56:25.352 PDT: IOS-RP-ENVMON: sensor READ callback P: pwr: Pwr, 0/1, 5
*Jul 8 21:56:32.354 PDT: IOS-RP-ENVMON: sensor READ callback P: pwr: Pwr, 1/0, 27

```

**debug ilpower: Example**

```
Router# debug ilpower ?
  cdp          ILPOWER CDP messages
  controller   ILPOWER controller
  event        ILPOWER event
  ha           ILPOWER High-Availability
  port         ILPOWER port management
  powerman    ILPOWER powerman
  registries   ILPOWER registries
  scp          ILPOWER SCP messages
  upoe         ILPOWER upoe
```

**debug power [inline|main]: Example**

In this example, there is one 1000W power supply and one 450W power supply. Inline and main power output is shown.

```
Router# debug power ?
  inline  ILPM inline power related
  main    Main power related
  <cr>    <cr>
Router# debug power
POWER all debug debugging is on

Router# show debugging | include POWER
POWER:
POWER main debugging is on
POWER inline debugging is on
Router#
..

*Jul  8 21:56:23.351: %ENVIRONMENTAL-6-NOTICE: V: PEM Out, Location: P1, State: Warning,
Reading: 0 mV
*Jul  8 21:56:23.351: %IOSXE_PEM-6-PEMOK: The PEM in slot P1 is functioning properly
*Jul  8 21:56:23.351: %PLATFORM_POWER-6-MODEMATCH: Main power is in Boost mode
*Jul  8 21:56:23.351: Power M: Received Msg for 12V/Main, total power 1450, Run same as cfg
Yes
*Jul  8 21:56:23.351: Power M: Received Msg for POE/ILPM, total power 500, Run same as cfg
No
*Jul  8 21:56:23.351: Power I: Updating pool power is 500 watts
*Jul  8 21:56:23.351: Power I: Intimating modules of total power 500 watts
*Jul  8 21:56:23.351: Power M: Received Msg for 12V/Main, total power 1450, Run same as cfg
Yes
*Jul  8 21:56:23.351: Power M: Received Msg for POE/ILPM, total power 500, Run same as cfg
No
*Jul  8 21:56:23.351: Power I: Updating pool power is 500 watts
*Jul  8 21:56:23.351: Power I: Intimating modules of total power 500 watts
Router#
```

**show diag all eeprom: Example**

```
Router# show diag all eeprom
MIDPLANE EEPROM data:

  Product Identifier (PID) : C8300-1N1S-6T
  Version Identifier (VID) : V00
  PCB Serial Number       : FDO231403QE
  Hardware Revision       : 1.0
```

```
CLEI Code                : TDBTBDTBDT
Power/Fan Module P0 EEPROM data:

    Product Identifier (PID) : PWR-4430-AC
    Version Identifier (VID) : V02
    PCB Serial Number       : LIT23032XFS
    CLEI Code               : IPUPAMFAAB
Power/Fan Module P1 EEPROM data is not initialized

External PoE Module POE0 EEPROM data is not initialized

External PoE Module POE1 EEPROM data is not initialized

Internal PoE is not present

Slot R0 EEPROM data:

    Product Identifier (PID) : C8300-1N1S-6T
    Version Identifier (VID) : V00
    PCB Serial Number       : FDO231403QE
    Hardware Revision       : 1.0
    CLEI Code               : TDBTBDTBDT
Slot F0 EEPROM data:

    Product Identifier (PID) : C8300-1N1S-6T
    Version Identifier (VID) : V00
    PCB Serial Number       : FDO231403QE
    Hardware Revision       : 1.0
    CLEI Code               : TDBTBDTBDT
Slot 0 EEPROM data:

    Product Identifier (PID) : C8300-1N1S-6T
    Version Identifier (VID) : V00
    PCB Serial Number       : FDO231403QE
    Hardware Revision       : 1.0
    CLEI Code               : TDBTBDTBDT
Slot 1 EEPROM data:

    Product Identifier (PID) : C8300-1N1S-6T
    Version Identifier (VID) : V00
    PCB Serial Number       : FDO231403QE
    Hardware Revision       : 1.0
    CLEI Code               : TDBTBDTBDT
SPA EEPROM data for subslot 0/0:

    Product Identifier (PID) : 4x1G-2xSFP
    Version Identifier (VID) : V01
    PCB Serial Number       :
    Top Assy. Part Number   : 68-2236-01
    Top Assy. Revision      : A0
    Hardware Revision       : 2.2
    CLEI Code               : CNUIAHSAAA
SPA EEPROM data for subslot 0/1 is not available

SPA EEPROM data for subslot 0/2 is not available

SPA EEPROM data for subslot 0/3 is not available

SPA EEPROM data for subslot 0/4 is not available

SPA EEPROM data for subslot 0/5 is not available

SPA EEPROM data for subslot 1/0 is not available
```

```

SPA EEPROM data for subslot 1/1 is not available

SPA EEPROM data for subslot 1/2 is not available

SPA EEPROM data for subslot 1/3 is not available

SPA EEPROM data for subslot 1/4 is not available

SPA EEPROM data for subslot 1/5 is not available

```

### show environment: Example

In this example, note the output for the slots POE0 and POE1.

```

Router# show environment
  Number of Critical alarms: 0
  Number of Major alarms:   0
  Number of Minor alarms:   0

  Slot          Sensor          Current State  Reading
  Threshold(Minor,Major,Critical,Shutdown)
  -----
  P0            Temp: Temp 1    Normal        34 Celsius (na ,na ,na ,na ) (Celsius)
  P0            Temp: Temp 2    Normal        39 Celsius (na ,na ,na ,na ) (Celsius)
  P0            Temp: Temp 3    Normal        43 Celsius (na ,na ,na ,na ) (Celsius)
  P0            V: PEM In       Normal        11900mV     na
  P0            V: PEM Out      Normal        12100mV     na
  P0            I: PEM In       Normal        820 mA      na
  P0            I: PEM Out      Normal        7200 mA     na
  P0            P: In pwr       Normal        97 Watts    na
  P0            P: Out pwr      Normal        88 Watts    na
  P0            RPM: fan0       Normal        5760 RPM    na
  P2            RPM: fan0       Normal        12600RPM   na
  P2            RPM: fan1       Normal        12900RPM   na
  P2            RPM: fan2       Normal        12840RPM   na
  P2            P: pwr         Normal        8 Watts     na
  R0            Temp: Inlet 1   Normal        29 Celsius (na ,na ,48 ,na ) (Celsius)
  R0            Temp: Inlet 2   Normal        30 Celsius (na ,na ,na ,na ) (Celsius)
  R0            Temp: Outlet 1  Normal        34 Celsius (na ,na ,81 ,na ) (Celsius)
  R0            Temp: Outlet 2  Normal        35 Celsius (na ,na ,81 ,na ) (Celsius)
  R0            Temp: CP-CPU   Normal        42 Celsius (na ,na ,97 ,na ) (Celsius)
  R0            V: 12v         Normal        12119mV     na
  R0            V: 5v          Normal        5022 mV     na
  R0            V: 3.3v        Normal        3308 mV     na
  R0            V: 3.0v        Normal        3023 mV     na
  R0            V: 2.5v        Normal        2490 mV     na
  R0            V: 1.8v        Normal        1798 mV     na
  R0            V: 1.2v        Normal        1203 mV     na
  R0            V: 1.2v_CPU   Normal        1201 mV     na
  R0            V: 1.05v_CPU  Normal        1054 mV     na
  R0            V: 1.05v       Normal        1060 mV     na
  R0            V: 1.0v        Normal        1002 mV     na
  R0            V: 0.6v        Normal        592 mV      na
  R0            P: pwr         Normal        85 Watts    na
  0/1          P: pwr: Pwr    Normal        5 Watts     na
  1/0          P: pwr: Pwr    Normal        28 Watts     na

```



**show environment all: Example**

```

Router# show environment all
Sensor List: Environmental Monitoring
Sensor      Location      State      Reading
Temp: Temp 1    P0          Normal     36 Celsius
Temp: Temp 2    P0          Normal     38 Celsius
Temp: Temp 3    P0          Normal     38 Celsius
V: PEM In      P0          Normal     206502 mV
V: PEM Out     P0          Normal     12000 mV
I: PEM In      P0          Normal     281 mA
I: PEM Out     P0          Normal     3500 mA
P: In pwr      P0          Normal     53 Watts
P: Out pwr     P0          Normal     43 Watts
RPM: fan0      P0          Normal     3712 RPM
RPM: fan0      P2          Normal     7260 RPM
RPM: fan1      P2          Normal     7260 RPM
RPM: fan2      P2          Normal     7200 RPM
P: pwr         P2          Normal     3 Watts
Temp: Inlet 1  R0          Normal     19 Celsius
Temp: Inlet 2  R0          Normal     21 Celsius
Temp: Outlet 1 R0          Normal     25 Celsius
Temp: Outlet 2 R0          Normal     23 Celsius
Temp: CP-CPU   R0          Normal     29 Celsius
V: 12v         R0          Normal     11984 mV
V: 5v          R0          Normal     5018 mV
V: 3.3v        R0          Normal     3311 mV
V: 3.0v        R0          Normal     2992 mV
V: 2.5v        R0          Normal     2488 mV
V: 1.8v        R0          Normal     1785 mV
V: 1.2v        R0          Normal     1201 mV
V: 1.2v_CPU    R0          Normal     1200 mV
V: 1.05v_CPU   R0          Normal     1051 mV
V: 1.05v       R0          Normal     1058 mV
V: 1.0v        R0          Normal     1001 mV
V: 0.6v        R0          Normal     595 mV
P: pwr         R0          Normal     45 Watts

```

**show inventory: Example**

```

Router# show inventory

+++++
INFO: Please use "show license UDI" to get serial number for licensing.
+++++

NAME: "Chassis", DESCR: "Cisco C8300-1N1S-6T Chassis"
PID: C8300-1N1S-6T      , VID: V00      , SN: FDO2320A0C

NAME: "Fan Tray", DESCR: "Cisco C8300 1RU Fan Assembly"
PID: C8300-FAN-1R      , VID:          , SN:

NAME: "module 0", DESCR: "Cisco C8300-1N1S-6T Built-In NIM controller"
PID: C8300-1N1S-6T      , VID:          , SN:

NAME: "NIM subslot 0/0", DESCR: "Front Panel 6 ports Gigabitethernet Module"
PID: 4x1G-2xSFP        , VID: V01      , SN:

NAME: "module 1", DESCR: "Cisco C8300-1N1S-6T Built-In SM controller"

```

```

PID: C8300-1N1S-6T      , VID:      , SN:

NAME: "module R0", DESCR: "Cisco C8300-1N1S-6T Route Processor"
PID: C8300-1N1S-6T      , VID: V00      , SN: FDO231403QE

NAME: "module F0", DESCR: "Cisco C8300-1N1S-6T Forwarding Processor"
PID: C8300-1N1S-6T      , VID:      , SN:

```

### show platform: Example

```

Router# show platform
Chassis type: C8300-1N1S-6T

```

Slot	Type	State	Insert time (ago)
0	C8300-1N1S-6T	ok	2d03h
0/0	4x1G-2xSFP	ok	2d03h
1	C8300-1N1S-6T	ok	2d03h
R0	C8300-1N1S-6T	ok, active	2d03h
F0	C8300-1N1S-6T	ok, active	2d03h
P0	PWR-4430-AC	ok	2d03h
P1	Unknown	empty	never
P2	C8300-FAN-1R	ok	2d03h

Slot	CPLD Version	Firmware Version
0	19121329	1RU-20191104
1	19121329	1RU-20191104
R0	19121329	1RU-20191104
F0	19121329	1RU-20191104

### show platform diag: Example

```

Router# show platform diag
Chassis type: C8300-1N1S-6T

```

```

Slot: 0, C8300-1N1S-6T
Running state           : ok
Internal state         : online
Internal operational state : ok
Physical insert detect time : 00:00:29 (2d03h ago)
Software declared up time  : 00:01:05 (2d03h ago)
CPLD version           : 19121329
Firmware version       : 1RU-20191104

```

```

Sub-slot: 0/0, 4x1G-2xSFP
Operational status     : ok
Internal state         : inserted
Physical insert detect time : 00:01:27 (2d03h ago)
Logical insert detect time  : 00:01:27 (2d03h ago)

```

```

Slot: 1, C8300-1N1S-6T
Running state           : ok
Internal state         : online
Internal operational state : ok
Physical insert detect time : 00:00:29 (2d03h ago)
Software declared up time  : 00:01:06 (2d03h ago)
CPLD version           : 19121329

```

```

Firmware version           : 1RU-20191104

Slot: R0, C8300-1N1S-6T
Running state              : ok, active
Internal state             : online
Internal operational state : ok
Physical insert detect time : 00:00:29 (2d03h ago)
Software declared up time  : 00:00:29 (2d03h ago)
CPLD version               : 19121329
Firmware version          : 1RU-20191104

Slot: F0, C8300-1N1S-6T
Running state              : ok, active
Internal state             : online
Internal operational state : ok
Physical insert detect time : 00:00:29 (2d03h ago)
Software declared up time  : 00:01:00 (2d03h ago)
Hardware ready signal time : 00:00:58 (2d03h ago)
Packet ready signal time  : 00:01:05 (2d03h ago)
CPLD version               : 19121329
Firmware version          : 1RU-20191104

Slot: P0, PWR-4430-AC
State                      : ok
Physical insert detect time : 00:00:52 (2d03h ago)

Slot: P1, Unknown
State                      : empty
Physical insert detect time : 00:00:00 (never ago)

Slot: P2, C8300-FAN-1R
State                      : ok
Physical insert detect time : 00:00:52 (2d03h ago)

Slot: POE0, Unknown
State                      : empty
Physical insert detect time : 00:00:00 (never ago)

Slot: POE1, Unknown
State                      : empty
Physical insert detect time : 00:00:00 (never ago)

Slot: GE-POE, Unknown
State                      : NA
Physical insert detect time : 00:00:00 (never ago)

```

### show platform software status control-processor: Example

```

Router# show platform software status control-processor
RP0: online, statistics updated 10 seconds ago
Load Average: healthy
  1-Min: 0.53, status: healthy, under 5.00
  5-Min: 0.90, status: healthy, under 5.00
 15-Min: 0.87, status: healthy, under 5.00
Memory (kb): healthy
  Total: 3884836
  Used: 1976928 (51%), status: healthy
  Free: 1907908 (49%)
  Committed: 3165956 (81%), under 90%
Per-core Statistics
CPU0: CPU Utilization (percentage of time spent)

```

```

User: 2.10, System: 2.20, Nice: 0.00, Idle: 95.69
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU1: CPU Utilization (percentage of time spent)
User: 2.80, System: 2.60, Nice: 0.00, Idle: 94.50
IRQ: 0.00, SIRQ: 0.10, IOWait: 0.00
CPU2: CPU Utilization (percentage of time spent)
User: 1.90, System: 2.10, Nice: 0.00, Idle: 96.00
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00
CPU3: CPU Utilization (percentage of time spent)
User: 10.12, System: 0.60, Nice: 0.00, Idle: 89.27
IRQ: 0.00, SIRQ: 0.00, IOWait: 0.00

```

### show diag slot R0 eeprom detail: Example

```

Router# show diag slot R0 eeprom detail
Slot R0 EEPROM data:

```

```

EEPROM version      : 4
Compatible Type     : 0xFF
PCB Serial Number   : FDO23470DHV
Controller Type     : 4268
Hardware Revision   : 1.0
PCB Part Number     : 73-19423-07
Board Revision      : A0
Top Assy. Part Number : 800-105842-02
Deviation Number    : 551831
Fab Version         : 07
Product Identifier (PID) : C8300-1N1S-4T2X
Version Identifier (VID) : V01
CLEI Code          : CMM6J00ARA
Processor type      : D0
Chassis Serial Number : FDO2401A038
Chassis MAC Address  : c4b2.399e.b6c0
MAC Address block size : 144
Manufacturing Test Data : 00 00 00 00 00 00 00 00
Asset ID           :

```

### show version: Example

```

Router# show version

```

```

Cisco IOS XE Software, Version 17.03.01prd8
Cisco IOS Software [Amsterdam], c8000be Software (X86_64_LINUX_IOSD-UNIVERSALK9-M), Version
17.3.1prd8, RELEASE SOFTWARE
(fcl)
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2020 by Cisco Systems, Inc.
Compiled Tue 19-May-20 12:00 by mcpre

```

Cisco IOS-XE software, Copyright (c) 2005-2020 by Cisco Systems, Inc. All rights reserved. Certain components of Cisco IOS-XE software are licensed under the GNU General Public License ("GPL") Version 2.0. The software code licensed under GPL Version 2.0 is free software that comes with ABSOLUTELY NO WARRANTY. You can redistribute and/or modify such GPL code under the terms of GPL Version 2.0. For more details, see the documentation or "License Notice" file accompanying the IOS-XE software, or the applicable URL provided on the flyer accompanying the IOS-XE software.

ROM: (c)

```
Router uptime is 2 days, 3 hours, 26 minutes
Uptime for this control processor is 2 days, 3 hours, 27 minutes
System returned to ROM by Reload Command
System image file is "bootflash:c8000be-universalk9.17.03.01prd8.SPA.bin"
Last reload reason: Reload Command
```

This product contains cryptographic features and is subject to United States and local country laws governing import, export, transfer and use. Delivery of Cisco cryptographic products does not imply third-party authority to import, export, distribute or use encryption. Importers, exporters, distributors and users are responsible for compliance with U.S. and local country laws. By using this product you agree to comply with applicable laws and regulations. If you are unable to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at: <http://www.cisco.com/wwl/export/crypto/tool/stqrg.html>

If you require further assistance please contact us by sending email to [export@cisco.com](mailto:export@cisco.com).

Technology Package License Information:

```
-----
Technology      Type          Technology-package Current  Technology-package Next Reboot
-----
Smart License  Perpetual    network-essentials network-essentials
Smart License  Subscription None          None
```

The current crypto throughput level is 1000000 kbps

Smart Licensing Status: UNREGISTERED/EVAL MODE

```
cisco C8300-1N1S-6T (1RU) processor with 3763047K/6147K bytes of memory.
Processor board ID FDO2320AOCF
Router operating mode: Autonomous
6 Gigabit Ethernet interfaces
32768K bytes of non-volatile configuration memory.
8388608K bytes of physical memory.
7090175K bytes of flash memory at bootflash:.
28884992K bytes of M.2 USB at harddisk:.
```

Configuration register is 0x2102

## Configuring Power Supply Mode

You can configure the power supplies of both the device and a connected Power over Ethernet (PoE) module.

- [Configuring the Edge Platforms Power Supply Mode, on page 220](#)
- [Configuring the External PoE Service Module Power Supply Mode, on page 220](#)

- [Examples for Configuring Power Supply Mode, on page 220](#)
- [Available PoE Power, on page 222](#)

For more information on the Power Supply Mode, See the Overview of the Power Options section.

- [Hardware Installation Guide for Cisco Catalyst 8300 Series Edge Platform](#)
- [Hardware Installation Guide for Cisco Catalyst 8200 Series Edge Platforms](#)

## Configuring the Edge Platforms Power Supply Mode

Configure the main power supply on the Edge Platforms using the **power main redundant** command:

- **power main redundant**—Sets the main power supply in redundant mode.
- **no power main redundant**—Sets the main power supply in boost mode.

The boost mode is supported only on C8300-2N2S-4T2X and C8300-2N2S-6T platforms.




---

**Note** The default mode for the device power supply is redundant mode.

---

## Configuring the External PoE Service Module Power Supply Mode

Configure the power supply of an external PoE service module using the **power inline redundant** command:

- **power inline redundant**—Sets the external PoE service module power supply in redundant mode.
- **no power inline redundant**—Sets the external PoE service module power supply in boost mode. The boost mode is supported only on C8300-2N2S-4T2X and C8300-2N2S-6T platforms.




---

**Note** The default mode for the external PoE service module power supply is redundant mode.

---

The **show power** command shows whether boost or redundant mode is configured and whether this mode is currently running on the system.

## Examples for Configuring Power Supply Mode

### Example—Configured Mode of Boost for Main PSU and PoE Module

The Boost mode is supported only on C8300-2N2S-4T2X and C8300-2N2S-6T platforms. In this example, the **show power** command shows the configured mode as `Boost`, which is also the current runtime state. The `Main PSU` shows information about the main power supply. The `POE Module` shows information about the inline/PoE power. In this example, the current run-time state for the main power supply is the same as the configured state (`Boost` mode).

```
Router# show power
Main PSU :
```

```

Configured Mode : Boost
Current runtime state same : Yes
Total power available : 2000 Watts
POE Module :
Configured Mode : Boost
Current runtime state same : Yes
Total power available : 1000 Watts
Router#

```

### Example—Configured Mode of Boost for Main PSU and PoE Module

In this example, the **show power** command shows the power supplies that are present in the device. The Main PSU and POE Module are configured to the `Boost` mode, which differs from the current runtime state. The current runtime state is the `Redundant` mode. A likely explanation for this is that there is only one main power supply present in the router. See mode example 4 in the table titled "Modes of Operation" in [Available PoE Power, on page 222](#).

You can enter the **show platform** command to show the power supplies that are present in the device.

```

Router# show power
Main PSU :
Configured Mode : Boost
Current runtime state same : No
Total power available : 1000 Watts
POE Module :
Configured Mode : Boost
Current runtime state same : No
Total power available : 500 Watts
Router#

```

### Example—Configured Mode of Redundant for Main PSU and PoE Module

In this example, the **show power** command shows the configured mode is `Redundant` for both the main and inline power. The system has one 450 W and one 100 W power supply.

```

Router# show powerMain PSU :
Configured Mode : Redundant
Current runtime state same : No
Total power available : 250 Watts
POE Module :
Configured Mode : Redundant
Current runtime state same : No
Total power available : 0 Watts

Router#

```

### Example—Configured Mode of Boost for Main Power

In this example, the main power is configured to be in `boost` mode by using the **no** form of the **power main redundant** command. This sets the main power to `boost` mode with 1450 W and inline power to `redundant` mode with 500 W.

```

Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# no power main redundant
Router(config)#
*Jan 31 03:35:22.284: %PLATFORM_POWER-6-MODEMATCH: Inline power is in Redundant mode

```

```

Router(config)#
Router(config)# exit
Router#
*Jan 31 03:36:13.111: %SYS-5-CONFIG_I: Configured from console by console
Router# show power
Main PSU :
    Configured Mode : Boost
    Current runtime state same : Yes
    Total power available : 1450 Watts
POE Module :
    Configured Mode : Redundant
    Current runtime state same : Yes
    Total power available : 500 Watts
Router#

```

### Example—Configured Mode of Boost for PoE Power

In this example, an attempt is made to configure the inline power in boost mode by using the **no** form of the **power inline redundant** command. The inline power mode is **not** changed to boost mode because that would require a total power available in redundant mode of 1000 W. The inline power mode is redundant and is shown by the following values for the PoE Module:

- Configured Mode : Boost
- Current runtime state same : No

```

Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# no power inline redundant
Router(config)#
*Jan 31 03:42:40.947: %PLATFORM_POWER-6-MODEMISMATCH: Inline power not in Boost mode
Router(config)#
Router(config)# exit
Router#
*Jan 31 03:36:13.111: %SYS-5-CONFIG_I: Configured from console by console
Router# show power
Main PSU :
    Configured Mode : Boost
    Current runtime state same : Yes
    Total power available : 1450 Watts
POE Module :
    Configured Mode : Boost
    Current runtime state same : No
    Total power available : 500 Watts
Router#

```

## Available PoE Power

For the PoE feature to be available on the external PoE module, the total power from the power supplies must be 500 W or higher.




---

**Note** To ensure the PoE feature is functional on the external PoE module, verify the availability of PoE power on your router using the **show platform** and **show power** commands.

---



To determine there is enough PoE power for use by an external PoE service module, use the **show platform** and **show power** commands to calculate the available PoE power based on the wattage values of the main power supplies and PoE inverters.

Take the values of your main P0 and P1 power supplies to give the Total Power (for main power supplies.) Then take the values of your PoE1 and PoE2 power inverters to calculate the Total PoE Power.

The following table shows example modes of operation, which may be similar to your configuration.

The Total PoE Power value, in the final column of the table needs to be 500 W or higher for the PoE feature to be functional on a connected PoE service module.



**Note** Add power inverters to the router before inserting an external PoE module. Otherwise, even if the Total PoE Power is sufficient, the PoE power will not be used by the external PoE module and the module will need to be re-booted for the PoE feature to be functional.

Configuring a power mode of boost or redundant on the main power supplies, or PoE inverters, may affect the value for Total PoE Power.

The following table shows all power values in Watts. The wattage ratings of the main power supplies are shown in columns Main P0 and Main P1. The wattage ratings of the PoE inverters are shown in columns PoE0 and PoE1.

**Table 28: Modes of Operation**

Mode Example	Main P0	Main P1	Config Mode	Total Power (Main)	PoE0	PoE1	Config Mode	Total PoE Power
1	450	None	Redundant or Boost	450	None	500	Redundant or Boost	0 (None)
2	450	450	Boost	900	None	500	Redundant or Boost	0 (None)
3	450	450	Redundant	450	500	None	Redundant or Boost	0 (None)
4	1000	None	Redundant or Boost	1000	500	None	Redundant or Boost	500
5	1000	450	Redundant	450	500	500	Redundant or Boost	0 (None)
6	1000	450	Boost	1450	500	500	Boost	500
7	1000	1000	Redundant	1000	500	500	Boost	500
8	1000	1000	Boost	2000	500	500	Boost	1000



---

**Note** In the table above, for 500 W or higher Total PoE Power to be available, the "Total Power" (of the main power supplies) must be 1000 W or higher.

For 1000 W Total PoE Power (see Mode Example 8 above), there must be two 1000 W main power supplies (in `Boost` mode) and two PoE inverters (also in `Boost` mode).

---



---

**Caution** Care should be taken while removing the power supplies and power inverters (especially in `Boost` mode of operation). If the total power consumption is higher than can be supported by one power supply alone and in this condition a power supply is removed, the hardware can be damaged. This may then result in the system being unstable or unusable.

Similarly, in the case where there is only one PoE inverter providing PoE power to a service module, and in this condition the PoE inverter is removed, the hardware may be damaged, and may result in the system being unstable or unusable.

---



## CHAPTER 16

# Configuring High Availability

The Cisco High Availability (HA) technology enable network-wide protection by providing quick recovery from disruptions that may occur in any part of a network. A network's hardware and software work together with Cisco High Availability technology, which besides enabling quick recovery from disruptions, ensures fault transparency to users and network applications.

The following sections describe how to configure Cisco High Availability features on your device:

- [About Cisco High Availability, on page 225](#)
- [Interchassis High Availability, on page 225](#)
- [Bidirectional Forwarding Detection, on page 226](#)
- [Configuring Cisco High Availability, on page 227](#)

## About Cisco High Availability

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

This section covers some aspects of Cisco High Availability that may be used on the Cisco Catalyst 8300 Series Edge Platform:

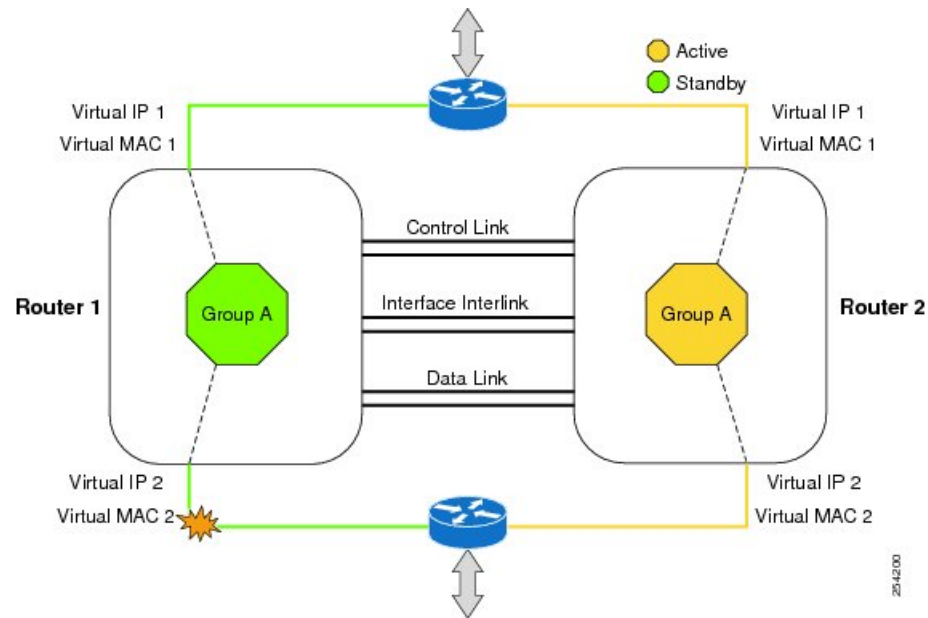
- [Interchassis High Availability, on page 225](#)
- [Bidirectional Forwarding Detection, on page 226](#)

## Interchassis High Availability

The Interchassis High Availability feature is also known as the box-to-box redundancy feature. Interchassis High Availability enables the configuration of pairs of devices to act as backup for each other. This feature can be configured to determine the active device based on several failover conditions. When a failover occurs, the standby device seamlessly takes over and starts processing call signaling and performing media forwarding tasks.

Groups of redundant interfaces are known as redundancy groups. The following figure depicts the active-standby device scenario. It shows how the redundancy group is configured for a pair of devices that have a single outgoing interface.

Figure 4: Redundancy Group Configuration



The devices are joined by a configurable control link and data synchronization link. The control link is used to communicate the status of the devices. The data synchronization link is used to transfer stateful information to synchronize the stateful database for the calls and media flows. Each pair of redundant interfaces are configured with the same unique ID number, also known as the RII. For information on configuring Interchassis HA on your device, see [Configuring Interchassis High Availability](#), on page 227.

## 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 a network administrator can use BFD to detect forwarding path failures at a uniform rate rather than 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” section in the [IP Routing: BFD Configuration Guide](#).

## Bidirectional Forwarding Detection Offload

The Bidirectional Forwarding Detection Offload feature allows the offload of BFD session management to the forwarding engine for improved failure detection times. BFD offload reduces the overall network convergence time by sending rapid failure detection packets (messages) to the routing protocols for recalculating the routing table. See [Configuring BFD Offload](#), on page 228.

# Configuring Cisco High Availability

- [Configuring Interchassis High Availability](#), on page 227
- [Configuring Bidirectional Forwarding](#), on page 228
- [Verifying Interchassis High Availability](#), on page 228
- [Verifying BFD Offload](#), on page 235

## Configuring Interchassis High Availability

### Prerequisites

- The active device and the standby device must run on the identical version of the Cisco IOS XE software.
- The active device and the standby device must be connected through an L2 connection for the control path.
- Either the Network Time Protocol (NTP) must be configured or the clock must be set identical on both devices to allow timestamps and call timers to match.
- Virtual Routing and Forwarding (VRF) must be defined in the same order on both active and standby devices for an accurate synchronization of data.
- The latency times must be minimal on all control and data links to prevent timeouts.
- Physically redundant links, such as Gigabit EtherChannel, must be used for the control and data paths.

### Restrictions

- The failover time for a box-to-box application is higher for a non-box-to-box application.
- LAN and MESH scenarios are not supported.
- VRFs are not supported and cannot be configured under ZBFW High Availability data and control interfaces.
- The maximum number of virtual MACs supported by the Front Panel Gigabit Ethernet (FPGE) interfaces depends on the platform. For information about the FPGE interfaces, see the [Hardware Installation Guide for Cisco Catalyst 8300 Edge Platform](#).
- When the configuration is replicated to the standby device, it is not committed to the startup configuration; it is in the running configuration. A user must run the **write memory** command to commit the changes that have been synchronized from the active device, on the standby device.

### How to Configure Interchassis High Availability

For more information on configuring Interchassis High Availability on the device, see the [IP Addressing: NAT Configuration Guide, Cisco IOS XE Release 3S](#).

## Configuring Bidirectional Forwarding

For information on configuring BFD on your device, see the [IP Routing BFD Configuration Guide](#).

For BFD commands, see the [Cisco IOS IP Routing: Protocol-Independent Command Reference](#) document.

### Configuring BFD Offload

#### Restrictions

- Only BFD version 1 is supported.
- When configured, only offloaded BFD sessions are supported; BFD session on RP are not supported.
- Only Asynchronous mode or no echo mode of BFD is supported.
- 511 asynchronous BFD sessions are supported.
- BFD hardware offload is supported for IPv4 sessions with non-echo mode only.
- BFD offload is supported only on port-channel interfaces.
- BFD offload is supported only for the Ethernet interface.
- BFD offload is not supported for IPv6 BFD sessions.
- BFD offload is not supported for BFD with TE/FRR.

#### How to Configure BFD Offload

BFD offload functionality is enabled by default. You can configure BFD hardware offload on the route processor. For more information, see [Configuring BFD](#) and the [IP Routing BFD Configuration Guide](#).

## Verifying Interchassis High Availability

Use the following **show** commands to verify the Interchassis High Availability.



---

**Note** Prerequisites and links to additional documentation configuring Interchassis High Availability are listed in [Configuring Interchassis High Availability, on page 227](#).

---

- **show redundancy application group [group-id | all]**
- **show redundancy application transport {client | group [group-id]}**
- **show redundancy application control-interface group [group-id]**
- **show redundancy application faults group [group-id]**
- **show redundancy application protocol {protocol-id | group [group-id]}**
- **show redundancy application if-mgr group [group-id]**
- **show redundancy application data-interface group [group-id]**

The following example shows the redundancy application groups configured on the device:

```
Router# show redundancy application group
Group ID      Group Name          State
-----
1             Generic-Redundancy-1  STANDBY
2             Generic-Redundancy2   ACTIVE
```

The following example shows the details of redundancy application group 1:

```
Router# show redundancy application group 1
Group ID:1
Group Name:Generic-Redundancy-1

Administrative State: No Shutdown
Aggregate operational state : Up
My Role: STANDBY
Peer Role: ACTIVE
Peer Presence: Yes
Peer Comm: Yes
Peer Progression Started: Yes

RF Domain: btob-one
RF state: STANDBY HOT
Peer RF state: ACTIVE
```

The following example shows the details of redundancy application group 2:

```
Router# show redundancy application group 2
Group ID:2
Group Name:Generic-Redundancy2

Administrative State: No Shutdown
Aggregate operational state : Up
My Role: ACTIVE
Peer Role: STANDBY
Peer Presence: Yes
Peer Comm: Yes
Peer Progression Started: Yes

RF Domain: btob-two
RF state: ACTIVE
Peer RF state: STANDBY HOT
```

The following example shows details of the redundancy application transport client:

```
Router# show redundancy application transport client
Client      Conn#  Priority  Interface  L3      L4
( 0)RF      0      1        CTRL      IPV4    SCTP
( 1)MCP_HA  1      1        DATA     IPV4    UDP_REL
( 4)AR      0      1        ASYM     IPV4    UDP
( 5)CF      0      1        DATA     IPV4    SCTP
```

The following example shows configuration details for the redundancy application transport group:

```
Router# show redundancy application transport group
Transport Information for RG (1)
Client = RF
TI   conn_id my_ip          my_port peer_ip          peer_por intf  L3      L4
0   0         192.0.2.8      59000  192.0.2.4      59000  CTRL   IPV4    SCTP
Client = MCP_HA
TI   conn_id my_ip          my_port peer_ip          peer_por intf  L3      L4
1   1         10.10.2.10     53000  10.10.6.9      53000  DATA  IPV4    UDP_REL
```

```

Client = AR
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
2 0 192.0.2.3 0 192.0.2.3 0 NONE_IN NONE_L3 NONE_L4
Client = CF
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
3 0 10.10.2.10 59001 10.10.6.9 59001 DATA IPV4 SCTP
Transport Information for RG (2)
Client = RF
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
8 0 192.0.2.8 59004 192.0.2.2 59004 CTRL IPV4 SCTP
Client = MCP_HA
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
9 1 10.10.2.10 53002 10.10.6.9 53002 DATA IPV4 UDP_REL
Client = AR
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
10 0 192.0.2.3 0 192.0.2.3 0 NONE_IN NONE_L3 NONE_L4
Client = CF
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
11 0 10.10.2.10 59005 10.10.6.9 59005 DATA IPV4 SCTP

```

The following example shows the configuration details of redundancy application transport group 1:

```

Router# show redundancy application transport group 1
Transport Information for RG (1)
Client = RF
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
0 0 192.0.2.8 59000 192.0.2.4 59000 CTRL IPV4 SCTP
Client = MCP_HA
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
1 1 10.10.2.10 53000 10.10.2.10 53000 DATA IPV4 UDP_REL
Client = AR
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
2 0 192.0.2.3 0 192.0.2.3 0 NONE_IN NONE_L3 NONE_L4
Client = CF
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
3 0 10.10.2.10 59001 10.10.2.10 59001 DATA IPV4 SCTP

```

The following example shows configuration details of redundancy application transport group 2:

```

Router# show redundancy application transport group 2
Transport Information for RG (2)
Client = RF
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
8 0 192.0.2.8 59004 192.0.2.4 59004 CTRL IPV4 SCTP
Client = MCP_HA
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
9 1 10.10.2.10 53002 10.10.2.10 53002 DATA IPV4 UDP_REL
Client = AR
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
10 0 192.0.2.3 0 192.0.2.3 0 NONE_IN NONE_L3 NONE_L4
Client = CF
TI conn_id my_ip my_port peer_ip peer_por intf L3 L4
11 0 10.10.2.10 59005 10.10.2.10 59005 DATA IPV4 SCTP

```

The following example shows configuration details of the redundancy application control-interface group:

```

Router# show redundancy application control-interface group
The control interface for rg[1] is GigabitEthernet0/0/0
Interface is Control interface associated with the following protocols: 2 1
BFD Enabled
Interface Neighbors:
Peer: 192.0.2.4 Active RGs: 1 Standby RGs: 2 BFD handle: 0

The control interface for rg[2] is GigabitEthernet0/0/0
Interface is Control interface associated with the following protocols: 2 1
BFD Enabled

```



```
Interface Neighbors:
Peer: 192.0.2.4 Active RGs: 1 Standby RGs: 2 BFD handle: 0
```

The following example shows configuration details of the redundancy application control-interface group 1:

```
Router# show redundancy application control-interface group 1
The control interface for rg[1] is GigabitEthernet0/0/0
Interface is Control interface associated with the following protocols: 2 1
BFD Enabled
Interface Neighbors:
Peer: 192.0.2.4 Active RGs: 1 Standby RGs: 2 BFD handle: 0
```

The following example shows configuration details of the redundancy application control-interface group 2:

```
Router# show redundancy application control-interface group 2
The control interface for rg[2] is GigabitEthernet0/0/0
Interface is Control interface associated with the following protocols: 2 1
BFD Enabled
Interface Neighbors:
Peer: 192.0.2.4 Active RGs: 1 Standby RGs: 2 BFD handle: 0
```

The following example shows configuration details of the redundancy application faults group:

```
Router# show redundancy application faults group
Faults states Group 1 info:
Runtime priority: [50]
RG Faults RG State: Up.
Total # of switchovers due to faults: 0
Total # of down/up state changes due to faults: 2
Faults states Group 2 info:
Runtime priority: [135]
RG Faults RG State: Up.
Total # of switchovers due to faults: 0
Total # of down/up state changes due to faults: 2
```

The following example shows configuration details specific to redundancy application faults group 1:

```
Router# show redundancy application faults group 1
Faults states Group 1 info:
Runtime priority: [50]
RG Faults RG State: Up.
Total # of switchovers due to faults: 0
Total # of down/up state changes due to faults: 2
```

The following example shows configuration details specific to redundancy application faults group 2:

```
Router# show redundancy application faults group 2
Faults states Group 2 info:
Runtime priority: [135]
RG Faults RG State: Up.
Total # of switchovers due to faults: 0
Total # of down/up state changes due to faults: 2
```

The following example shows configuration details for the redundancy application protocol group:

```
Router# show redundancy application protocol group
RG Protocol RG 1
-----
Role: Standby
Negotiation: Enabled
Priority: 50
Protocol state: Standby-hot
Ctrl Intf(s) state: Up
Active Peer: address 192.0.4.2, priority 150, intf Gi0/0/0
Standby Peer: Local
Log counters:
```

```

role change to active: 0
role change to standby: 1
disable events: rg down state 1, rg shut 0
ctrl intf events: up 2, down 1, admin_down 1
reload events: local request 0, peer request 0

```

```

RG Media Context for RG 1
-----

```

```

Ctx State: Standby
Protocol ID: 1
Media type: Default
Control Interface: GigabitEthernet0/0/0
Current Hello timer: 3000
Configured Hello timer: 3000, Hold timer: 10000
Peer Hello timer: 3000, Peer Hold timer: 10000
Stats:
Pkts 117, Bytes 7254, HA Seq 0, Seq Number 117, Pkt Loss 0
Authentication not configured
Authentication Failure: 0
Reload Peer: TX 0, RX 0
Resign: TX 0, RX 0
Active Peer: Present. Hold Timer: 10000
Pkts 115, Bytes 3910, HA Seq 0, Seq Number 1453975, Pkt Loss 0

```

```

RG Protocol RG 2
-----

```

```

Role: Active
Negotiation: Enabled
Priority: 135
Protocol state: Active
Ctrl Intf(s) state: Up
Active Peer: Local
Standby Peer: address 192.0.4.2, priority 130, intf Gi0/0/0
Log counters:
role change to active: 1
role change to standby: 1
disable events: rg down state 1, rg shut 0
ctrl intf events: up 2, down 1, admin_down 1
reload events: local request 0, peer request 0

```

```

RG Media Context for RG 2
-----

```

```

Ctx State: Active
Protocol ID: 2
Media type: Default
Control Interface: GigabitEthernet0/0/0
Current Hello timer: 3000
Configured Hello timer: 3000, Hold timer: 10000
Peer Hello timer: 3000, Peer Hold timer: 10000
Stats:
Pkts 118, Bytes 7316, HA Seq 0, Seq Number 118, Pkt Loss 0
Authentication not configured
Authentication Failure: 0
Reload Peer: TX 0, RX 0
Resign: TX 0, RX 1
Standby Peer: Present. Hold Timer: 10000
Pkts 102, Bytes 3468, HA Seq 0, Seq Number 1453977, Pkt Loss 0

```

The following example shows configuration details for the redundancy application protocol group 1:

```

Router# show redundancy application protocol group 1
RG Protocol RG 1
-----

```

```

Role: Standby
Negotiation: Enabled
Priority: 50
Protocol state: Standby-hot
Ctrl Intf(s) state: Up
Active Peer: address 192.0.4.2, priority 150, intf Gi0/0/0
Standby Peer: Local
Log counters:
role change to active: 0
role change to standby: 1
disable events: rg down state 1, rg shut 0
ctrl intf events: up 2, down 1, admin_down 1
reload events: local request 0, peer request 0

```

```

RG Media Context for RG 1
-----

```

```

Ctx State: Standby
Protocol ID: 1
Media type: Default
Control Interface: GigabitEthernet0/0/0
Current Hello timer: 3000
Configured Hello timer: 3000, Hold timer: 10000
Peer Hello timer: 3000, Peer Hold timer: 10000
Stats:
Pkts 120, Bytes 7440, HA Seq 0, Seq Number 120, Pkt Loss 0
Authentication not configured
Authentication Failure: 0
Reload Peer: TX 0, RX 0
Resign: TX 0, RX 0
Active Peer: Present. Hold Timer: 10000
Pkts 118, Bytes 4012, HA Seq 0, Seq Number 1453978, Pkt Loss 0

```

The following example shows configuration details for the redundancy application protocol group 2:

```

Router# show redundancy application protocol group 2

```

```

RG Protocol RG 2
-----
Role: Active
Negotiation: Enabled
Priority: 135
Protocol state: Active
Ctrl Intf(s) state: Up
Active Peer: Local
Standby Peer: address 192.0.4.2, priority 130, intf Gi0/0/0
Log counters:
role change to active: 1
role change to standby: 1
disable events: rg down state 1, rg shut 0
ctrl intf events: up 2, down 1, admin_down 1
reload events: local request 0, peer request 0

```

```

RG Media Context for RG 2
-----

```

```

Ctx State: Active
Protocol ID: 2
Media type: Default
Control Interface: GigabitEthernet0/0/0
Current Hello timer: 3000
Configured Hello timer: 3000, Hold timer: 10000
Peer Hello timer: 3000, Peer Hold timer: 10000
Stats:
Pkts 123, Bytes 7626, HA Seq 0, Seq Number 123, Pkt Loss 0
Authentication not configured
Authentication Failure: 0
Reload Peer: TX 0, RX 0

```

```

Resign: TX 0, RX 1
Standby Peer: Present. Hold Timer: 10000
Pkts 107, Bytes 3638, HA Seq 0, Seq Number 1453982, Pkt Loss 0

```

The following example shows configuration details for the redundancy application protocol 1:

```

Router# show redundancy application protocol 1
Protocol id: 1, name: rg-protocol-1
BFD: ENABLE
Hello timer in msec: 3000
Hold timer in msec: 10000
OVL1-1#show redundancy application protocol 2
Protocol id: 2, name: rg-protocol-2
BFD: ENABLE
Hello timer in msec: 3000
Hold timer in msec: 10000

```

The following example shows configuration details for redundancy application interface manager group:

```

Router# show redundancy application if-mgr group
RG ID: 1
=====

interface      GigabitEthernet0/0/3.152
-----
VMAC           0007.b421.4e21
VIP            203.0.113.1
Shut           shut
Decrement     10

interface      GigabitEthernet0/0/2.152
-----
VMAC           0007.b421.5209
VIP            203.0.113.4
Shut           shut
Decrement     10

RG ID: 2
=====

interface      GigabitEthernet0/0/3.166
-----
VMAC           0007.b422.14d6
VIP            203.0.113.6
Shut           no shut
Decrement     10

interface      GigabitEthernet0/0/2.166
-----
VMAC           0007.b422.0d06
VIP            203.0.113.9
Shut           no shut
Decrement     10

```

The following examples shows configuration details for redundancy application interface manager group 1 and group 2:

```

Router# show redundancy application if-mgr group 1
RG ID: 1
=====

interface      GigabitEthernet0/0/3.152
-----

```

```

VMAC          0007.b421.4e21
VIP           203.0.113.3
Shut          shut
Decrement    10

interface     GigabitEthernet0/0/2.152
-----
VMAC          0007.b421.5209
VIP           203.0.113.2
Shut          shut
Decrement    10

```

```

Router# show redundancy application if-mgr group 2
RG ID: 2
=====

```

```

interface     GigabitEthernet0/0/3.166
-----
VMAC          0007.b422.14d6
VIP           203.0.113.5
Shut          no shut
Decrement    10

interface     GigabitEthernet0/0/2.166
-----
VMAC          0007.b422.0d06
VIP           203.0.113.7
Shut          no shut
Decrement    10

```

The following example shows configuration details for redundancy application data-interface group:

```

Router# show redundancy application data-interface group
The data interface for rg[1] is GigabitEthernet0/0/1
The data interface for rg[2] is GigabitEthernet0/0/1

```

The following examples show configuration details specific to redundancy application data-interface group 1 and group 2:

```

Router# show redundancy application data-interface group 1
The data interface for rg[1] is GigabitEthernet0/0/1

```

```

Router # show redundancy application data-interface group 2
The data interface for rg[2] is GigabitEthernet0/0/1

```

## Verifying BFD Offload

Use the following commands to verify and monitor BFD offload feature on your device.



**Note** Configuration of BFD Offload is described in [Configuring Bidirectional Forwarding](#), on page 228.

- **show bfd neighbors [details]**
- **debug bfd [packet | event]**
- **debug bfd event**

The **show bfd neighbors** command displays the BFD adjacency database:

Router# show bfd neighbor

```
IPv4 Sessions
NeighAddr          LD/RD          RH/RS    State    Int
192.0.2.1          362/1277      Up        Up        Gi0/0/1.2
192.0.2.5          445/1278      Up        Up        Gi0/0/1.3
192.0.2.3          1093/961      Up        Up        Gi0/0/1.4
192.0.2.2          1244/946      Up        Up        Gi0/0/1.5
192.0.2.6          1094/937      Up        Up        Gi0/0/1.6
192.0.2.7          1097/1260     Up        Up        Gi0/0/1.7
192.0.2.4          1098/929      Up        Up        Gi0/0/1.8
192.0.2.9          1111/928      Up        Up        Gi0/0/1.9
192.0.2.8          1100/1254     Up        Up        Gi0/0/1.10
```

The **debug bfd neighbor detail** command displays the debugging information related to BFD packets:

Router# show bfd neighbor detail

```
IPv4 Sessions
NeighAddr          LD/RD          RH/RS    State    Int
192.0.2.1          362/1277      Up        Up        Gi0/0/1.2
Session state is UP and not using echo function.
Session Host: Hardware
OurAddr: 192.0.2.2
Handle: 33
Local Diag: 0, Demand mode: 0, Poll bit: 0
MinTxInt: 50000, MinRxInt: 50000, Multiplier: 3
Received MinRxInt: 50000, Received Multiplier: 3
Holddown (hits): 0(0), Hello (hits): 50(0)
Rx Count: 3465, Rx Interval (ms) min/max/avg: 42/51/46
Tx Count: 3466, Tx Interval (ms) min/max/avg: 39/52/46
Elapsed time watermarks: 0 0 (last: 0)
Registered protocols: CEF EIGRP
Uptime: 00:02:50
Last packet: Version: 1          - Diagnostic: 0
                State bit: Up      - Demand bit: 0
                Poll bit: 0        - Final bit: 0
                C bit: 1
                Multiplier: 3      - Length: 24
                My Discr.: 1277    - Your Discr.: 362
                Min tx interval: 50000 - Min rx interval: 50000
                Min Echo interval: 0
```

The **show bfd summary** command displays the BFD summary:

Router# show bfd summary

	Session	Up	Down
Total	400	400	0

The **show bfd drops** command displays the number of packets dropped in BFD:

Router# show bfd drops

```
BFD Drop Statistics
```

	IPV4	IPV6	IPV4-M	IPV6-M	MPLS_PW	MPLS_TP_LSP
Invalid TTL	0	0	0	0	0	0
BFD Not Configured	0	0	0	0	0	0
No BFD Adjacency	33	0	0	0	0	0
Invalid Header Bits	0	0	0	0	0	0
Invalid Discriminator	1	0	0	0	0	0
Session AdminDown	94	0	0	0	0	0
Authen invalid BFD ver	0	0	0	0	0	0
Authen invalid len	0	0	0	0	0	0
Authen invalid seq	0	0	0	0	0	0
Authen failed	0	0	0	0	0	0

The `debug bfd packet` command displays debugging information about BFD control packets.

**Router# debug bfd packet**

```
*Nov 12 23:08:27.982: BFD-DEBUG Packet: Rx IP:192.0.2.1 ld/rd:1941/0 diag:0(No Diagnostic)
  Down C cnt:4 ttl:254 (0)
*Nov 12 23:08:27.982: BFD-DEBUG Packet: Tx IP:192.0.2.1 ld/rd:983/1941 diag:3(Neighbor
  Signaled Session Down) Init C cnt:44 (0)
*Nov 12 23:08:28.007: BFD-DEBUG Packet: Rx IP:192.0.2.1 ld/rd:1941/983 diag:0(No Diagnostic)
  Up PC cnt:4 ttl:254 (0)
*Nov 12 23:08:28.007: BFD-DEBUG Packet: Tx IP:192.0.2.1 ld/rd:983/1941 diag:0(No Diagnostic)
  Up F C cnt:0 (0)
*Nov 12 23:08:28.311: BFD-DEBUG Packet: Rx IP:192.0.2.1 ld/rd:1941/983 diag:0(No Diagnostic)
  Up FC cnt:0 ttl:254 (0)
*Nov 12 23:08:28.311: BFD-DEBUG Packet: Tx IP:192.0.2.1 ld/rd:983/1941 diag:0(No Diagnostic)
  Up C cnt:0 (0)
*Nov 12 23:08:28.311: BFD-DEBUG Packet: Rx IP:192.0.2.3 ld/rd:1907/0 diag:0(No Diagnostic)
  Down C cnt:3 ttl:254 (0)
*Nov 12 23:08:28.311: BFD-DEBUG Packet: Tx IP:192.0.2.3 ld/rd:993/1907 diag:3(Neighbor
  Signaled Session Down) Init C cnt:43 (0)
*Nov 12 23:08:28.311: BFD-DEBUG Packet: Rx IP:192.0.2.1 ld/rd:1941/983 diag:0(No Diagnostic)
  Up C cnt:0 ttl:254 (0)
*Nov 12 23:08:28.626: BFD-DEBUG Packet: Rx IP:192.0.2.3 ld/rd:1907/993 diag:0(No Diagnostic)
  Up PC cnt:3 ttl:254 (0)
*Nov 12 23:08:28.626: BFD-DEBUG Packet: Tx IP:192.0.2.3 ld/rd:993/1907 diag:0(No Diagnostic)
  Up F C cnt:0 (0)
*Nov 12 23:08:28.645: BFD-DEBUG Packet: Rx IP:192.0.2.3 ld/rd:1907/993 diag:0(No Diagnostic)
  Up C cnt:0 ttl:254 (0)
*Nov 12 23:08:28.700: BFD-DEBUG Packet: Rx IP:192.0.2.3 ld/rd:1907/993 diag:0(No Diagnostic)
  Up FC cnt:0 ttl:254 (0)
*Nov 12 23:08:28.700: BFD-DEBUG Packet: Tx IP:192.0.2.3 ld/rd:993/1907 diag:0(No Diagnostic)
  Up C cnt:0 (0)
*Nov 12 23:08:28.993: BFD-DEBUG Packet: Rx IP:192.0.2.3 ld/rd:1907/993 diag:0(No Diagnostic)
  Up C cnt:0 ttl:254 (0)
```

The `debug bfd event` displays debugging information about BFD state transitions:

**Router# deb bfd event**

```
*Nov 12 23:11:29.503: BFD-DEBUG Event: notify client(EIGRP) IP:192.0.2.6, ld:1401, handle:77,
  event:DOWN adminDown, (0)
*Nov 12 23:11:29.503: BFD-DEBUG Event: notify client(CEF) IP:192.0.2.6, ld:1401, handle:77,
  event:DOWN adminDown, (0)
*Nov 12 23:11:29.503: BFD-DEBUG Event: notify client(EIGRP) IP:192.0.2.10, ld:1400, handle:39,
  event:DOWN adminDown, (0)
*Nov 12 23:11:29.503: BFD-DEBUG Event: notify client(CEF) IP:192.0.2.10, ld:1400, handle:39,
  event:DOWN adminDown, (0)
*Nov 12 23:11:29.503: BFD-DEBUG Event: notify client(EIGRP) IP:192.0.2.8, ld:1399, handle:25,
  event:DOWN adminDown, (0)
*Nov 12 23:11:29.503: BFD-DEBUG Event: notify client(CEF) IP:192.0.2.8, ld:1399, handle:25,
  event:DOWN adminDown, (0)
*Nov 12 23:11:29.503: BFD-DEBUG Event: notify client(EIGRP) IP:192.0.2.5, ld:1403, handle:173,
  event:DOWN adminDown, (0)
*Nov 12 23:11:29.503: BFD-DEBUG Event: notify client(CEF) IP:192.0.2.6, ld:1403, handle:173,
  event:DOWN adminDown, (0)
*Nov 12 23:11:29.503: BFD-DEBUG Event: notify client(EIGRP) IP:192.0.2.4, ld:1402, handle:95,
  event:DOWN adminDown, (0)
*Nov 12 23:11:29.503: BFD-DEBUG Event: notify client(CEF) IP:192.0.2.4, ld:1402, handle:95,
  event:DOWN adminDown, (0)
*Nov 12 23:11:30.639: BFD-HW-API: Handle 1404: Timers: Tx timer 1000000 Detect timer 0
*Nov 12 23:11:30.639: BFD-HW-API: Handle 1404: Flags: Poll 0 Final 0
*Nov 12 23:11:30.639: BFD-HW-API: Handle 1404: Buffer: 0x23480318 0x0000057C 0x00000000
  0x000F4240 0x000F4240 0x00000000 size 24
*Nov 12 23:11:30.641: BFD-HW-API: Handle 1405: Timers: Tx timer 1000000 Detect timer 0
*Nov 12 23:11:30.641: BFD-HW-API: Handle 1405: Flags: Poll 0 Final 0
*Nov 12 23:11:30.641: BFD-HW-API: Handle 1405: Buffer: 0x23480318 0x0000057D 0x00000000
```

```
0x000F4240 0x000F4240 0x00000000 size 24
*Nov 12 23:11:30.649: BFD-DEBUG Packet: Rx IP:192.0.2.6 ld/rd:1601/1404
diag:7(Administratively Down) AdminDown C cnt:0 ttl:254 (0)
*Nov 12 23:11:30.650: BFD-DEBUG Event: V1 FSM ld:1404 handle:207 event:RX ADMINDOWN state:UP
(0)
*Nov 12 23:11:30.650: BFD-DEBUG Event: resetting timestamps ld:1404 handle:207 (0)
*Nov 12 23:11:30.650: BFD-DEBUG Event: notify client(CEF) IP:192.0.2.1, ld:1404, handle:207,
event:DOWN adminDown, (0)
*Nov 12 23:11:30.650: BFD-DEBUG Packet: Tx IP:192.0.2.1 ld/rd:1404/0 diag:3(Neighbor Signaled
Session Down) Down C cnt:0 (0)
*Nov 12 23:11:30.650: BFD-DEBUG Packet: Rx IP:192.0.2.1 ld/rd:1620/1405
diag:7(Administratively Down) AdminDown C cnt:0 ttl:254 (0)
*Nov 12 23:11:30.650: BFD-DEBUG Event: V1 FSM ld:1405 handle:209 event:RX ADMINDOWN state:UP
(0)
*Nov 12 23:11:30.650: BFD-DEBUG Event: resetting timestamps ld:1405 handle:209 (0)
*Nov 12 23:11:30.650: BFD-DEBUG Event: notify client(CEF) IP:192.0.2.1, ld:1405, handle:209,
event:DOWN adminDown, (0)
*Nov 12 23:11:30.650: BFD-DEBUG Packet: Tx IP:192.0.2.7 ld/rd:1405/0 diag:3(Neighbor Signaled
Session Down) Down C cnt:0 (0)
*Nov 12 23:11:30.650: BFD-DEBUG Event: notify client(EIGRP) IP:192.0.2.7, ld:1404, handle:207,
event:DOWN adminDown, (0)
*Nov 12 23:11:30.650: BFD-DEBUG Event: notify client(CEF) IP:192.0.2.7, ld:1404, handle:207,
event:DOWN adminDown, (0)
*Nov 12 23:11:30.650: BFD-DEBUG Event: notify client(EIGRP) IP:192.0.2.7, ld:1405, handle:209,
event:DOWN adminDown, (0)
*Nov 12 23:11:30.650: BFD-DEBUG Event: notify client(CEF) IP:192.0.2.7, ld:1405, handle:209,
event:DOWN adminDown, (0)
*Nov 12 23:11:31.035: %DUAL-5-NBRCHANGE: EIGRP-IPv4 100: Neighbor 192.0.2.8
```





# CHAPTER 17

## Configuring Secure Storage

Secure Storage feature allows you to secure critical configuration information by encrypting it. It encrypts VPN, IPSec, and other asymmetric key-pairs, pre-shared secrets, the type 6 password encryption key and certain credentials. An instance-unique encryption key is stored in the hardware trust anchor to prevent it from being compromised.

By default, this feature is enabled on platforms that come with a hardware trust anchor. This feature is not supported on platforms that do not have hardware trust anchor.

- [Enabling Secure Storage](#) , on page 239
- [Disabling Secure Storage](#) , on page 240
- [Verifying the Status of Encryption](#), on page 241
- [Verifying the Platform Identity](#), on page 241

## Enabling Secure Storage

### Before you begin

By default, this feature is enabled on a platform. Use this procedure on a platform where it is disabled.

### SUMMARY STEPS

1. Config terminal
2. service private-config-encryption
3. do write memory

### DETAILED STEPS

	Command or Action	Purpose
Step 1	Config terminal <b>Example:</b> router#config terminal	Enters the configuration mode.
Step 2	service private-config-encryption <b>Example:</b>	Enables the Secure Storage feature on your platform.

	Command or Action	Purpose
	<code>router(config)# service private-config-encryption</code>	
<b>Step 3</b>	do write memory <b>Example:</b> <code>router(config)# do write memory</code>	Encrypts the private-config file and saves the file in an encrypted format.

**Example**

The following example shows how to enable Secure Storage:

```
router#config terminal
router(config)# service private-config-encryption
router(config)# do write memory
```

## Disabling Secure Storage

**Before you begin**

To disable Secure Storage feature on a platform, perform this task:

**SUMMARY STEPS**

1. Config terminal
2. no service private-config-encryption
3. do write memory

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	Config terminal <b>Example:</b> <code>router#config terminal</code>	Enters the configuration mode.
<b>Step 2</b>	no service private-config-encryption <b>Example:</b> <code>router(config)# no service private-config-encryption</code>	Disables the Secure Storage feature on your platform.
<b>Step 3</b>	do write memory <b>Example:</b> <code>router(config)# do write memory</code>	Decrypts the private-config file and saves the file in plane format.

### Example

The following example shows how to disable Secure Storage:

```
router#config terminal
router(config)# no service private-config-encryption
router(config)# do write memory
```

## Verifying the Status of Encryption

Use the **show parser encrypt file status** command to verify the status of encryption. The following command output indicates that the feature is available but the file is not encrypted. The file is in 'plain text' format.

```
router#show parser encrypt file status
Feature: Enabled
File Format: Plain Text
Encryption Version: Ver1
```

The following command output indicates that the feature is enabled and the file is encrypted. The file is in 'cipher text' format.

```
router#show parser encrypt file status
Feature: Enabled
File Format: Cipher Text
Encryption Version: Ver1
```

## Verifying the Platform Identity

Use the **show platform sudi certificate** command to display the SUDI certificate in standard PEM format. The command output helps you verify the platform identity.

In the command output, the first certificate is the Cisco Root CA 2048 and the second is the Cisco subordinate CA (ACT2 SUDI CA). The third is the SUDI certificate.

```
router#show platform sudi certificate sign nonce 123
-----BEGIN CERTIFICATE-----
MIIDQzCCAiuGAWIBAgIQX/h7KctU3I1CoxW1aMmt/zANBgkqhkiG9w0BAQUFADA1
MRYwFAYDVQQKEw1DaXNjbyBTeXN0ZW1zMRswGQYDVQQDEsJDaXNjbyBSb290IENB
IDIwNDgwHhcNMDQwNTE0MjAxNzEyWcNMjkwNTE0MjAyNTQyWjA1MRYwFAYDVQQK
Ew1DaXNjbyBTeXN0ZW1zMRswGQYDVQQDEsJDaXNjbyBSb290IENBIDIwNDgwggEg
MA0GCSqGSIb3DQEBAQUAA4IBDQAwggEIAoIBAQCWmrmrp68Kd6f1cba0ZmKUEIhH
xmJVhEAYv8CrLqUccda8bnuoqrpu0hWISEWdovyD0My5j0AmaHBKeN8hF570YQXJ
FcjPFto1YYmUQ6iEqDGYeJu5Tm8sUxJsZr2tKyS7McQr/4NEb7Y9JhcJ6r8qqB9q
VvYgDxFU14F1pyXOWWqCZe+36ufijXWLBvLdT6ZeYpzPEApk0E5tzivMW/VgpSdH
jWn0f84bcN5wGyDWbs2mAg8EtKpP6BrXruOIIt6ke01a06g58QBdKtCytKmg9L
Eg6CTY5j/e/rmxrbU6YTYK/CfdFhbBcl1HP7R2RQgYCUTOG/rksc35LtLgXfAgED
o1EwTzALBgNVHQ8EBAMCAYYwDwYDVR0TAAQH/BAUwAwEB/zAdBgNVHQ4EFgQUJ/PI
FR5umgIjFq0roIlgX9p7L6owEAYJKwYBBAGCNxUBBAMCAQAwDQYJKoZIhvcNAQEF
BQADggEBAJ2dhISjQa18dwy3U8pORFbi71R803UXHOjgXkhLtv5M0hmBvRbW7hmW
Yqpao2TB9k5UM8Z3/sUcuuVdJcr18JOagxEu5sv4dEX+5wW4q+ffY0vhN4TauYuX
cB7w4ovXsNgOnbFp1iqRe61JT37mjpXYgyC81WhJdtSd9i7rp77rMKSsH0T81asZ
Bvt9YaretIpjsJyp8qS5UwGH0GikJ3+r/+n6yUA4iGe00caEb1fJU9u6ju7AQ7L4
CYNu/2bPPu8Xs1gYJQk0XuPL1hs27PKSb3TkL4EqlZKR4OCXPDJoBYVL0fdX41Id
kxpUnwVwwEpxYB5DC2Ae/qPOgRnhCzU=
-----END CERTIFICATE-----
```

```

-----BEGIN CERTIFICATE-----
MIIEPCCAySgAwIBAgIKYQlufQAAAAAADANBgkqhkiG9w0BAQUFADA1MRYwFAYD
VQOKEw1DaXNjbyBTeXN0ZW1zMRswGQYDVQQDExJDaXNjbyBSb290IENBIDIwNDgw
HhcNMTEwNjMwMTE1NjU3WhcnMjkwNTE0MjAyNTQyWjAnMQ4wDAYDVQQKEwVDA1MRYw
bzEVMBMGAlUEAxMMQUNUMiBTvURJIENBMB4XDTE1MTEwNjMwMTE1NjU3WhcnMjkw
MIIBCgKCAQEAM5l3THIx9tN/hS5qR/6UZRpdd+9aE2JbFknjht6gfHKd477AkS
5XAtUs5oxDYVt/zEbs1Zq3+LR6qrqKQV6JYvH05UYLBqCj38s76NLk53905Wzp
9pRcmRCPuX+a6tHF/qRuOiJ44mdeDYz03qCpxzprWJDPc1M4iYKHUMQMqmgmg+
xghHIOoWS80BocdiynEbeP5rZ7qRuewKMpl1TiI3WdBNjZjnpfjg66F+P4SaDkGb
BXDgJl3oVeF+EyFWLrFjj97fL2+8oauV43Qrvnf3d/GfqXj7ew+z/sXlXtEOjSXJ
URsyMEj53Rdd9tJwHky8neapszS+r+kdvQIDAQABo4IBWjCCAVYwCwYDVR0PBAQD
AgHGMBOGA1UdDgQWBRI2PHxwnDVW7t8cwmTr7i4MAP4fzAfBgNVHSMEGDAWgBQn
88gVhm6aAgkWrSugiWbF2nsvqjBDBGNVHR8EPDA6MDigNqA0hjJodHRwOi8vd3d3
LmNpc2NvLmNvbS9zZW50eS9wa2kvY3JsL2NyY2EyMDQ4LmNybDBQBggrBgEF
BQcBAQREMEIwQAYIKwYBBQUHMAKGNH0dHA6Ly93d3cuY2l2Y28uY29tL3NlY3Vy
aXR5L3BraS9jZjXJ0cy9jcmNhMjA0OC5jZlIwXAYDVR0gBFUwUzBRBgorBgEAAQkV
AQwAMEMwQQYIKwYBBQUHAgEWNWh0dHA6Ly93d3cuY2l2Y28uY29tL3NlY3VyYXR5
L3BraS9wb2xpY2llcy9pbmRleC50dG1sMBIGA1UdEwEB/wQIMAYBAf8CAQAwDQYJ
KoZIhvcNAQEFBQADggEBAGh1qc1r9tx4hzWgDERm371yeuEmqcIfi9b9+GbMSJbi
ZHc/CcC10lJu0a9zTXA9w47H9/t6leduGxb4WeLxcwCiUgvFtCa51Ikl8nNbcKY
/4dwlex+7amATUQ04QggIE67wVlPu6bgAE3Ja/nRS3xKYSnj8H5TehimBSv6TECi
i5jUhoWryAK4dVo8hCkjEkzu3ufBTJapnv89g9OE+H3VKM4L+/KdkUO+52djFKn
hyl47d7cZR4DY4LIuFM2PlAs8YyjoNpK/urSRI4WdIlplR1nH7KND15618yFVP
0IFJZBGrooCRBjOSwFv8cpWCbmWdPaCQT2nwIjTfY8c=
-----END CERTIFICATE-----
-----BEGIN CERTIFICATE-----
MIIDhzCCAm+gAwIBAgIEAJT3DDANBgkqhkiG9w0BAQsFADANMQ4wDAYDVQQKEwVDA1
aXNjbyEVMBMGAlUEAxMMQUNUMiBTvURJIENBMB4XDTE1MTEwNjMwMTE1NjU3Whcn
MjkwNTE0MjAyNTQyWjAnMQ4wDAYDVQQKEwVDA1MRYwY2l2Y28uY29tL3NlY3VyYXR5
L3BraS9wb2xpY2llcy9pbmRleC50dG1sMBIGA1UdEwEB/wQIMAYBAf8CAQAwDQYJ
KoZIhvcNAQEFBQADggEBAGh1qc1r9tx4hzWgDERm371yeuEmqcIfi9b9+GbMSJbi
ZHc/CcC10lJu0a9zTXA9w47H9/t6leduGxb4WeLxcwCiUgvFtCa51Ikl8nNbcKY
/4dwlex+7amATUQ04QggIE67wVlPu6bgAE3Ja/nRS3xKYSnj8H5TehimBSv6TECi
i5jUhoWryAK4dVo8hCkjEkzu3ufBTJapnv89g9OE+H3VKM4L+/KdkUO+52djFKn
hyl47d7cZR4DY4LIuFM2PlAs8YyjoNpK/urSRI4WdIlplR1nH7KND15618yFVP
0IFJZBGrooCRBjOSwFv8cpWCbmWdPaCQT2nwIjTfY8c=
-----END CERTIFICATE-----
Signature version: 1
Signature:
405c70d802b73947EDBF8D0D2C8180F10D4B3EF9694514219C579D2ED52F7D583E0F40813FC4E9F549B2EB1C21725F7C
B1C79F98271E47E780E703E67472380FB52D4963E1D1FB9787B38E28B8E696570A180B7A2F131B1F174EA79F5DB4765DF67386126D8
9E07EDF6C26E0A81272EA1437D03F2692937082756AE1F1BFAFBFACD6BE9CF9C84C961FACE9FA0FE64D85AE4FA086969D0702C536ABD
B8FBFC47C14C17D02FEFB4F7F5B24D2932FA876F56B4C07816270A0B4195C53D975C85AEAE3A74F2DBF293F52423ECB7B853967080A
9C57DA3E4B08B2B2CA623B2CBAF7080A0AEB09B2E5B756970A3A27E0F1D17C8A243

```



## CHAPTER 18

# Configuring Call Home

The Call Home feature provides e-mail-based and web-based notification of critical system events. A versatile range of message formats are available for optimal compatibility with pager services, standard e-mail, or XML-based automated parsing applications. Common uses of this feature may include direct paging of a network support engineer, e-mail notification to a Network Operations Center, XML delivery to a support website, and use of Cisco Smart Call Home services for direct case generation with the Cisco Systems Technical Assistance Center (TAC).

This chapter includes the following sections:

- [Finding Feature Information, on page 243](#)
- [Prerequisites for Call Home, on page 243](#)
- [Information About Call Home, on page 244](#)
- [How to Configure Call Home, on page 246](#)
- [Configuring Diagnostic Signatures, on page 268](#)
- [Displaying Call Home Configuration Information, on page 276](#)
- [Default Call Home Settings, on page 281](#)
- [Alert Group Trigger Events and Commands, on page 282](#)
- [Message Contents, on page 289](#)

## Finding Feature Information

Your software release may not support all of the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release.

Use the Cisco Feature Navigator to find information about platform support and Cisco IOS and Catalyst OS software image support. To access Cisco Feature Navigator, see <http://tools.cisco.com/ITDIT/CFN/>. A Cisco account is not required to access the Cisco Feature Navigator.

## Prerequisites for Call Home

The following are the prerequisites before you configure Call Home:

- Contact e-mail address (required for full registration with Smart Call Home, optional if Call Home is enabled in anonymous mode), phone number (optional), and street address information (optional) should be configured so that the receiver can determine the origin of messages received.

- At least one destination profile (predefined or user-defined) must be configured. The destination profile you use depends on whether the receiving entity is a pager, an e-mail address, or an automated service such as Cisco Smart Call Home.

If the destination profile uses e-mail message delivery, you must specify a Simple Mail Transfer Protocol (SMTP) server.

- The router must have IP connectivity to an e-mail server or the destination HTTP server.
- If Cisco Smart Call Home is used, an active service contract covering the device is required to provide full Cisco Smart Call Home service.

## Information About Call Home

The Call Home feature can deliver alert messages containing information on configuration, environmental conditions, inventory, syslog, snapshot, and crash events. It provides these alert messages as either e-mail-based or web-based messages. Multiple message formats are available, allowing for compatibility with pager services, standard e-mail, or XML-based automated parsing applications. This feature can deliver alerts to multiple recipients, referred to as Call Home destination profiles, each with configurable message formats and content categories. A predefined destination profile is provided for sending alerts to the Cisco TAC ([callhome@cisco.com](mailto:callhome@cisco.com)). You can also define your own destination profiles.

Flexible message delivery and format options make it easy to integrate specific support requirements.

This section contains the following subsections:

- [Benefits of Using Call Home](#)
- [Obtaining Smart Call Home Services](#)

## Benefits of Using Call Home

The Call Home feature offers the following benefits:

- Multiple message-format options, which include:
  - Short Text—Suitable for pagers or printed reports.
  - Plain Text—Full formatted message information suitable for human reading.
  - XML—Machine-readable format using XML and Adaptive Markup Language (AML) document type definitions (DTDs). The XML format enables communication with the Cisco TAC.
- Multiple concurrent message destinations.
- Multiple message categories including configuration, environmental conditions, inventory, syslog, snapshot, and crash events.
- Filtering of messages by severity and pattern matching.
- Scheduling of periodic message sending.

## Obtaining Smart Call Home Services

If you have a service contract directly with Cisco, you can register for the Smart Call Home service. Smart Call Home analyzes Smart Call Home messages and provides background information and recommendations. For known issues, particularly online diagnostics failures, Automatic Service Requests are generated with the Cisco TAC.

Smart Call Home offers the following features:

- Continuous device health monitoring and real-time diagnostic alerts.
- Analysis of Smart Call Home messages and, if needed, Automatic Service Request generation routed to the correct TAC team, including detailed diagnostic information to speed problem resolution.
- Secure message transport directly from your device or through an HTTP proxy server or a downloadable Transport Gateway (TG). You can use a TG aggregation point to support multiple devices or in cases where security dictates that your devices may not be connected directly to the Internet.
- Web-based access to Smart Call Home messages and recommendations, inventory, and configuration information for all Smart Call Home devices provides access to associated field notices, security advisories, and end-of-life information.

You need the following items to register for Smart Call Home:

- SMARTnet contract number for your router
- Your e-mail address
- Your Cisco.com username

For more information about Smart Call Home, see <https://supportforums.cisco.com/community/4816/smart-call-home>.

## Anonymous Reporting

Smart Call Home is a service capability included with many Cisco service contracts and is designed to assist customers resolve problems more quickly. In addition, the information gained from crash messages helps Cisco understand equipment and issues occurring in the field. If you decide not to use Smart Call Home, you can still enable Anonymous Reporting to allow Cisco to securely receive minimal error and health information from the device. If you enable Anonymous Reporting, your customer identity will remain anonymous, and no identifying information will be sent.



---

**Note** When you enable Anonymous Reporting, you acknowledge your consent to transfer the specified data to Cisco or to vendors operating on behalf of Cisco (including countries outside the United States). Cisco maintains the privacy of all customers. For information about how Cisco treats personal information, see the Cisco Privacy Statement at <http://www.cisco.com/web/siteassets/legal/privacy.html>.

---

When Call Home is configured in an anonymous way, only crash, inventory, and test messages are sent to Cisco. No customer identifying information is sent.

For more information about what is sent in these messages, see [Alert Group Trigger Events and Commands, on page 282](#).

# How to Configure Call Home

The following sections show how to configure Call Home using a single command:

- [Configuring Smart Call Home \(Single Command\), on page 246](#)
- [Configuring and Enabling Smart Call Home, on page 247](#)

The following sections show detailed or optional configurations:

- [Enabling and Disabling Call Home, on page 247](#)
- [Configuring Contact Information, on page 248](#)
- [Configuring Destination Profiles, on page 250](#)
- [Subscribing to Alert Groups, on page 253](#)
- [Configuring General E-Mail Options, on page 258](#)
- [Specifying Rate Limit for Sending Call Home Messages, on page 260](#)
- [Specifying HTTP Proxy Server, on page 261](#)
- [Enabling AAA Authorization to Run IOS Commands for Call Home Messages, on page 261](#)
- [Configuring Syslog Throttling, on page 262](#)
- [Configuring Call Home Data Privacy, on page 263](#)
- [Sending Call Home Communications Manually, on page 263](#)

## Configuring Smart Call Home (Single Command)

To enable all Call Home basic configurations using a single command, perform the following steps:

### SUMMARY STEPS

1. **configure terminal**
2. **call-home reporting** {**anonymous** | **contact-email-addr** *email-address*} [**http-proxy** {*ipv4-address* | *ipv6-address* | *name*} **port** *port-number*]

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> Router# <code>configure terminal</code>	Enters configuration mode.
Step 2	<b>call-home reporting</b> { <b>anonymous</b>   <b>contact-email-addr</b> <i>email-address</i> } [ <b>http-proxy</b> { <i>ipv4-address</i>   <i>ipv6-address</i>   <i>name</i> } <b>port</b> <i>port-number</i> ]	Enables the basic configurations for Call Home using a single command.



	Command or Action	Purpose
	<p><b>Example:</b></p> <pre>Router(config)# call-home reporting contact-email-addr email@company.com</pre>	<ul style="list-style-type: none"> <li>• <b>anonymous</b>—Enables Call-Home TAC profile to send only crash, inventory, and test messages and send the messages anonymously.</li> <li>• <b>contact-email-addr</b>—Enables Smart Call Home service full reporting capability and sends a full inventory message from Call-Home TAC profile to Smart Call Home server to start full registration process.</li> <li>• <b>http-proxy</b> {<i>ipv4-address</i>   <i>ipv6-address</i>   <i>name</i>}—Configures an ipv4 or ipv6 address or server name. Maximum length is 64 characters.</li> <li>• <b>port</b> <i>port-number</i>—Port number. Range is 1 to 65535.</li> </ul> <p><b>Note</b> The HTTP proxy option allows you to make use of your own proxy server to buffer and secure Internet connections from your devices.</p> <p><b>Note</b> After successfully enabling Call Home either in anonymous or full registration mode using the <b>call-home reporting</b> command, an inventory message is sent out. If Call Home is enabled in full registration mode, a Full Inventory message for full registration mode is sent out. If Call Home is enabled in anonymous mode, an anonymous inventory message is sent out. For more information about what is sent in these messages, see <a href="#">Alert Group Trigger Events and Commands, on page 282</a>.</p>

## Configuring and Enabling Smart Call Home

For application and configuration information about the Cisco Smart Call Home service, see the “Getting Started” section of the Smart Call Home User Guide at <https://supportforums.cisco.com/community/4816/smart-call-home>. This document includes configuration examples for sending Smart Call Home messages directly from your device or through a transport gateway (TG) aggregation point.



**Note** For security reasons, we recommend that you use the HTTPS transport options, due to the additional payload encryption that HTTPS offers. The Transport Gateway software is downloadable from Cisco.com and is available if you require an aggregation point or a proxy for connection to the Internet.

## Enabling and Disabling Call Home

To enable or disable the Call Home feature, perform the following steps:

## SUMMARY STEPS

1. **configure terminal**
2. **service call-home**
3. **no service call-home**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
<b>Step 2</b>	<b>service call-home</b> <b>Example:</b> Router(config)# service call-home	Enables the Call Home feature.
<b>Step 3</b>	<b>no service call-home</b> <b>Example:</b> Router(config)# no service call-home	Disables the Call Home feature.

## Configuring Contact Information

Each router must include a contact e-mail address (except if Call Home is enabled in anonymous mode). You can optionally include a phone number, street address, contract ID, customer ID, and site ID.

To assign the contact information, perform the following steps:

## SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **contact-email-addr** *email-address*
4. **phone-number** *+phone-number*
5. **street-address** *street-address*
6. **customer-id** *text*
7. **site-id** *text*
8. **contract-id** *text*

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.

	Command or Action	Purpose
<b>Step 2</b>	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters the Call Home configuration submenu.
<b>Step 3</b>	<b>contact-email-addr</b> <i>email-address</i> <b>Example:</b> Router(cfg-call-home)# contact-email-addr username@example.com	Designates your e-mail address. Enter up to 200 characters in e-mail address format with no spaces.
<b>Step 4</b>	<b>phone-number</b> <i>+phone-number</i> <b>Example:</b> Router(cfg-call-home)# phone-number +1-800-555-4567	(Optional) Assigns your phone number. <b>Note</b> The number must begin with a plus (+) prefix and may contain only dashes (-) and numbers. Enter up to 17 characters. If you include spaces, you must enclose your entry in quotes ("").
<b>Step 5</b>	<b>street-address</b> <i>street-address</i> <b>Example:</b> Router(cfg-call-home)# street-address "1234 Picaboo Street, Any city, Any state, 12345"	(Optional) Assigns your street address where RMA equipment can be shipped. Enter up to 200 characters. If you include spaces, you must enclose your entry in quotes ("").
<b>Step 6</b>	<b>customer-id</b> <i>text</i> <b>Example:</b> Router(cfg-call-home)# customer-id Customer1234	(Optional) Identifies customer ID. Enter up to 64 characters. If you include spaces, you must enclose your entry in quotes ("").
<b>Step 7</b>	<b>site-id</b> <i>text</i> <b>Example:</b> Router(cfg-call-home)# site-id Site1ManhattanNY	(Optional) Identifies customer site ID. Enter up to 200 characters. If you include spaces, you must enclose your entry in quotes ("").
<b>Step 8</b>	<b>contract-id</b> <i>text</i> <b>Example:</b> Router(cfg-call-home)# contract-id Company1234	(Optional) Identifies your contract ID for the router. Enter up to 64 characters. If you include spaces, you must enclose your entry in quotes ("").

### Example

The following example shows how to configure contact information:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# call-home
Router(cfg-call-home)# contact-email-addr username@example.com
Router(cfg-call-home)# phone-number +1-800-555-4567
Router(cfg-call-home)# street-address "1234 Picaboo Street, Any city, Any state, 12345"
Router(cfg-call-home)# customer-id Customer1234
Router(cfg-call-home)# site-id Site1ManhattanNY
Router(cfg-call-home)# contract-id Company1234
Router(cfg-call-home)# exit
```

## Configuring Destination Profiles

A destination profile contains the required delivery information for an alert notification. At least one destination profile is required. You can configure multiple destination profiles of one or more types.

You can create and define a new destination profile or copy and use the predefined destination profile. If you define a new destination profile, you must assign a profile name.



---

**Note** If you use the Cisco Smart Call Home service, the destination profile must use the XML message format.

---

You can configure the following attributes for a destination profile:

- Profile name—String that uniquely identifies each user-defined destination profile. The profile name is limited to 31 characters and is not case-sensitive.



---

**Note** You cannot use **all** as a profile name.

---

- Transport method—Transport mechanism, either e-mail or HTTP (including HTTPS), for delivery of alerts.
  - For user-defined destination profiles, e-mail is the default, and you can enable either or both transport mechanisms. If you disable both methods, e-mail is enabled.
  - For the predefined Cisco TAC profile, you can enable either transport mechanism, but not both.
- Destination address—The actual address related to the transport method to which the alert should be sent.
- Message formatting—The message format used for sending the alert. The format options for a user-defined destination profile are long-text, short-text, or XML. The default is XML. For the predefined Cisco TAC profile, only XML is allowed.
- Message size—The maximum destination message size. The valid range is 50 to 3,145,728 Bytes. The default is 3,145,728 Bytes.

Anonymous reporting—You can choose for your customer identity to remain anonymous, and no identifying information is sent.
- Subscribing to interesting alert-groups—You can choose to subscribe to alert-groups highlighting your interests.

This section contains the following subsections:

- [Creating a New Destination Profile, on page 250](#)
- [Copying a Destination Profile, on page 252](#)
- [Setting Profiles to Anonymous Mode, on page 252](#)

### Creating a New Destination Profile

To create and configure a new destination profile, perform the following steps:

## SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **profile** *name*
4. **[no] destination transport-method** {**email** | **http**}
5. **destination address** {**email** *email-address* | **http** *url*}
6. **destination preferred-msg-format** {**long-text** | **short-text** | **xml**}
7. **destination message-size-limit** *bytes*
8. **active**
9. **end**
10. **show call-home profile** {*name* | **all**}

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
Step 2	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters the Call Home configuration submenu.
Step 3	<b>profile</b> <i>name</i> <b>Example:</b> Router(config-call-home)# profile profile1	Enters the Call Home destination profile configuration submenu for the specified destination profile. If the specified destination profile does not exist, it is created.
Step 4	<b>[no] destination transport-method</b> { <b>email</b>   <b>http</b> }	(Optional) Enables the message transport method. The <b>no</b> option disables the method.
Step 5	<b>destination address</b> { <b>email</b> <i>email-address</i>   <b>http</b> <i>url</i> }	Configures the destination e-mail address or URL to which Call Home messages are sent. <b>Note</b> When entering a destination URL, include either <b>http://</b> or <b>https://</b> , depending on whether the server is a secure server.
Step 6	<b>destination preferred-msg-format</b> { <b>long-text</b>   <b>short-text</b>   <b>xml</b> }	(Optional) Configures a preferred message format. The default is XML.
Step 7	<b>destination message-size-limit</b> <i>bytes</i> <b>Example:</b>	(Optional) Configures a maximum destination message size for the destination profile.

	Command or Action	Purpose
	<code>Router(cfg-call-home-profile)# destination message-size-limit 3145728</code>	
<b>Step 8</b>	<b>active</b> <b>Example:</b> <code>Router(cfg-call-home-profile)# active</code>	Enables the destination profile. By default, the profile is enabled when it is created.
<b>Step 9</b>	<b>end</b> <b>Example:</b> <code>Router(cfg-call-home-profile)# end</code>	Returns to privileged EXEC mode.
<b>Step 10</b>	<b>show call-home profile {name   all}</b> <b>Example:</b> <code>Router# show call-home profile profile1</code>	Displays the destination profile configuration for the specified profile or all configured profiles.

## Copying a Destination Profile

To create a new destination profile by copying an existing profile, perform the following steps:

### SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **copy profile source-profile target-profile**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> <code>Router# configure terminal</code>	Enters configuration mode.
<b>Step 2</b>	<b>call-home</b> <b>Example:</b> <code>Router(config)# call-home</code>	Enters the Call Home configuration submode.
<b>Step 3</b>	<b>copy profile source-profile target-profile</b> <b>Example:</b> <code>Router(cfg-call-home)# copy profile profile1 profile2</code>	Creates a new destination profile with the same configuration settings as the existing destination profile.

## Setting Profiles to Anonymous Mode

To set an anonymous profile, perform the following steps:

**SUMMARY STEPS**

1. **configure terminal**
2. **call-home**
3. **profile *name***
4. **anonymous-reporting-only**

**DETAILED STEPS**

	<b>Command or Action</b>	<b>Purpose</b>
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
<b>Step 2</b>	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters the Call Home configuration submode.
<b>Step 3</b>	<b>profile <i>name</i></b> <b>Example:</b> Router(cfg-call-home) profile Profile-1	Enables the profile configuration mode.
<b>Step 4</b>	<b>anonymous-reporting-only</b> <b>Example:</b> Router(cfg-call-home-profile)# anonymous-reporting-only	Sets the profile to anonymous mode.  <b>Note</b> By default, Call Home sends a full report of all types of events subscribed in the profile. When <b>anonymous-reporting-only</b> is set, only crash, inventory, and test messages will be sent.

## Subscribing to Alert Groups

An alert group is a predefined subset of Call Home alerts supported in all routers. Different types of Call Home alerts are grouped into different alert groups depending on their type. The following alert groups are available:

- Crash
- Configuration
- Environment
- Inventory
- Snapshot
- Syslog

This section contains the following subsections:

- [Periodic Notification, on page 256](#)

- [Message Severity Threshold, on page 257](#)
- [Configuring a Snapshot Command List, on page 257](#)

The triggering events for each alert group are listed in [Alert Group Trigger Events and Commands, on page 282](#), and the contents of the alert group messages are listed in [Message Contents, on page 289](#).

You can select one or more alert groups to be received by a destination profile.



**Note** A Call Home alert is only sent to destination profiles that have subscribed to the alert group containing that Call Home alert. In addition, the alert group must be enabled.

To subscribe a destination profile to one or more alert groups, perform the following steps:

## SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **alert-group** {all | configuration | environment | inventory | syslog | crash | snapshot}
4. **profile** *name*
5. **subscribe-to-alert-group all**
6. **subscribe-to-alert-group configuration** [periodic {daily *hh:mm* | monthly *date hh:mm* | weekly *day hh:mm*}]
7. **subscribe-to-alert-group environment** [severity {catastrophic | disaster | fatal | critical | major | minor | warning | notification | normal | debugging}]
8. **subscribe-to-alert-group inventory** [periodic {daily *hh:mm* | monthly *date hh:mm* | weekly *day hh:mm*}]
9. **subscribe-to-alert-group syslog** [severity {catastrophic | disaster | fatal | critical | major | minor | warning | notification | normal | debugging}]
10. **subscribe-to-alert-group crash**
11. **subscribe-to-alert-group snapshot periodic** {daily *hh:mm* | hourly *mm* | interval *mm* | monthly *date hh:mm* | weekly *day hh:mm*}
12. **exit**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
<b>Step 2</b>	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters Call Home configuration submode.



	Command or Action	Purpose
<b>Step 3</b>	<b>alert-group</b> { <b>all</b>   <b>configuration</b>   <b>environment</b>   <b>inventory</b>   <b>syslog</b>   <b>crash</b>   <b>snapshot</b> }  <b>Example:</b> <pre>Router(cfg-call-home)# alert-group all</pre>	Enables the specified alert group. Use the keyword <b>all</b> to enable all alert groups. By default, all alert groups are enabled.
<b>Step 4</b>	<b>profile</b> <i>name</i>  <b>Example:</b> <pre>Router(cfg-call-home)# profile profile1</pre>	Enters the Call Home destination profile configuration submode for the specified destination profile.
<b>Step 5</b>	<b>subscribe-to-alert-group all</b>  <b>Example:</b> <pre>Router(cfg-call-home-profile)# subscribe-to-alert-group all</pre>	<p>Subscribes to all available alert groups using the lowest severity.</p> <p>You can subscribe to alert groups individually by specific type, as described in Step 6 through Step 11.</p> <p><b>Note</b> This command subscribes to the syslog debug default severity. This causes a large number of syslog messages to generate. You should subscribe to alert groups individually, using appropriate severity levels and patterns when possible.</p>
<b>Step 6</b>	<b>subscribe-to-alert-group configuration</b> [ <b>periodic</b> { <b>daily</b> <i>hh:mm</i>   <b>monthly</b> <i>date hh:mm</i>   <b>weekly</b> <i>day hh:mm</i> }]  <b>Example:</b> <pre>Router(cfg-call-home-profile)# subscribe-to-alert-group configuration periodic daily 12:00</pre>	Subscribes this destination profile to the Configuration alert group. The Configuration alert group can be configured for periodic notification, as described in <a href="#">Periodic Notification, on page 256</a> .
<b>Step 7</b>	<b>subscribe-to-alert-group environment</b> [ <b>severity</b> { <b>catastrophic</b>   <b>disaster</b>   <b>fatal</b>   <b>critical</b>   <b>major</b>   <b>minor</b>   <b>warning</b>   <b>notification</b>   <b>normal</b>   <b>debugging</b> }]  <b>Example:</b> <pre>Router(cfg-call-home-profile)# subscribe-to-alert-group environment severity major</pre>	Subscribes this destination profile to the Environment alert group. The Environment alert group can be configured to filter messages based on severity, as described in <a href="#">Message Severity Threshold, on page 257</a> .
<b>Step 8</b>	<b>subscribe-to-alert-group inventory</b> [ <b>periodic</b> { <b>daily</b> <i>hh:mm</i>   <b>monthly</b> <i>date hh:mm</i>   <b>weekly</b> <i>day hh:mm</i> }]  <b>Example:</b> <pre>Router(cfg-call-home-profile)# subscribe-to-alert-group inventory periodic monthly 1 12:00</pre>	Subscribes this destination profile to the Inventory alert group. The Inventory alert group can be configured for periodic notification, as described in <a href="#">Periodic Notification, on page 256</a> .
<b>Step 9</b>	<b>subscribe-to-alert-group syslog</b> [ <b>severity</b> { <b>catastrophic</b>   <b>disaster</b>   <b>fatal</b>   <b>critical</b>   <b>major</b>   <b>minor</b>   <b>warning</b>   <b>notification</b>   <b>normal</b>   <b>debugging</b> }]  <b>Example:</b> <pre>Router(cfg-call-home-profile)# subscribe-to-alert-group syslog severity major</pre>	Subscribes this destination profile to the Syslog alert group. The Syslog alert group can be configured to filter messages

	Command or Action	Purpose
	<p>  <b>minor</b>   <b>warning</b>   <b>notification</b>   <b>normal</b>   <b>debugging</b>}]</p> <p><b>Example:</b></p> <pre>Router(cfg-call-home-profile)# subscribe-to-alert-group environment severity major</pre>	<p>based on severity, as described in <a href="#">Message Severity Threshold, on page 257</a>.</p> <p>You can specify a text pattern to be matched within each syslog message. If you configure a pattern, a Syslog alert group message is sent only if it contains the specified pattern and meets the severity threshold. If the pattern contains spaces, you must enclose it in quotes (""). You can specify up to five patterns for each destination profile.</p>
<b>Step 10</b>	<p><b>subscribe-to-alert-group crash</b></p> <p><b>Example:</b></p> <pre>Router(cfg-call-home-profile)# [no   default] subscribe-to-alert-group crash</pre>	<p>Subscribes to the Crash alert group in user profile. By default, TAC profile subscribes to the Crash alert group and cannot be unsubscribed.</p>
<b>Step 11</b>	<p><b>subscribe-to-alert-group snapshot periodic {daily hh:mm   hourly mm   interval mm   monthly date hh:mm   weekly day hh:mm}</b></p> <p><b>Example:</b></p> <pre>Router(cfg-call-home-profile)# subscribe-to-alert-group snapshot periodic daily 12:00</pre>	<p>Subscribes this destination profile to the Snapshot alert group. The Snapshot alert group can be configured for periodic notification, as described in <a href="#">Periodic Notification, on page 256</a>.</p> <p>By default, the Snapshot alert group has no command to run. You can add commands into the alert group, as described in <a href="#">Configuring a Snapshot Command List, on page 257</a>. In doing so, the output of the commands added in the Snapshot alert group will be included in the snapshot message.</p>
<b>Step 12</b>	<p><b>exit</b></p> <p><b>Example:</b></p> <pre>Router(cfg-call-home-profile)# exit</pre>	<p>Exits the Call Home destination profile configuration submode.</p>

## Periodic Notification

When you subscribe a destination profile to the Configuration, Inventory, or Snapshot alert group, you can choose to receive the alert group messages asynchronously or periodically at a specified time. The sending period can be one of the following:

- Daily—Specifies the time of day to send, using an hour:minute format *hh:mm*, with a 24-hour clock (for example, 14:30).
- Weekly—Specifies the day of the week and time of day in the format *day hh:mm*, where the day of the week is spelled out (for example, Monday).
- Monthly—Specifies the numeric date, from 1 to 31, and the time of day, in the format *date hh:mm*.
- Interval—Specifies the interval at which the periodic message is sent, from 1 to 60 minutes.
- Hourly—Specifies the minute of the hour at which the periodic message is sent, from 0 to 59 minutes.



**Note** Hourly and by interval periodic notifications are available for the Snapshot alert group only.

## Message Severity Threshold

When you subscribe a destination profile to the Environment or Syslog alert group, you can set a threshold for the sending of alert group messages based on the level of severity of the message. Any message with a value lower than the destination profile specified threshold is not sent to the destination.

The severity threshold is configured using the keywords listed in the following table. The severity threshold ranges from catastrophic (level 9, highest level of urgency) to debugging (level 0, lowest level of urgency). If no severity threshold is configured for the Syslog or Environment alert groups, the default is debugging (level 0). The Configuration and Inventory alert groups do not allow severity configuration; severity is always set as normal.



**Note** Call Home severity levels are not the same as system message logging severity levels.

**Table 29: Severity and Syslog Level Mapping**

Level	Keyword	Syslog Level	Description
9	catastrophic	—	Network-wide catastrophic failure.
8	disaster	—	Significant network impact.
7	fatal	Emergency (0)	System is unusable.
6	critical	Alert (1)	Critical conditions, immediate attention needed.
5	major	Critical (2)	Major conditions.
4	minor	Error (3)	Minor conditions.
3	warning	Warning (4)	Warning conditions.
2	notification	Notice (5)	Basic notification and informational messages. Possibly independently insignificant.
1	normal	Information (6)	Normal event signifying return to normal state.
0	debugging	Debug (7)	Debugging messages.

## Configuring a Snapshot Command List

To configure a snapshot command list, perform the following steps:

### SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **[no | default] alert-group-config snapshot**
4. **[no | default] add-command *command string***

## 5. exit

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
Step 2	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters Call Home configuration submode.
Step 3	<b>[no   default] alert-group-config snapshot</b> <b>Example:</b> Router(cfg-call-home)# alert-group-config snapshot	Enters snapshot configuration mode. The <b>no</b> or <b>default</b> command will remove all snapshot command.
Step 4	<b>[no   default] add-command <i>command string</i></b> <b>Example:</b> Router(cfg-call-home-snapshot)# add-command "show version"	Adds the command to the Snapshot alert group. The <b>no</b> or <b>default</b> command removes the corresponding command. <ul style="list-style-type: none"><li><i>command string</i>—IOS command. Maximum length is 128.</li></ul>
Step 5	<b>exit</b> <b>Example:</b> Router(cfg-call-home-snapshot)# exit	Exits and saves the configuration.

## Configuring General E-Mail Options

To use the e-mail message transport, you must configure at least one Simple Mail Transfer Protocol (SMTP) e-mail server address. You can configure the from and reply-to e-mail addresses, and you can specify up to four backup e-mail servers.

Note the following guidelines when configuring general e-mail options:

- Backup e-mail servers can be defined by repeating the **mail-server** command using different priority numbers.
- The **mail-server priority** number parameter can be configured from 1 to 100. The server with the highest priority (lowest priority number) is tried first.

To configure general e-mail options, perform the following steps:

## SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **mail-server** [*ipv4-address* | *ipv6-address*] [*name*] **priority** *number*
4. **sender from** *email-address*

5. **sender reply-to** *email-address*
6. **source-interface** *interface-name*
7. **vrf** *vrf-name*

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
Step 2	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters Call Home configuration submenu.
Step 3	<b>mail-server</b> [ <i>ipv4-address</i>   <i>ipv6-address</i> ]   <i>name</i> <b>priority</b> <i>number</i> <b>Example:</b> Router(cfg-call-home)# mail-server stmp.example.com priority 1	Assigns an e-mail server address and its relative priority among configured e-mail servers.  Provide either of these: <ul style="list-style-type: none"> <li>• The e-mail server's IP address.</li> <li>• The e-mail server's fully qualified domain name (FQDN) of 64 characters or less.</li> </ul> Assign a priority number between 1 (highest priority) and 100 (lowest priority).
Step 4	<b>sender from</b> <i>email-address</i> <b>Example:</b> Router(cfg-call-home)# sender from username@example.com	(Optional) Assigns the e-mail address that appears in the from field in Call Home e-mail messages. If no address is specified, the contact e-mail address is used.
Step 5	<b>sender reply-to</b> <i>email-address</i> <b>Example:</b> Router(cfg-call-home)# sender reply-to username@example.com	(Optional) Assigns the e-mail address that appears in the reply-to field in Call Home e-mail messages.
Step 6	<b>source-interface</b> <i>interface-name</i> <b>Example:</b> Router(cfg-call-home)# source-interface loopback1	Assigns the source interface name to send call-home messages. <ul style="list-style-type: none"> <li>• <i>interface-name</i>—Source interface name. Maximum length is 64.</li> </ul> <b>Note</b> For HTTP messages, use the <b>ip http client source-interface</b> <i>interface-name</i> command in global configuration mode to configure the source interface name. This allows all HTTP clients on the device to use the same source interface.

	Command or Action	Purpose
<b>Step 7</b>	<b>vrf</b> <i>vrf-name</i> <b>Example:</b> Router(cfg-call-home)# vrf vpn1	(Optional) Specifies the VRF instance to send call-home e-mail messages. If no vrf is specified, the global routing table is used.  <b>Note</b> For HTTP messages, if the source interface is associated with a VRF, use the <b>ip http client source-interface</b> <i>interface-name</i> command in global configuration mode to specify the VRF instance that will be used for all HTTP clients on the device.

### Example

The following example shows the configuration of general e-mail parameters, including a primary and secondary e-mail server:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# call-home
Router(cfg-call-home)# mail-server smtp.example.com priority 1
Router(cfg-call-home)# mail-server 192.0.2.1 priority 2
Router(cfg-call-home)# sender from username@example.com
Router(cfg-call-home)# sender reply-to username@example.com
Router(cfg-call-home)# source-interface loopback1
Router(cfg-call-home)# vrf vpn1
Router(cfg-call-home)# exit
Router(config)#
```

## Specifying Rate Limit for Sending Call Home Messages

To specify the rate limit for sending Call Home messages, perform the following steps:

### SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **rate-limit** *number*

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
<b>Step 2</b>	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters Call Home configuration submode.

	Command or Action	Purpose
Step 3	<b>rate-limit</b> <i>number</i> <b>Example:</b> Router(cfg-call-home)# rate-limit 40	Specifies a limit on the number of messages sent per minute. <ul style="list-style-type: none"> <li>• <i>number</i>—Range is 1 to 60. The default is 20.</li> </ul>

## Specifying HTTP Proxy Server

To specify an HTTP proxy server for sending Call Home HTTP(S) messages to a destination, perform the following steps:

### SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **http-proxy** {*ipv4-address* | *ipv6-address* | *name*} **port** *port-number*

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
Step 2	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters Call Home configuration submenu.
Step 3	<b>http-proxy</b> { <i>ipv4-address</i>   <i>ipv6-address</i>   <i>name</i> } <b>port</b> <i>port-number</i> <b>Example:</b> Router(cfg-call-home)# http-proxy 192.0.2.1 port 1	Specifies the proxy server for the HTTP request.

## Enabling AAA Authorization to Run IOS Commands for Call Home Messages

To specify an HTTP proxy server for sending Call Home HTTP(S) messages to a destination, perform the following steps:

### SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **aaa-authorization**
4. **aaa-authorization** [*username username*]

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
<b>Step 2</b>	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters Call Home configuration submode.
<b>Step 3</b>	<b>aaa-authorization</b> <b>Example:</b> Router(cfg-call-home)# aaa-authorization	Enables AAA authorization. <b>Note</b> By default, AAA authorization is disabled for Call Home.
<b>Step 4</b>	<b>aaa-authorization [username username]</b> <b>Example:</b> Router(cfg-call-home)# aaa-authorization username user	Specifies the username for authorization. <ul style="list-style-type: none"><li>• <b>username username</b>—Default username is callhome. Maximum length is 64.</li></ul>

## Configuring Syslog Throttling

To specify an HTTP proxy server for sending Call Home HTTP(S) messages to a destination, perform the following steps:

## SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **[no] syslog-throttling**

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
<b>Step 2</b>	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters Call Home configuration submode.
<b>Step 3</b>	<b>[no] syslog-throttling</b> <b>Example:</b> Router(cfg-call-home)# syslog-throttling	Enables or disables call-home syslog message throttling and avoids sending repetitive call-home syslog messages. <b>Note</b> By default, syslog message throttling is enabled.



## Configuring Call Home Data Privacy

The data-privacy command scrubs data, such as IP addresses, from running configuration files to protect the privacy of customers. Enabling the data-privacy command can affect CPU utilization when scrubbing a large amount of data. Currently, the **show** command output is not being scrubbed except for configuration messages in the outputs for the **show running-config all** and the **show startup-config data** commands.

### SUMMARY STEPS

1. **configure terminal**
2. **call-home**
3. **data-privacy {level {normal | high} | hostname}**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters configuration mode.
Step 2	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters Call Home configuration submenu.
Step 3	<b>data-privacy {level {normal   high}   hostname}</b> <b>Example:</b> Router(cfg-call-home)# data-privacy level high	Scrubs data from running configuration file to protect the privacy of the user. The default data-privacy level is normal. <b>Note</b> Enabling the data-privacy command can affect CPU utilization when scrubbing a large amount of data. <ul style="list-style-type: none"> <li>• <b>normal</b>—Scrubs all normal-level commands.</li> <li>• <b>high</b>—Scrubs all normal-level commands plus the IP domain name and IP address commands.</li> <li>• <b>hostname</b>—Scrubs all high-level commands plus the hostname command.</li> </ul> <b>Note</b> Scrubbing the hostname from configuration messages can cause Smart Call Home processing failure on some platforms.

## Sending Call Home Communications Manually

You can manually send several types of Call Home communications. To send Call Home communications, perform the tasks in this section. This section contains the following subsections:

- [Sending a Call Home Test Message Manually, on page 264](#)
- [Sending Call Home Alert Group Messages Manually, on page 264](#)

- [Submitting Call Home Analysis and Report Requests, on page 265](#)
- [Manually Sending Command Output Message for One Command or a Command List, on page 266](#)

## Sending a Call Home Test Message Manually

You can use the **call-home test** command to send a user-defined Call Home test message.

To manually send a Call Home test message, perform the following step:

### SUMMARY STEPS

1. **call-home test** [*“test-message”*] **profile name**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>call-home test</b> [ <i>“test-message”</i> ] <b>profile name</b> <b>Example:</b> Router# call-home test profile profile1	Sends a test message to the specified destination profile. The user-defined test message text is optional but must be enclosed in quotes (“”) if it contains spaces. If no user-defined message is configured, a default message is sent.

## Sending Call Home Alert Group Messages Manually

You can use the **call-home send** command to manually send a specific alert group message.

Note the following guidelines when manually sending a Call Home alert group message:

- Only the crash, snapshot, configuration, and inventory alert groups can be sent manually.
- When you manually trigger a crash, snapshot, configuration, or inventory alert group message and you specify a destination profile name, a message is sent to the destination profile regardless of the profile’s active status, subscription status, or severity setting.
- When you manually trigger a crash, snapshot, configuration, or inventory alert group message and do not specify a destination profile name, a message is sent to all active profiles that have either a normal or periodic subscription to the specified alert group.

To manually trigger Call Home alert group messages, perform the following steps:

### SUMMARY STEPS

1. **call-home send alert-group snapshot** [**profile name**]
2. **call-home send alert-group crash** [**profile name**]
3. **call-home send alert-group configuration** [**profile name**]
4. **call-home send alert-group inventory** [**profile name**]

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>call-home send alert-group snapshot [profile name]</b> <b>Example:</b> <pre>Router# call-home send alert-group snapshot profile profile1</pre>	Sends a snapshot alert group message to one destination profile if specified, or to all subscribed destination profiles.
Step 2	<b>call-home send alert-group crash [profile name]</b> <b>Example:</b> <pre>Router# call-home send alert-group crash profile profile1</pre>	Sends a crash alert group message to one destination profile if specified, or to all subscribed destination profiles.
Step 3	<b>call-home send alert-group configuration [profile name]</b> <b>Example:</b> <pre>Router# call-home send alert-group configuration profile profile1</pre>	Sends a configuration alert group message to one destination profile if specified, or to all subscribed destination profiles.
Step 4	<b>call-home send alert-group inventory [profile name]</b> <b>Example:</b> <pre>Router# call-home send alert-group inventory profile profile1</pre>	Sends an inventory alert group message to one destination profile if specified, or to all subscribed destination profiles.

## Submitting Call Home Analysis and Report Requests

You can use the **call-home request** command to submit information about your system to Cisco to receive helpful analysis and report information specific to your system. You can request a variety of reports, including security alerts, known bugs, best practices, and command references.

Note the following guidelines when manually sending Call Home analysis and report requests:

- If a **profile name** is specified, the request is sent to the profile. If no profile is specified, the request is sent to the Cisco TAC profile. The recipient profile does not need to be enabled for the call-home request. The profile should specify the e-mail address where the transport gateway is configured so that the request message can be forwarded to the Cisco TAC and the user can receive the reply from the Smart Call Home service.
- The **ccoid user-id** is the registered identifier of the Smart Call Home user. If the **user-id** is specified, the response is sent to the e-mail address of the registered user. If no **user-id** is specified, the response is sent to the contact e-mail address of the device.
- Based on the keyword specifying the type of report requested, the following information is returned:
  - **config-sanity**—Information on best practices as related to the current running configuration.
  - **bugs-list**—Known bugs in the running version and in the currently applied features.
  - **command-reference**—Reference links to all commands in the running configuration.
  - **product-advisory**—Product Security Incident Response Team (PSIRT) notices, End of Life (EOL) or End of Sales (EOS) notices, or field notices (FN) that may affect the devices in your network.

To submit a request for analysis and report information from the Cisco Output Interpreter tool, perform the following steps:

## SUMMARY STEPS

1. **call-home request output-analysis** *“show-command”* [**profile name**] [**ccoid user-id**]
2. **call-home request** {**config-sanity** | **bugs-list** | **command-reference** | **product-advisory**} [**profile name**] [**ccoid user-id**]

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>call-home request output-analysis</b> <i>“show-command”</i> [ <b>profile name</b> ] [ <b>ccoid user-id</b> ]  <b>Example:</b> Router# call-home request output-analysis “show diag” profile TG	Sends the output of the specified show command for analysis. The show command must be contained in quotes (“”).
<b>Step 2</b>	<b>call-home request</b> { <b>config-sanity</b>   <b>bugs-list</b>   <b>command-reference</b>   <b>product-advisory</b> } [ <b>profile name</b> ] [ <b>ccoid user-id</b> ]  <b>Example:</b> Router# call-home request config-sanity profile TG	Sends the output of a predetermined set of commands such as the <b>show running-config all</b> , <b>show version</b> or <b>show module</b> commands, for analysis. In addition, the <b>call home request product-advisory</b> sub-command includes all inventory alert group commands. The keyword specified after <b>request</b> specifies the type of report requested.

### Example

The following example shows a request for analysis of a user-specified **show** command:

```
Router# call-home request output-analysis "show diag" profile TG
```

## Manually Sending Command Output Message for One Command or a Command List

You can use the **call-home send** command to execute an IOS command or a list of IOS commands and send the command output through HTTP or e-mail protocol.

Note the following guidelines when sending the output of a command:

- The specified IOS command or list of IOS commands can be any run command, including commands for all modules. The command must be contained in quotes (“”).
- If the e-mail option is selected using the “email” keyword and an e-mail address is specified, the command output is sent to that address. If neither the e-mail nor the HTTP option is specified, the output is sent in long-text format with the specified service request number to the Cisco TAC (attach@cisco.com).
- If neither the “email” nor the “http” keyword is specified, the service request number is required for both long-text and XML message formats and is provided in the subject line of the e-mail.
- If the HTTP option is specified, the CiscoTac-1 profile destination HTTP or HTTPS URL is used as the destination. The destination e-mail address can be specified so that Smart Call Home can forward the

message to the e-mail address. The user must specify either the destination e-mail address or an SR number but they can also specify both.

To execute a command and send the command output, perform the following step:

## SUMMARY STEPS

1. **call-home send** *{cli command | cli list}* [**email** *email* **msg-format** *{long-text | xml}*] | **http** *{destination-email-address email}*] [**tac-service-request** *SR#*]

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<p><b>call-home send</b> <i>{cli command   cli list}</i> [<b>email</b> <i>email</i> <b>msg-format</b> <i>{long-text   xml}</i>]   <b>http</b> <i>{destination-email-address email}</i>] [<b>tac-service-request</b> <i>SR#</i>]</p> <p><b>Example:</b></p> <pre>Router# call-home send "show version;show running-config;show inventory" email support@example.com msg-format xml</pre>	<p>Executes the CLI or CLI list and sends output via e-mail or HTTP.</p> <ul style="list-style-type: none"> <li>• <i>{cli command   cli list}</i>—Specifies the IOS command or list of IOS commands (separated by ‘;’). It can be any run command, including commands for all modules. The commands must be contained in quotes (“”).</li> <li>• <b>email</b> <i>email</i> <b>msg-format</b> <i>{long-text   xml}</i>—If the <b>email</b> option is selected, the command output will be sent to the specified e-mail address in long-text or XML format with the service request number in the subject. The e-mail address, the service request number, or both must be specified. The service request number is required if the e-mail address is not specified (default is <code>attach@cisco.com</code> for long-text format and <code>callhome@cisco.com</code> for XML format).</li> <li>• <b>http</b> <i>{destination-email-address email}</i>—If the <b>http</b> option is selected, the command output will be sent to Smart Call Home backend server (URL specified in TAC profile) in XML format.</li> </ul> <p><b>destination-email-address</b> <i>email</i> can be specified so that the backend server can forward the message to the e-mail address. The e-mail address, the service request number, or both must be specified.</p> <ul style="list-style-type: none"> <li>• <b>tac-service-request</b> <i>SR#</i>—Specifies the service request number. The service request number is required if the e-mail address is not specified.</li> </ul>

### Example

The following example shows how to send the output of a command to a user-specified e-mail address:

```
Router# call-home send "show diag" email support@example.com
```

The following example shows the command output sent in long-text format to `attach@cisco.com`, with the SR number specified:

```
Router# call-home send "show version; show run" tac-service-request 123456
```

The following example shows the command output sent in XML message format to `callhome@cisco.com`:

```
Router# call-home send "show version; show run" email callhome@cisco.com msg-format xml
```

The following example shows the command output sent in XML message format to the Cisco TAC backend server, with the SR number specified:

```
Router# call-home send "show version; show run" http tac-service-request 123456
```

The following example shows the command output sent to the Cisco TAC backend server through the HTTP protocol and forwarded to a user-specified email address:

```
Router# call-home send "show version; show run" http destination-email-address user@company.com
```

## Configuring Diagnostic Signatures

The Diagnostic Signatures feature downloads digitally signed signatures to devices. Diagnostic Signatures (DS) files are formatted files that collate knowledge of diagnostic events and provide methods to troubleshoot them without a need to upgrade the Cisco software. The aim of DS is to deliver flexible intelligence that can detect and collect troubleshooting information that can be used to resolve known problems in customers networks.

### Information About Diagnostic Signatures

- [Diagnostic Signatures Overview](#), on page 269
- [Prerequisites for Diagnostic Signatures](#), on page 269
- [Downloading Diagnostic Signatures](#), on page 270
- [Diagnostic Signature Workflow](#), on page 270
- [Diagnostic Signature Events and Actions](#), on page 270
- [Diagnostic Signature Event Detection](#), on page 271
- [Diagnostic Signature Actions](#), on page 271
- [Diagnostic Signature Variables](#), on page 272

## Diagnostic Signatures Overview

Diagnostic signatures (DS) for the Call Home system provides a flexible framework that allows the defining of new events and corresponding CLIs that can analyze these events without upgrading the Cisco software.

DSs provide the ability to define more types of events and trigger types than the standard Call Home feature supports. The DS subsystem downloads and processes files on a device as well as handles callbacks for diagnostic signature events.

The Diagnostic Signature feature downloads digitally signed signatures that are in the form of files to devices. DS files are formatted files that collate the knowledge of diagnostic events and provide methods to troubleshoot these events.

DS files contain XML data to specify the event description, and these files include CLI commands or scripts to perform required actions. These files are digitally signed by Cisco or a third party to certify their integrity, reliability, and security.

The structure of a DS file can be one of the following formats:

- Metadata-based simple signature that specifies the event type and contains other information that can be used to match the event and perform actions such as collecting information by using the CLI. The signature can also change configurations on the device as a workaround for certain bugs.
- Embedded Event Manager (EEM) Tool Command Language (Tcl) script-based signature that specifies new events in the event register line and additional action in the Tcl script.
- Combination of both the formats above.

The following basic information is contained in a DS file:

- **ID (unique number)**—Unique key that represents a DS file that can be used to search a DS.
- **Name (ShortDescription)**—Unique description of the DS file that can be used in lists for selection.
- **Description**—Long description about the signature.
- **Revision**—Version number, which increments when the DS content is updated.
- **Event & Action**—Defines the event to be detected and the action to be performed after the event happens.

## Prerequisites for Diagnostic Signatures

Before you download and configure diagnostic signatures (DSs) on a device, you must ensure that the following conditions are met:

- You must assign one or more DSs to the device. For more information on how to assign DSs to devices, see [Downloading Diagnostic Signatures, on page 270](#).
- HTTP/Secure HTTP (HTTPS) transport is required for downloading DS files. You must install the certification authority (CA) certificate to enable the authentication of the destination HTTPS server.



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**Note** If you configure the trustpool feature, the CA certificate is not required.

---

## Downloading Diagnostic Signatures

To download the diagnostic signature (DS) file, you require the secure HTTP (HTTPS) protocol. If you have already configured an email transport method to download files on your device, you must change your assigned profile transport method to HTTPS to download and use DS.

Cisco software uses a PKI Trustpool Management feature, which is enabled by default on devices, to create a scheme to provision, store, and manage a pool of certificates from known certification authorities (CAs). The trustpool feature installs the CA certificate automatically. The CA certificate is required for the authentication of the destination HTTPS servers.

There are two types of DS update requests to download DS files: regular and forced-download. Regular download requests DS files that were recently updated. You can trigger a regular download request either by using a periodic configuration or by initiating an on-demand CLI. The regular download update happens only when the version of the requested DS is different from the version of the DS on the device. Periodic download is only started after there is any DS assigned to the device from DS web portal. After the assignment happens, the response to the periodic inventory message from the same device will include a field to notify device to start its periodic DS download/update. In a DS update request message, the status and revision number of the DS is included such that only a DS with the latest revision number is downloaded.

Forced-download downloads a specific DS or a set of DSes. You can trigger the forced-download update request only by initiating an on-demand CLI. In a force-download update request, the latest version of the DS file is downloaded irrespective of the current DS file version on the device.

The DS file is digitally signed, and signature verification is performed on every downloaded DS file to make sure it is from a trusted source.

## Diagnostic Signature Workflow

The diagnostic signature feature is enabled by default in Cisco software. The following is the workflow for using diagnostic signatures:

- Find the DS(es) you want to download and assign them to the device. This step is mandatory for regular periodic download, but not required for forced download.
- The device downloads all assigned DS(es) or a specific DS by regular periodic download or by on-demand forced download.
- The device verifies the digital signature of every single DS. If verification passes, the device stores the DS file into a non-removable disk, such as bootflash or hard disk, so that DS files can be read after the device is reloaded. On the router, the DS file is stored in the bootflash:/call home directory.
- The device continues sending periodic regular DS download requests to get the latest revision of DS and replace the older one in device.
- The device monitors the event and executes the actions defined in the DS when the event happens.

## Diagnostic Signature Events and Actions

The events and actions sections are the key areas used in diagnostic signatures. The event section defines all event attributes that are used for event detection. The action section lists all actions which should be performed after the event happens, such as collecting show command outputs and sending them to Smart Call Home to parse.



## Diagnostic Signature Event Detection

Event detection in a DS is defined in two ways: single event detection and multiple event detection.

### Single Event Detection

In single event detection, only one event detector is defined within a DS. The event specification format is one of the following two types:

- DS event specification type: syslog, periodic, configuration, Online Insertion Removal (OIR) immediate, and call home are the supported event types, where “immediate” indicates that this type of DS does not detect any events, its actions are performed once it is downloaded, and the call-home type modifies the current CLI commands defined for existing alert-group.
- The Embedded Event Manager (EEM) specification type: supports any new EEM event detector without having to modify the Cisco software.

Other than using EEM to detect events, a DS is triggered when a Tool Command Language (Tcl) script is used to specify event detection types.

### Multiple Event Detection

Multiple event detection involves defining two or more event detectors, two or more corresponding tracked object states, and a time period for the events to occur. The specification format for multiple event detection can include complex event correlation for tracked event detectors. For example, three event detectors (syslog, OIR, and IPSLA) are defined during the creation of a DS file. The correlation that is specified for these event detectors is that the DS will execute its action if both syslog and OIR events are triggered simultaneously, or if IPSLA is triggered alone.

## Diagnostic Signature Actions

The diagnostic signature (DS) file consists of various actions that must be initiated when an event occurs. The action type indicates the kind of action that will be initiated in response to a certain event.

Variables are elements within a DS that are used to customize the files.

DS actions are categorized into the following four types:

- call-home
- command
- emailto
- script

DS action types call-home and emailto collect event data and send a message to call-home servers or to the defined email addresses. The message uses “diagnostic-signature” as its message type and DS ID as the message sub-type.

The commands defined for the DS action type initiate CLI commands that can change configuration of the device, collect show command outputs, or run any EXEC command on the device. The DS action type script executes Tcl scripts.

## Diagnostic Signature Variables

Variables are referenced within a DS and are used to customize the DS file. All DS variable names have the prefix `ds_` to separate them from other variables. The following are the supported DS variable types:

- System variable: variables assigned automatically by the device without any configuration changes. The Diagnostic Signatures feature supports two system variables: `ds_hostname` and `ds_signature_id`.
- Environment variable: values assigned manually by using the **environment** *variable-name variable-value* command in call-home diagnostic-signature configuration mode. Use the **show call-home diagnostic-signature** command to display the name and value of all DS environment variables. If the DS file contains unresolved environment variables, this DS will stay in pending status until the variable gets resolved.
- Prompt variable: values assigned manually by using the **call-home diagnostic-signature install ds-id** command in privileged EXEC mode. If you do not set this value, the status of the DS indicates pending.
- Regular expression variable: values assigned from a regular expression pattern match with predefined CLI command outputs. The value is assigned during the DS run.
- Syslog event variable: values assigned during a syslog event detection in the DS file. This variable is valid only for syslog event detection.

## How to Configure Diagnostic Signatures

- [Configuring the Call Home Service for Diagnostic Signatures, on page 272](#)
- [Configuring Diagnostic Signatures, on page 274](#)

## Configuring the Call Home Service for Diagnostic Signatures

Configure the Call Home Service feature to set attributes such as the contact email address where notifications related with diagnostic signatures (DS) are sent and destination HTTP/secure HTTP (HTTPS) URL to download the DS files from.

You can also create a new user profile, configure correct attributes and assign it as the DS profile. For periodic downloads, the request is sent out just following full inventory message. By changing the inventory periodic configuration, the DS periodic download also gets rescheduled.



---

**Note** The predefined CiscoTAC-1 profile is enabled as a DS profile by default and we recommend that you use it. If used, you only need to change the destination transport-method to the **http** setting.

---

### SUMMARY STEPS

1. **configure terminal**
2. **service call-home**
3. **call-home**
4. **contact-email-addr** *email-address*
5. **mail-server** {*ipv4-addr* | *name*} **priority** *number*
6. **profile** *profile-name*

7. **destination transport-method** {email | http}
8. **destination address** {email address | http url}
9. **subscribe-to-alert-group inventory** [periodic {daily hh:mm | monthly day hh:mm | weekly day hh:mm}]
10. **exit**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 2	<b>service call-home</b> <b>Example:</b> Router(config)# service call-home	Enables Call Home service on a device.
Step 3	<b>call-home</b> <b>Example:</b> Router(config)# call-home	Enters call-home configuration mode for the configuration of Call Home settings.
Step 4	<b>contact-email-addr</b> <i>email-address</i> <b>Example:</b> Router(cfg-call-home)# contact-email-addr userid@example.com	(Optional) Assigns an email address to be used for Call Home customer contact.
Step 5	<b>mail-server</b> { <i>ipv4-addr</i>   <i>name</i> } <b>priority</b> <i>number</i> <b>Example:</b> Router(cfg-call-home)# mail-server 10.1.1.1 priority 4	(Optional) Configures a Simple Mail Transfer Protocol (SMTP) email server address for Call Home. This command is only used when sending email is part of the actions defined in any DS.
Step 6	<b>profile</b> <i>profile-name</i> <b>Example:</b> Router(cfg-call-home)# profile user1	Configures a destination profile for Call Home and enters call-home profile configuration mode.
Step 7	<b>destination transport-method</b> {email   http} <b>Example:</b> Router(cfg-call-home-profile)# destination transport-method http	Specifies a transport method for a destination profile in the Call Home. <b>Note</b> To configure diagnostic signatures, you must use the <b>http</b> option.
Step 8	<b>destination address</b> {email address   http url} <b>Example:</b> Router(cfg-call-home-profile)# destination address http https://tools.cisco.com/its/service/odbc/services/DDCEService	Configures the address type and location to which call-home messages are sent. <b>Note</b> To configure diagnostic signatures, you must use the <b>http</b> option.

	Command or Action	Purpose
<b>Step 9</b>	<b>subscribe-to-alert-group inventory</b> [ <b>periodic</b> { <b>daily</b> <i>hh:mm</i>   <b>monthly</b> <i>day hh:mm</i>   <b>weekly</b> <i>day hh:mm</i> }]  <b>Example:</b> <pre>Router(cfg-call-home-profile)# subscribe-to-alert-group inventory periodic daily 14:30</pre>	Configures a destination profile to send messages for the Inventory alert group for Call Home. <ul style="list-style-type: none"> <li>This command is used only for the periodic downloading of DS files.</li> </ul>
<b>Step 10</b>	<b>exit</b>  <b>Example:</b> <pre>Router(cfg-call-home-profile)# exit</pre>	Exits call-home profile configuration mode and returns to call-home configuration mode.

**What to do next**

Set the profile configured in the previous procedure as the DS profile and configure other DS parameters.

**Configuring Diagnostic Signatures****Before you begin**

Configure the Call Home feature to set attributes for the Call Home profile. You can either use the default CiscoTAC-1 profile or use the newly-created user profile.

**SUMMARY STEPS**

- call-home**
- diagnostic-signature**
- profile** *ds-profile-name*
- environment** *ds\_env-var-name ds-env-var-value*
- end**
- call-home diagnostic-signature** [{**deinstall** | **download**} {*ds-id* | **all**} | **install** *ds-id*]
- show call-home diagnostic-signature** [*ds-id* {**actions** | **events** | **prerequisite** | **prompt** | **variables** | **failure** | **statistics** | **download**}]

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<b>call-home</b>  <b>Example:</b> <pre>Router(config)# call-home</pre>	Enters call-home configuration mode for the configuration of Call Home settings.
<b>Step 2</b>	<b>diagnostic-signature</b>  <b>Example:</b> <pre>Router(cfg-call-home)# diagnostic-signature</pre>	Enters call-home diagnostic signature mode.
<b>Step 3</b>	<b>profile</b> <i>ds-profile-name</i>  <b>Example:</b>	Specifies the destination profile on a device that DS uses.

	Command or Action	Purpose
	Router(cfg-call-home-diag-sign)# profile user1	
<b>Step 4</b>	<b>environment</b> <i>ds_env-var-name ds-env-var-value</i> <b>Example:</b> Router(cfg-call-home-diag-sign)# environment ds_env1 envarval	Sets the environment variable value for DS on a device.
<b>Step 5</b>	<b>end</b> <b>Example:</b> Router(cfg-call-home-diag-sign)# end	Exits call-home diagnostic signature mode and returns to privileged EXEC mode.
<b>Step 6</b>	<b>call-home diagnostic-signature</b> [{ <b>deinstall</b>   <b>download</b> } { <i>ds-id</i>   <b>all</b> }   <b>install</b> <i>ds-id</i> ] <b>Example:</b> Router# call-home diagnostic-signature download 6030	Downloads, installs, and uninstalls diagnostic signature files on a device.
<b>Step 7</b>	<b>show call-home diagnostic-signature</b> [ <i>ds-id</i> { <b>actions</b>   <b>events</b>   <b>prerequisite</b>   <b>prompt</b>   <b>variables</b>   <b>failure</b>   <b>statistics</b>   <b>download</b> }] <b>Example:</b> Router# show call-home diagnostic-signature actions	Displays the call-home diagnostic signature information.

### Configuration Examples for Diagnostic Signatures

The following example shows how to enable the periodic downloading request for diagnostic signature (DS) files. This configuration will send download requests to the service call-home server daily at 2:30 p.m. to check for updated DS files. The transport method is set to HTTP.

```
Router> enable
Router# configure terminal
Router(config)# service call-home
Router(config)# call-home
Router(cfg-call-home)# contact-email-addr userid@example.com
Router(cfg-call-home)# mail-server 10.1.1.1 priority 4
Router(cfg-call-home)# profile user-1
Router(cfg-call-home-profile)# destination transport-method http
Router(cfg-call-home-profile)# destination address http
https://tools.cisco.com/its/service/oddce/services/DCEService
Router(cfg-call-home-profile)# subscribe-to-alert-group inventory periodic daily 14:30
Router(cfg-call-home-profile)# exit
Router(cfg-call-home)# diagnostic-signature
Router(cfg-call-home-diag-sign)# profile user1
Router(cfg-call-home-diag-sign)# environment ds_env1 envarval
Router(cfg-call-home-diag-sign)# end
```

The following is sample output from the **show call-home diagnostic-signature** command for the configuration displayed above:

```
outer# show call-home diagnostic-signature
```

```

Current diagnostic-signature settings:
Diagnostic-signature: enabled
Profile: user1 (status: ACTIVE)
Environment variable:
ds_env1: abc
Downloaded DSes:
DS ID      DS Name                      Revision Status      Last Update (GMT+00:00)
-----
6015      CronInterval                 1.0      registered 2013-01-16 04:49:52
6030      ActCH                       1.0      registered 2013-01-16 06:10:22
6032      MultiEvents                 1.0      registered 2013-01-16 06:10:37
6033      PureTCL                     1.0      registered 2013-01-16 06:11:48

```

## Displaying Call Home Configuration Information

You can use variations of the **show call-home** command to display Call Home configuration information.

To display the configured Call Home information, perform the following:

### SUMMARY STEPS

1. **show call-home**
2. **show call-home detail**
3. **show call-home alert-group**
4. **show call-home mail-server status**
5. **show call-home profile {all | name}**
6. **show call-home statistics [detail | profile profile\_name]**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>show call-home</b> <b>Example:</b> Router# show call-home	Displays the Call Home configuration in summary.
<b>Step 2</b>	<b>show call-home detail</b> <b>Example:</b> Router# show call-home detail	Displays the Call Home configuration in detail.
<b>Step 3</b>	<b>show call-home alert-group</b> <b>Example:</b> Router# show call-home alert-group	Displays the available alert groups and their status.
<b>Step 4</b>	<b>show call-home mail-server status</b> <b>Example:</b> Router# show call-home mail-server status	Checks and displays the availability of the configured e-mail server(s).

	Command or Action	Purpose
Step 5	<b>show call-home profile</b> {all   name} <b>Example:</b> Router# show call-home profile all	Displays the configuration of the specified destination profile. Use the <b>all</b> keyword to display the configuration of all destination profiles.
Step 6	<b>show call-home statistics</b> [detail   profile profile_name] <b>Example:</b> Router# show call-home statistics	Displays the statistics of Call Home events.

## Examples

### Call Home Information in Summary

### Call Home Information in Detail

### Available Call Home Alert Groups

### E-Mail Server Status Information

### Information for All Destination Profiles

### Information for a User-Defined Destination Profile

### Call Home Statistics

The following examples show the sample output when using different options of the **show call-home** command.

```
Router# show call-home
Current call home settings:
  call home feature : enable
  call home message's from address: router@example.com
  call home message's reply-to address: support@example.com

vrf for call-home messages: Not yet set up

contact person's email address: technical@example.com

contact person's phone number: +1-408-555-1234
street address: 1234 Picaboo Street, Any city, Any state, 12345
customer ID: ExampleCorp
contract ID: X123456789
site ID: SantaClara

source ip address: Not yet set up
source interface: GigabitEthernet0/0
Mail-server[1]: Address: 192.0.2.1 Priority: 1
Mail-server[2]: Address: 209.165.202.254 Priority: 2
http proxy: 192.0.2.2:80
```

```

aaa-authorization: disable
aaa-authorization username: callhome (default)
data-privacy: normal
syslog throttling: enable

```

```
Rate-limit: 20 message(s) per minute
```

```
Snapshot command[0]: show version
Snapshot command[1]: show clock
```

Available alert groups:

Keyword	State	Description
configuration	Enable	configuration info
crash	Enable	crash and traceback info
environment	Enable	environmental info
inventory	Enable	inventory info
snapshot	Enable	snapshot info
syslog	Enable	syslog info

Profiles:

```
Profile Name: campus-noc
Profile Name: CiscoTAC-1
```

Router#

Router# **show call-home detail**

Current call home settings:

```
call home feature : enable
call home message's from address: router@example.com
call home message's reply-to address: support@example.com

```

vrf for call-home messages: Not yet set up

contact person's email address: technical@example.com

```
contact person's phone number: +1-408-555-1234
street address: 1234 Picaboo Street, Any city, Any state, 12345
customer ID: ExampleCorp
contract ID: X123456789
site ID: SantaClara

```

```
source ip address: Not yet set up
source interface: GigabitEthernet0/0
Mail-server[1]: Address: 192.0.2.1 Priority: 1
Mail-server[2]: Address: 209.165.202.254 Priority: 2
http proxy: 192.0.2.2:80

```

```

aaa-authorization: disable
aaa-authorization username: callhome (default)
data-privacy: normal
syslog throttling: enable

```

```
Rate-limit: 20 message(s) per minute
```

```
Snapshot command[0]: show version
Snapshot command[1]: show clock
```

Available alert groups:

Keyword	State	Description
configuration	Enable	configuration info
crash	Enable	crash and traceback info
environment	Enable	environmental info
inventory	Enable	inventory info
snapshot	Enable	snapshot info



```

        syslog                Enable  syslog info

Profiles:

Profile Name: campus-noc
  Profile status: ACTIVE
  Preferred Message Format: xml
  Message Size Limit: 3145728 Bytes
  Transport Method: email
  Email address(es): noc@example.com
  HTTP address(es): Not yet set up

Alert-group                Severity
-----
configuration              normal
crash                      normal
environment                debug
inventory                  normal

Syslog-Pattern            Severity
-----
.*CALL_LOOP.*             debug

Profile Name: CiscoTAC-1
  Profile status: INACTIVE
  Profile mode: Full Reporting
  Preferred Message Format: xml
  Message Size Limit: 3145728 Bytes
  Transport Method: email
  Email address(es): callhome@cisco.com
  HTTP address(es): https://tools.cisco.com/its/service/oddce/services/DDCEService

  Periodic configuration info message is scheduled every 14 day of the month at 11:12

  Periodic inventory info message is scheduled every 14 day of the month at 10:57

Alert-group                Severity
-----
crash                      normal
environment                minor

Syslog-Pattern            Severity
-----
.*CALL_LOOP.*             debug
Router#

Router# show call-home alert-group
Available alert groups:
  Keyword                State  Description
  -----
  configuration          Enable configuration info
  crash                  Enable crash and traceback info
  environment            Enable environmental info
  inventory              Enable inventory info
  snapshot              Enable snapshot info
  syslog                Enable syslog info
Router#

Router# show call-home mail-server status
Please wait. Checking for mail server status ...

  Mail-server[1]: Address: 192.0.2.1 Priority: 1 [Not Available]
  Mail-server[2]: Address: 209.165.202.254 Priority: 2 [Available]
Router#

```

```
Router# show call-home profile all
```

```
Profile Name: campus-noc
Profile status: ACTIVE
Preferred Message Format: xml
Message Size Limit: 3145728 Bytes
Transport Method: email
Email address(es): noc@example.com
HTTP address(es): Not yet set up
```

Alert-group	Severity
configuration	normal
crash	normal
environment	debug
inventory	normal

Syslog-Pattern	Severity
.*CALL_LOOP.*	debug

```
Profile Name: CiscoTAC-1
Profile status: INACTIVE
Profile mode: Full Reporting
Preferred Message Format: xml
Message Size Limit: 3145728 Bytes
Transport Method: email
Email address(es): callhome@cisco.com
HTTP address(es): https://tools.cisco.com/its/service/oddce/services/DDCEService
```

Periodic configuration info message is scheduled every 14 day of the month at 11:12

Periodic inventory info message is scheduled every 14 day of the month at 10:57

Alert-group	Severity
crash	normal
environment	minor

Syslog-Pattern	Severity
.*CALL_LOOP.*	debug

```
Router#
```

```
Router# show call-home profile campus-noc
```

```
Profile Name: campus-noc
Profile status: ACTIVE
Preferred Message Format: xml
Message Size Limit: 3145728 Bytes
Transport Method: email
Email address(es): noc@example.com
HTTP address(es): Not yet set up
```

Alert-group	Severity
configuration	normal
crash	normal
environment	debug
inventory	normal

Syslog-Pattern	Severity
.*CALL_LOOP.*	debug

```
Router#
```

```

Router# show call-home statistics
Message Types      Total      Email      HTTP
-----
Total Success     3          3          0
  Config          3          3          0
  Crash           0          0          0
  Environment     0          0          0
  Inventory       0          0          0
  Snapshot        0          0          0
  SysLog          0          0          0
  Test            0          0          0
  Request         0          0          0
  Send-CLI        0          0          0

Total In-Queue    0          0          0
  Config          0          0          0
  Crash           0          0          0
  Environment     0          0          0
  Inventory       0          0          0
  Snapshot        0          0          0
  SysLog          0          0          0
  Test            0          0          0
  Request         0          0          0
  Send-CLI        0          0          0

Total Failed      0          0          0
  Config          0          0          0
  Crash           0          0          0
  Environment     0          0          0
  Inventory       0          0          0
  Snapshot        0          0          0
  SysLog          0          0          0
  Test            0          0          0
  Request         0          0          0
  Send-CLI        0          0          0

Total Ratelimit
  -dropped       0          0          0
  Config          0          0          0
  Crash           0          0          0
  Environment     0          0          0
  Inventory       0          0          0
  Snapshot        0          0          0
  SysLog          0          0          0
  Test            0          0          0
  Request         0          0          0
  Send-CLI        0          0          0

Last call-home message sent time: 2011-09-26 23:26:50 GMT-08:00
Router#

```

## Default Call Home Settings

The following table lists the default Call Home settings.

Table 30: Default Call Home Settings

Parameters	Default
Call Home feature status	Disabled
User-defined profile status	Active
Predefined Cisco TAC profile status	Inactive
Transport method	E-mail
Message format type	XML
Destination message size for a message sent in long text, short text, or XML format	3,145,728
Alert group status	Enabled
Call Home message severity threshold	Debug
Message rate limit for messages per minute	20
AAA Authorization	Disabled
Call Home syslog message throttling	Enabled
Data privacy level	Normal

## Alert Group Trigger Events and Commands

Call Home trigger events are grouped into alert groups, with each alert group assigned commands to execute when an event occurs. The command output is included in the transmitted message. The following table lists the trigger events included in each alert group, including the severity level of each event and the executed commands for the alert group.

Table 31: Call Home Alert Groups, Events, and Actions

Alert Group	Call Home Trigger Event	Syslog Event	Severity	Description and Commands Executed
Crash	SYSTEM_CRASH	–	–	<p>Events related to software crash.</p> <p>The following commands are executed:</p> <p><b>show version</b></p> <p><b>show logging</b></p> <p><b>show region</b></p> <p><b>show inventory</b></p> <p><b>show stack</b></p> <p><b>crashinfo file</b> (this command shows the contents of the crashinfo file)</p>
–	TRACEBACK	–	–	<p>Detects software traceback events.</p> <p>The following commands are executed:</p> <p><b>show version</b></p> <p><b>show logging</b></p> <p><b>show region</b></p> <p><b>show stack</b></p>

Alert Group	Call Home Trigger Event	Syslog Event	Severity	Description and Commands Executed
Configuration	–	–	–	User-generated request for configuration or configuration change event.  The following commands are executed: <b>show platform</b> <b>show inventory</b> <b>show running-config all</b> <b>show startup-config</b> <b>show version</b>
Environmental	–	–	–	Events related to power, fan, and environment sensing elements such as temperature alarms.  The following commands are executed: <b>show environment</b> <b>show inventory</b> <b>show platform</b> <b>show logging</b>
–	–	SHUT	0	Environmental Monitor initiated shutdown.
–	–	ENVCRIT	2	Temperature or voltage measurement exceeded critical threshold.
–	–	BLOWER	3	Required number of fan trays is not present.

Alert Group	Call Home Trigger Event	Syslog Event	Severity	Description and Commands Executed
–	–	ENVWARN	4	Temperature or voltage measurement exceeded warning threshold.
–	–	RPSFAIL	4	Power supply may have a failed channel.
–	ENVM	PSCHANGE	6	Power supply name change.
–	–	PSLEV	6	Power supply state change.
–	–	PSOK	6	Power supply now appears to be working correctly.

<b>Alert Group</b>	<b>Call Home Trigger Event</b>	<b>Syslog Event</b>	<b>Severity</b>	<b>Description and Commands Executed</b>
Inventory	–	–	–	



Alert Group	Call Home Trigger Event	Syslog Event	Severity	Description and Commands Executed
				<p>Inventory status should be provided whenever a unit is cold-booted or when FRUs are inserted or removed. This is considered a noncritical event, and the information is used for status and entitlement.</p> <p>Commands executed for all Inventory messages sent in anonymous mode and for Delta Inventory message sent in full registration mode:</p> <p><b>show diag all</b>  <b>eeprom detail</b></p> <p><b>show version</b></p> <p><b>show inventory oid</b></p> <p><b>show platform</b></p> <p>Commands executed for Full Inventory message sent in full registration mode:</p> <p><b>show platform</b></p> <p><b>show diag all</b>  <b>eeprom detail</b></p> <p><b>show version</b></p> <p><b>show inventory oid</b></p> <p><b>show bootflash: all</b></p> <p><b>show data-corruption</b></p> <p><b>show interfaces</b></p> <p><b>show file systems</b></p> <p><b>show memory statistics</b></p>

Alert Group	Call Home Trigger Event	Syslog Event	Severity	Description and Commands Executed
				<b>show process memory</b> <b>show process cpu</b> <b>show process cpu history</b> <b>show license udi</b> <b>show license detail</b> <b>show buffers</b>
–	HARDWARE_REMOVAL	REMCARD	6	Card removed from slot %d, interfaces disabled.
–	HARDWARE_INSERTION	INSCARD	6	Card inserted in slot %d, interfaces administratively shut down.
Syslog	–	–	–	Event logged to syslog. The following commands are executed: <b>show inventory</b> <b>show logging</b>
–	SYSLOG	LOG_EMERG	0	System is unusable.
–	SYSLOG	LOG_ALERT	1	Action must be taken immediately.
–	SYSLOG	LOG_CRIT	2	Critical conditions.
–	SYSLOG	LOG_ERR	3	Error conditions.
–	SYSLOG	LOG_WARNING	4	Warning conditions.
–	SYSLOG	LOG_NOTICE	5	Normal but signification condition.
–	SYSLOG	LOG_INFO	6	Informational.
–	SYSLOG	LOG_DEBUG	7	Debug-level messages.

Alert Group	Call Home Trigger Event	Syslog Event	Severity	Description and Commands Executed
Test	–	TEST	–	User-generated test message.  The following commands are executed:  <b>show platform</b>  <b>show inventory</b>  <b>show version</b>

## Message Contents

This section consists of tables which list the content formats of alert group messages.

The following table lists the content fields of a short text message.

**Table 32: Format for a Short Text Message**

Data Item	Description
Device identification	Configured device name
Date/time stamp	Time stamp of the triggering event
Error isolation message	Plain English description of triggering event
Alarm urgency level	Error level such as that applied to a system message

The following table shows the content fields that are common to all long text and XML messages. The fields specific to a particular alert group message are inserted at a point between the common fields. The insertion point is identified in the table.

**Table 33: Common Fields for All Long Text and XML Messages**

Data Item (Plain Text and XML)	Description (Plain Text and XML)	Call-Home Message Tag (XML Only)
Time stamp	Date and time stamp of event in ISO time notation: <i>YYYY-MM-DD HH:MM:SS GMT+HH:MM</i> .	CallHome/EventTime
Message name	Name of message. Specific event names are listed in the <a href="#">Alert Group Trigger Events and Commands, on page 282</a> .	For short text message only
Message type	Specifically “Call Home”.	CallHome/Event/Type

Data Item (Plain Text and XML)	Description (Plain Text and XML)	Call-Home Message Tag (XML Only)
Message subtype	Specific type of message: full, delta, test	CallHome/Event/SubType
Message group	Specifically “reactive”. Optional because default is “reactive”.	For long-text message only
Severity level	Severity level of message (see <a href="#">Message Severity Threshold, on page 257</a> ).	Body/Block/Severity
Source ID	Product type for routing through the workflow engine. This is typically the product family name.	For long-text message only
Device ID	<p>Unique device identifier (UDI) for end device generating message. This field should be empty if the message is nonspecific to a fabric switch. The format is <i>type@Sid@serial</i>.</p> <ul style="list-style-type: none"> <li>• <i>type</i> is the product model number from backplane IDPROM.</li> <li>• <i>@</i> is a separator character.</li> <li>• <i>Sid</i> is C, identifying the serial ID as a chassis serial number.</li> <li>• <i>serial</i> is the number identified by the Sid field.</li> </ul> <p>Example: CISCO3845@C@12345678</p>	CallHome/CustomerData/ContractData/DeviceId
Customer ID	Optional user-configurable field used for contract information or other ID by any support service.	CallHome/CustomerData/ContractData/CustomerId
Contract ID	Optional user-configurable field used for contract information or other ID by any support service.	CallHome/CustomerData/ContractData/CustomerId
Site ID	Optional user-configurable field used for Cisco-supplied site ID or other data meaningful to alternate support service.	CallHome/CustomerData/ContractData/CustomerId

Data Item (Plain Text and XML)	Description (Plain Text and XML)	Call-Home Message Tag (XML Only)
Server ID	<p>If the message is generated from the fabric switch, this is the unique device identifier (UDI) of the switch.</p> <ul style="list-style-type: none"> <li>• <i>type</i> is the product model number from backplane IDPROM.</li> <li>• @ is a separator character.</li> <li>• <i>Sid</i> is C, identifying the serial ID as a chassis serial number.</li> <li>• <i>serial</i> is the number identified by the Sid field.</li> </ul> <p>Example: CISCO3845@C@12345678</p>	For long text message only.
Message description	Short text describing the error.	CallHome/MessageDescription
Device name	Node that experienced the event. This is the host name of the device.	CallHome/CustomerData/SystemInfo/NameName
Contact name	Name of person to contact for issues associated with the node experiencing the event.	CallHome/CustomerData/SystemInfo/Contact
Contact e-mail	E-mail address of person identified as contact for this unit.	CallHome/CustomerData/SystemInfo/ContactEmail
Contact phone number	Phone number of the person identified as the contact for this unit.	CallHome/CustomerData/SystemInfo/ContactPhoneNumber
Street address	Optional field containing street address for RMA part shipments associated with this unit.	CallHome/CustomerData/SystemInfo/StreetAddress
Model name	Model name of the router. This is the “specific model as part of a product family name.	CallHome/Device/Cisco_Chassis/Model
Serial number	Chassis serial number of the unit.	CallHome/Device/Cisco_Chassis/SerialNumber
Chassis part number	Top assembly number of the chassis.	CallHome/Device/Cisco_Chassis/AdditionalInformation/AD@name=“PartNumber”

Data Item (Plain Text and XML)	Description (Plain Text and XML)	Call-Home Message Tag (XML Only)
System object ID	System Object ID that uniquely identifies the system.	CallHome/Device/ Cisco_Chassis/AdditionalInformation/ AD@name="sysObjectID"
System description	System description for the managed element.	CallHome/Device/ Cisco_Chassis/AdditionalInformation/ AD@name="sysDescr"

The following table shows the inserted fields specific to a particular alert group message.



**Note** The following fields may be repeated if multiple commands are executed for this alert group.

**Table 34: Inserted Fields Specific to a Particular Alert Group Message**

Command output name	Exact name of the issued command.	/aml/Attachments/Attachment/Name
Attachment type	Attachment type. Usually "inline".	/aml/Attachments/Attachment@type
MIME type	Normally "text" or "plain" or encoding type.	/aml/Attachments/Attachment/ Data@encoding
Command output text	Output of command automatically executed (see <a href="#">Alert Group Trigger Events and Commands, on page 282</a> ).	/mml/attachments/attachment/atdata

The following table shows the inserted content fields for reactive messages (system failures that require a TAC case) and proactive messages (issues that might result in degraded system performance).

**Table 35: Inserted Fields for a Reactive or Proactive Event Message**

Data Item (Plain Text and XML)	Description (Plain Text and XML)	Call-Home Message Tag (XML Only)
Chassis hardware version	Hardware version of chassis	CallHome/Device/Cisco_Chassis/ HardwareVersion
Supervisor module software version	Top-level software version	CallHome/Device/Cisco_Chassis/ AdditionalInformation/AD@name= "SoftwareVersion"
Affected FRU name	Name of the affected FRU generating the event message	CallHome/Device/Cisco_Chassis/ Cisco_Card/Model
Affected FRU serial number	Serial number of affected FRU	CallHome/Device/Cisco_Chassis/ Cisco_Card/SerialNumber
Affected FRU part number	Part number of affected FRU	CallHome/Device/Cisco_Chassis/ Cisco_Card/PartNumber

Data Item (Plain Text and XML)	Description (Plain Text and XML)	Call-Home Message Tag (XML Only)
FRU slot	Slot number of FRU generating the event message	CallHome/Device/Cisco_Chassis/Cisco_Card/LocationWithinContainer
FRU hardware version	Hardware version of affected FRU	CallHome/Device/Cisco_Chassis/Cisco_Card/HardwareVersion
FRU software version	Software version(s) running on affected FRU	CallHome/Device/Cisco_Chassis/Cisco_Card/SoftwareIdentity/VersionString

The following table shows the inserted content fields for an inventory message.

**Table 36: Inserted Fields for an Inventory Event Message**

Data Item (Plain Text and XML)	Description (Plain Text and XML)	Call-Home Message Tag (XML Only)
Chassis hardware version	Hardware version of chassis	CallHome/Device/Cisco_Chassis/HardwareVersion
Supervisor module software version	Top-level software version	CallHome/Device/Cisco_Chassis/AdditionalInformation/AD@name="SoftwareVersion"
FRU name	Name of the affected FRU generating the event message	CallHome/Device/Cisco_Chassis/Cisco_Card/Model
FRU s/n	Serial number of FRU	CallHome/Device/Cisco_Chassis/Cisco_Card/SerialNumber
FRU part number	Part number of FRU	CallHome/Device/Cisco_Chassis/Cisco_Card/PartNumber
FRU slot	Slot number of FRU	CallHome/Device/Cisco_Chassis/Cisco_Card/LocationWithinContainer
FRU hardware version	Hardware version of FRU	CallHome/Device/Cisco_Chassis/CiscoCard/HardwareVersion
FRU software version	Software version(s) running on FRU	CallHome/Device/Cisco_Chassis/Cisco_Card/SoftwareIdentity/VersionString







## CHAPTER 19

# Managing Cisco Enhanced Services and Network Interface Modules

---

The router supports Cisco Enhanced Services Modules (SMs) and Cisco Network Interface Modules (NIMs). The modules are inserted into the router using an adapter, or carrier card, into various slots. For more information, see the following documents:

- [Hardware Installation Guide for the Cisco Catalyst 8300 Series Edge Platform.](#)
- [Hardware Installation Guide for Cisco Catalyst 8200 Series Edge Platforms](#)

The following sections are included in this chapter:

- [Information About Cisco Service Modules and Network Interface Modules, on page 295](#)
- [Modules Supported, on page 296](#)
- [Network Interface Modules and Enhanced Service Modules, on page 296](#)
- [Implementing SMs and NIMs on Your Platforms, on page 296](#)
- [Managing Modules and Interfaces, on page 304](#)
- [Configuration Examples, on page 304](#)

## Information About Cisco Service Modules and Network Interface Modules

The router configures, manages, and controls the supported Cisco Service Modules (SMs), Network Interface Modules (NIMs) and PIM (Pluggable Interface Modules) using the module management facility built in its architecture. This new centralized module management facility provides a common way to control and monitor all the modules in the system regardless of their type and application. All Cisco Enhanced Service and Network Interface Modules supported on your router use standard IP protocols to interact with the host router. Cisco IOS software uses alien data path integration to switch between the modules.

- [Modules Supported, on page 296](#)
- [Network Interface Modules and Enhanced Service Modules, on page 296](#)

## Modules Supported

For information about the interfaces and modules supported by the Cisco Catalyst 8000 Edge Platform, see [Hardware Installation Guide for Cisco Catalyst 8000 Series Edge Platform](#).

## Network Interface Modules and Enhanced Service Modules

For more information on the supported Network Interface Modules and Service Modules, refer to the Cisco Catalyst 8300 Series Edge Platforms [datasheet](#).

## Implementing SMs and NIMs on Your Platforms

- [Downloading the Module Firmware, on page 296](#)
- [Installing SMs and NIMs, on page 296](#)
- [Accessing Your Module Through a Console Connection or Telnet, on page 296](#)
- [Online Insertion and Removal, on page 297](#)

## Downloading the Module Firmware

Module firmware must be loaded to the router to be able to use a service module. For more information, see [Installing a Firmware Subpackage, on page 145](#).

The modules connect to the RP via the internal eth0 interface to download the firmware. Initially, the module gets an IP address for itself via BOOTP. The BOOTP also provides the address of the TFTP server used to download the image. After the image is loaded and the module is booted, the module provides an IP address for the running image via DHCP.

## Installing SMs and NIMs

For more information, see "Installing and Removing NIMs and SMs" in the [Hardware Installation Guide for Cisco Catalyst 8300 Edge Platform](#) and [Hardware Installation Guide for Cisco Catalyst 8200 Series Edge Platforms](#).



---

**Note** Service modules are not supported on Cisco Catalyst 8200 Series Edge Platforms.

---

## Accessing Your Module Through a Console Connection or Telnet

Before you can access the modules, you must connect to the host router through the router console or through Telnet. After you are connected to the router, you must configure an IP address on the Gigabit Ethernet interface connected to your module. Open a session to your module using the **hw-module session** command in privileged EXEC mode on the router.

To establish a connection to the module, connect to the router console using Telnet or Secure Shell (SSH) and open a session to the switch using the **hw-module session slot/subslot** command in privileged EXEC mode on the router.

Use the following configuration examples to establish a connection:

- The following example shows how to open a session from the router using the **hw-module session** command:

```
Router# hw-module session slot/card
Router# hw-module session 0/1 endpoint 0

Establishing session connect to subslot 0/1
```

- The following example shows how to exit a session from the router, by pressing **Ctrl-A** followed by **Ctrl-Q** on your keyboard:

```
type ^a^q
picocom v1.4

port is      : /dev/ttyDASH2
flowcontrol  : none
baudrate is  : 9600
parity is    : none
databits are : 8
escape is    : C-a
noinit is    : no
noreset is   : no
nolock is    : yes
send_cmd is  : ascii_xfr -s -v -l10
receive_cmd is : rz -vv
```

## Online Insertion and Removal

The router supports online insertion and removal (OIR) of Cisco Enhanced Services Modules and Cisco Network Interface Modules. You can perform the following tasks using the OIR function:

- [Preparing for Online Removal of a Module, on page 297](#)
- [Deactivating a Module, on page 298](#)
- [Deactivating Modules and Interfaces in Different Command Modes, on page 299](#)
- [Deactivating and Reactivating an SSD/HDD Carrier Card NIM, on page 300](#)
- [Reactivating a Module, on page 301](#)
- [Verifying the Deactivation and Activation of a Module, on page 301](#)

### Preparing for Online Removal of a Module

The router supports the OIR of a module, independent of removing another module installed in your router. This means that an active module can remain installed in your router, while you remove another module from one of the subslots. If you are not planning to immediately replace a module, ensure that you install a blank filler plate in the subslot.

## Deactivating a Module

A module can be removed from the router without first being deactivated. However, we recommend that you perform a graceful deactivation (or graceful power down) of the module before removing it. To perform a graceful deactivation, use the **hw-module subslot slot/subslot stop** command in EXEC mode.



**Note** When you are preparing for an OIR of a module, it is not necessary to independently shut down each of the interfaces before deactivating the module. The **hw-module subslot slot/subslot stop** command in EXEC mode automatically stops traffic on the interfaces and deactivates them along with the module in preparation for OIR. Similarly, you do not have to independently restart any of the interfaces on a module after OIR.

The following example shows how to use the **show facility-alarm status** command to verify if any critical alarm is generated when a module is removed from the system:

```
Router# show facility-alarm status
System Totals  Critical: 18  Major: 0  Minor: 0
```

Source	Time	Severity	Description [Index]
Power Supply Bay 1 Missing [0]	Sep 28 2020 10:02:34	CRITICAL	Power Supply/FAN Module
POE Bay 0 Missing [0]	Sep 28 2020 10:02:34	INFO	Power Over Ethernet Module
POE Bay 1 Missing [0]	Sep 28 2020 10:02:34	INFO	Power Over Ethernet Module
GigabitEthernet0/0/2 State Down [2]	Sep 28 2020 10:02:46	INFO	Physical Port Administrative
GigabitEthernet0/0/3 State Down [2]	Sep 28 2020 10:02:46	INFO	Physical Port Administrative
xcvr container 0/0/4 Down [1]	Sep 28 2020 10:02:46	INFO	Transceiver Missing - Link
TenGigabitEthernet0/0/5	Sep 28 2020 10:02:54	CRITICAL	Physical Port Link Down [1]
TenGigabitEthernet0/1/0 State Down [2]	Sep 28 2020 10:03:26	INFO	Physical Port Administrative
GigabitEthernet1/0/0	Sep 28 2020 10:07:35	CRITICAL	Physical Port Link Down [1]
GigabitEthernet1/0/1	Sep 28 2020 10:07:35	CRITICAL	Physical Port Link Down [1]
GigabitEthernet1/0/2	Sep 28 2020 10:07:35	CRITICAL	Physical Port Link Down [1]
GigabitEthernet1/0/3	Sep 28 2020 10:07:35	CRITICAL	Physical Port Link Down [1]
GigabitEthernet1/0/4	Sep 28 2020 10:07:35	CRITICAL	Physical Port Link Down [1]
GigabitEthernet1/0/5	Sep 28 2020 10:07:35	CRITICAL	Physical Port Link Down [1]
TwoGigabitEthernet1/0/16 State Down [2]	Sep 28 2020 10:07:35	INFO	Physical Port Administrative
TwoGigabitEthernet1/0/17 State Down [2]	Sep 28 2020 10:07:35	INFO	Physical Port Administrative
TwoGigabitEthernet1/0/18 State Down [2]	Sep 28 2020 10:07:35	INFO	Physical Port Administrative
TwoGigabitEthernet1/0/19 State Down [2]	Sep 28 2020 10:07:35	INFO	Physical Port Administrative
xcvr container 1/0/20 Down [1]	Sep 28 2020 10:04:00	INFO	Transceiver Missing - Link
xcvr container 1/0/21 Down [1]1]	Sep 28 2020 10:04:00	INFO	Transceiver Missing - Link



**Note** A critical alarm (Active Card Removed OIR Alarm) is generated even if a module is removed after performing graceful deactivation.

## Deactivating Modules and Interfaces in Different Command Modes

You can deactivate a module and its interfaces using the **hw-module subslot** command in one of the following modes:

- If you choose to deactivate your module and its interfaces by executing the **hw-module subslot slot/subslot shutdown unpowered** command in global configuration mode, you are able to change the configuration in such a way that no matter how many times the router is rebooted, the module does not boot. This command is useful when you need to shut down a module located in a remote location and ensure that it does not boot automatically when the router is rebooted.
- If you choose to use the **hw-module subslot slot/subslot stop** command in EXEC mode, you cause the module to gracefully shut down. The module is rebooted when the **hw-module subslot slot/subslot start** command is executed.

To deactivate a module and all of its interfaces before removing the module, use one of the following commands in global configuration mode.

### Procedure

	Command or Action	Purpose
Step 1	<b>hw-module subslot slot/subslot shutdown unpowered</b> <b>Example:</b> Router# <b>hw-module subslot 0/2 shutdown unpowered</b>	Deactivates the module located in the specified slot and subslot of the router, where: <ul style="list-style-type: none"> <li>• <i>slot</i>—Specifies the chassis slot number where the module is installed.</li> <li>• <i>subslot</i>—Specifies the subslot number of the chassis where the module is installed.</li> <li>• <b>shutdown</b>—Shuts down the specified module.</li> <li>• <b>unpowered</b>—Removes all interfaces on the module from the running configuration and the module is powered off.</li> </ul>
Step 2	<b>hw-module subslot slot/subslot [reload   stop   start]</b> <b>Example:</b> Router# <b>hw-module subslot 0/2 stop</b>	Deactivates the module in the specified slot and subslot, where: <ul style="list-style-type: none"> <li>• <i>slot</i>—Specifies the chassis slot number where the module is installed.</li> <li>• <i>subslot</i>—Specifies the subslot number of the chassis where the module is installed.</li> <li>• <b>reload</b>—Stops and restarts the specified module.</li> <li>• <b>stop</b>—Removes all interfaces from the module and the module is powered off.</li> <li>• <b>start</b>—Powers on the module similar to a physically inserted module in the specified slot. The module firmware reboots and the entire module initialization sequence is executed in the IOSd and Input/Output Module daemon (IOMd) processes.</li> </ul>

## Deactivating and Reactivating an SSD/HDD Carrier Card NIM

The following restrictions apply:

- Deactivating or reactivating an SSD/HDD Carrier Card NIM without an SSD or HDD disk is not supported.
- Only a single (SSD or HDD) Carrier Card NIM can be plugged into a bay. If you plug an additional (SSD or HDD) Carrier Card NIM into another bay, the module powers down and kernel, log, or error messages are displayed on the Cisco IOS console. In rare cases, the file system may get corrupted on the additional drive.



**Caution** Deactivation of an SSD/HDD Carrier Card NIM may cause loss of data.

To deactivate an SSD/HDD Carrier Card NIM, perform the following steps:

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>virtual-service</b> <i>name</i> <b>Example:</b> Router(config)# <b>virtual-service my-kwaas-instance</b>	Identifies the kWAAS service (by name), supported on your router, in preparation for the router to be shut down by the <b>no activate</b> command. We recommend that you use this command before reseating or replacing an SSD or HDD.
<b>Step 2</b>	<b>no activate</b> <b>Example:</b> Router(config-virt-serv)# <b>no activate</b>	Shuts down the kWAAS instance on your router. kWAAS services remain installed. The service will have to be reactivated after the HDD/SSD NIM (module) is restarted.
<b>Step 3</b>	<b>hw-module subslot slot/subslot [reload   stop   start]</b> <b>Example:</b> Router# <b>hw-module subslot 0/2 stop</b> Proceed with stop of module? [confirm] Router# *Mar 6 15:13:23.997: %SPA_OIR-6-OFFLINECARD: SPA (NIM-SSD) offline in subslot 0/2 ...	Deactivates or reactivates the module in the specified slot and subslot. <ul style="list-style-type: none"> <li>• <i>slot</i>—The chassis slot number where the module is installed.</li> <li>• <i>subslot</i>—The subslot number of the chassis where the module is installed.</li> <li>• <b>reload</b>—Deactivates and reactivates (stops and restarts) the specified module.</li> <li>• <b>stop</b>—Removes all interfaces from the module and the module is powered off.</li> <li>• <b>start</b>—Powers on the module similar to a physically inserted module in the specified slot. The module firmware reboots and the entire module initialization sequence is executed in the IOSd and IOMd processes.</li> </ul>
<b>Step 4</b>	Wait for the EN (Enable) LED to turn off, and then remove the SSD/HDD Carrier Card NIM.	

## Reactivating a Module

If, after deactivating a module using the **hw-module subslot slot/subslot stop** command, you want to reactivate it without performing an OIR, use one of the following commands (in privileged EXEC mode):

- **hw-module subslot slot/subslot start**
- **hw-module subslot slot/subslot reload**

## Verifying the Deactivation and Activation of a Module

When you deactivate a module, the corresponding interfaces are also deactivated. This means that these interfaces will no longer appear in the output of the **show interface** command.

1. To verify the deactivation of a module, enter the **show hw-module subslot all oir** command in privileged EXEC configuration mode.

Observe the "Operational Status" field associated with the module that you want to verify. In the following example, the module located in subslot 1 of the router is administratively down.

```
Router# show hw-module subslot all oir
```

Module	Model	Operational Status
subslot 0/0	4x1G-2xSFP+	ok
subslot 0/1	C-NIM-1X	ok
subslot 1/0	SM-X-16G4M2X	ok

```
RadiumPP#
```

2. To verify activation and proper operation of a module, enter the **show hw-module subslot all oir** command and observe "ok" in the **Operational Status** field as shown in the following example:

```
Router# show hw-module subslot all oir
```

Module	Model	Operational Status
subslot 0/0	4x1G-2xSFP+	ok
subslot 0/1	C-NIM-1X	ok
subslot 1/0	SM-X-16G4M2X	ok

```
RadiumPP#
```

```
Router# show platform hardware backplaneswitch-manager R0 status
```

slot	bay	port	enable	link status	speed(Mbps)	duplex	autoneg	pause_tx	pause_rx	mtu
------	-----	------	--------	-------------	-------------	--------	---------	----------	----------	-----

0	0	CP	True	Up	1000	Full	ENABLED	ENABLED	ENABLED	10240
1	0	GE1	True	Up	1000	Full	DISABLED	ENABLED	ENABLED	10240
1	0	GE0	True	Up	1000	Full	DISABLED	ENABLED	ENABLED	10240
2	0	GE1	True	Up	1000	Full	DISABLED	ENABLED	ENABLED	10240
2	0	GE0	True	Up	1000	Full	DISABLED	ENABLED	ENABLED	10240
0	1	GE1	True	Down	1000	Full	DISABLED	ENABLED	ENABLED	10240
0	1	GE0	True	Down	1000	Full	DISABLED	ENABLED	ENABLED	10240
0	2	GE1	True	Down	1000	Full	DISABLED	ENABLED	ENABLED	10240

Verifying the Deactivation and Activation of a Module

```

0      2      GE0      True      Down      1000      Full      DISABLED  ENABLED
ENABLED 10240
0      3      GE1      True      Down      1000      Full      DISABLED  ENABLED
ENABLED 10240
0      3      GE0      True      Down      1000      Full      DISABLED  ENABLED
ENABLED 10240
0      4      GE1      True      Down      1000      Full      DISABLED  ENABLED
ENABLED 10240
0      4      GE0      True      Down      1000      Full      DISABLED  ENABLED
ENABLED 10240
0      0      FFP      True      Up        10000     Full      ENABLED   DISABLED
DISABLED 10240

```

slot	bay	port	mac	vid	modid	flags - Layer 2
0	0	FFP	2c54.2dd2.661b	2351	1	0x20
0	0	FFP	2c54.2dd2.661b	2352	1	0x20
0	0	CP	2c54.2dd2.661e	2351	0	0xC60
0	0	CP	2c54.2dd2.661e	2352	0	0x20
1	0	GE0	58bf.ea3a.00f6	2350	0	0x460
0	0	FFP	2c54.2dd2.661b	2350	1	0x20
1	0	GE0	58bf.ea3a.00f6	2352	0	0x20
0	0	CP	2c54.2dd2.661e	2350	0	0x20
1	0	GE0	58bf.ea3a.00f6	2351	0	0xC60

Port block masks: rows=from port, columns=to port, u=unknown unicast, m=unknown multicast, b=broadcast, A=all

```

          CP      FFP  1/0/1  1/0/0  2/0/1  2/0/0  0/1/1  0/1/0  0/2/1  0/2/0  0/3/1
0/3/0  0/4/1  0/4/0 drops

```

CP	um	FFP	1/0/1	1/0/0	2/0/1	2/0/0	0/1/1	0/1/0	0/2/1	0/2/0	0/3/1
um	um	A	um	um	um	um	um	um	um	um	um
FFP	-	A	-	-	-	-	-	-	-	-	-
1/0/1	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
1/0/0	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
2/0/1	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
2/0/0	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
0/1/1	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
0/1/0	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
0/2/1	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
0/2/0	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
0/3/1	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
0/3/0	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
0/4/1	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb
0/4/0	um	umb	umb	umb	umb	umb	umb	umb	umb	umb	umb

Port VLAN membership: [untagged vlan] U=untagged T=tagged <VLAN range begin>-<VLAN range end>

```

CP [2352] U:0001-0001 T:0002-2351 U:2352-2352 T:2353-4095
FFP [2352] T:0001-4095
1/0/1 [2352] T:0002-2351 U:2352-2352 T:2353-4095

```



```

1/0/0 [2352] T:0002-2351 U:2352-2352 T:2353-4095
2/0/1 [2352] T:0002-2351 U:2352-2352 T:2353-4095
2/0/0 [2352] T:0002-2351 U:2352-2352 T:2353-4095
0/1/1 [2352] T:0002-2351 U:2352-2352 T:2353-4095
0/1/0 [2352] T:0002-2351 U:2352-2352 T:2353-4095
0/2/1 [2352] T:0002-2351 U:2352-2352 T:2353-4095
0/2/0 [2352] T:0002-2351 U:2352-2352 T:2353-4095
0/3/1 [2352] T:0002-2351 U:2352-2352 T:2353-4095
0/3/0 [2352] T:0002-2351 U:2352-2352 T:2353-4095
0/4/1 [2352] T:0002-2351 U:2352-2352 T:2353-4095
0/4/0 [2352] T:0002-2351 U:2352-2352 T:2353-4095
    
```

**show platform hardware backplaneswitch-manager rp active ffp statistics: Example**

```

Router# show platform hardware backplaneswitch-manager rp active ffp statistics
Broadcom 10G port(e.g: FFP) status:
    
```

	Rx pkts	Rx Bytes	Tx Pkts	Tx Bytes
All	0	0	0	0
=64	0		0	
65~127	0		0	
128~255	0		0	
256~511	0		0	
512~1023	0		0	
1024~1518	0		0	
1519~2047	0		0	
2048~4095	0		0	
4096~9216	0		0	
9217~16383	0		0	
Max	0		0	
Good	0		0	
CoS 0			0	0
CoS 1			0	0
CoS 2			0	0
CoS 3			0	0
CoS 4			0	0
CoS 5			0	0
CoS 6			0	0
CoS 7			0	0
Unicast	0		0	
Multicast	0		0	
Broadcast	0		0	
Control	0			
Errored				
FCS	0		0	
Undersize	0			
Ether len	0			
Fragment	0		0	
Jabber	0			
MTU ck, good	0			
MTU ck, bad	0			
Tx underflow				0
err symbol	0			
frame err	0			
junk	0			
Drops				
CoS 0			0	0
CoS 1			0	0
CoS 2			0	0
CoS 3			0	0
CoS 4			0	0
CoS 5			0	0

```

CoS 6                                0                0
CoS 7                                0                0
STP                                  0
backpress                            0
congest                               0                0
purge/cell                            0
no destination                        0
Pause PFC                            0                0
CoS 0                                0
CoS 1                                0
CoS 2                                0
CoS 3                                0
CoS 4                                0
CoS 5                                0
CoS 6                                0
CoS 7                                0

```

## Managing Modules and Interfaces

The router supports various modules. For a list of supported modules, see [Modules Supported, on page 296](#). The module management process involves bringing up the modules so that their resources can be utilized. This process consists of tasks such as module detection, authentication, configuration by clients, status reporting, and recovery.

For a list of small-form-factor pluggable (SFP) modules supported on your router, see the "Installing and Upgrading Internal Modules and FRUs" section in the [Hardware Installation Guide for Cisco Catalyst 8300 Edge Platform](#).

The following sections provide additional information on managing the modules and interfaces:

- [Managing Module Interfaces, on page 304](#)

## Managing Module Interfaces

After a module is in service, you can control and monitor its module interface. Interface management includes configuring clients with **shut** or **no shut** commands and reporting on the state of the interface and the interface-level statistics.

## Configuration Examples

This section provides examples of deactivating and activating modules.

### Deactivating a Module Configuration: Example

You can deactivate a module to perform OIR of that module. The following example shows how to deactivate a module (and its interfaces) and remove power to the module. In this example, the module is installed in subslot 0 of the router.

```
Router(config)# hw-module slot 1 subslot 1/0 shutdown unpowered
```

### Activating a Module Configuration: Example

You can activate a module if you have previously deactivated it. If you have not deactivated a module and its interfaces during OIR, then the module is automatically reactivated upon reactivation of the router.

The following example shows how to activate a module. In this example, the module is installed in subslot 0, located in slot 1 of the router:

```
Router(config)# hw-module slot 1 subslot 1/0 start
```





## CHAPTER 20

# Cellular IPv6 Address

This chapter provides an overview of the IPv6 addresses and describes how to configure Cellular IPv6 address on Cisco Catalyst 8000 Series Edge Platform.

This chapter includes this section:

- [Cellular IPv6 Address, on page 307](#)

## Cellular IPv6 Address

IPv6 addresses are represented as a series of 16-bit hexadecimal fields separated by colons (:) in the format: x:x:x:x:x:x:x. Following are two examples of IPv6 addresses:

- 2001:CDBA:0000:0000:0000:0000:3257:9652
- 2001:CDBA::3257:9652 (zeros can be omitted)

IPv6 addresses commonly contain successive hexadecimal fields of zeros. Two colons (::) may be used to compress successive hexadecimal fields of zeros at the beginning, middle, or end of an IPv6 address (the colons represent successive hexadecimal fields of zeros). The table below lists compressed IPv6 address formats.

An IPv6 address prefix, in the format ipv6-prefix/prefix-length, can be used to represent bit-wise contiguous blocks of the entire address space. The ipv6-prefix must be in the form documented in RFC 2373 where the address is specified in hexadecimal using 16-bit values between colons. The prefix length is a decimal value that indicates how many of the high-order contiguous bits of the address comprise the prefix (the network portion of the address). For example, 2001:cdba::3257:9652 /64 is a valid IPv6 prefix.

## IPv6 Unicast Routing

An IPv6 unicast address is an identifier for a single interface, on a single node. A packet that is sent to a unicast address is delivered to the interface identified by that address.

Cisco Catalyst 8300 Edge Platform support the following address types:

- [Link-Lock Address , on page 308](#)
- [Global Address, on page 308](#)

## Link-Lock Address

A link-local address is an IPv6 unicast address that can be automatically configured on any interface using the link-local prefix FE80::/10 (1111 1110 10) and the interface identifier in the modified EUI-64 format. An link-local address is automatically configured on the cellular interface when an IPv6 address is enabled.

After the data call is established, the link-local address on the cellular interface is updated with the host generated link-local address that consists of the link-local prefix FF80::/10 (1111 1110 10) and the auto-generated interface identifier from the USB hardware address.

## Global Address

A global IPv6 unicast address is defined by a global routing prefix, a subnet ID, and an interface ID. The routing prefix is obtained from the PGW. The Interface Identifier is automatically generated from the USB hardware address using the interface identifier in the modified EUI-64 format. The USB hardware address changes after the router reloads.

## Configuring Cellular IPv6 Address

To configure the cellular IPv6 address, perform these steps:

### SUMMARY STEPS

1. **configure terminal**
2. **ipv6 unicast-routing**
3. **interface Cellular {type| number}**
4. ip address negotiated
5. load-interval *seconds*
6. dialer in-band
7. dialer idle-timeout *seconds*
8. dialer-group *group-number*
9. no peer default ip address
10. ipv6 address autoconfig or ipv6 enable
11. **dialer-list dialer-group protocol protocol-name {permit | deny} list | access-list-number | access-group }**
12. **ipv6 route ipv6-prefix/prefix-length 128**
13. **End**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> Router# configure terminal	Enters global configuration mode.
<b>Step 2</b>	<b>ipv6 unicast-routing</b> <b>Example:</b> Router(config)# ipv6 unicast-routing	Enables forwarding of IPv6 unicast data packets.

	Command or Action	Purpose
Step 3	<b>interface Cellular {type   number}</b> <b>Example:</b> Router(config)# interface cellular 0/1/0	Specifies the cellular interface.
Step 4	<b>ip address negotiated</b> <b>Example:</b> Router(config-if)# ip address negotiated	Specifies that the IP address for a particular interface is dynamically obtained.
Step 5	<b>load-interval <i>seconds</i></b> <b>Example:</b> Router(config-if)# load-interval 30	Specifies the length of time for which data is used to compute load statistics.
Step 6	<b>dialer in-band</b> <b>Example:</b> Router(config-if)# dialer in-band	Enables DDR and configures the specified serial interface to use in-band dialing.
Step 7	<b>dialer idle-timeout <i>seconds</i></b> <b>Example:</b> Router(config-if)# dialer idle-timeout 0	Specifies the dialer idle timeout period.
Step 8	<b>dialer-group <i>group-number</i></b> <b>Example:</b> Router(config-if)# dialer-group 1	Specifies the number of the dialer access group to which the specific interface belongs.
Step 9	<b>no peer default ip address</b> <b>Example:</b> Router(config-if)# no peer default ip address	Removes the default address from your configuration.
Step 10	<b>ipv6 address autoconfig or ipv6 enable</b> <b>Example:</b> Router(config-if)# ipv6 address autoconfig or Router(config-if)# ipv6 enable	Enables automatic configuration of IPv6 addresses using stateless autoconfiguration on an interface and enables IPv6 processing on the interface.
Step 11	<b>dialer-list <i>dialer-group</i> protocol <i>protocol-name</i> {permit   deny} list   access-list-number   access-group }</b> <b>Example:</b> Router(config)# dialer-list 1 protocol ipv6 permit	Defines a dial-on-demand routing (DDR) dialer list for dialing by protocol or by a combination of a protocol and a previously defined access list.
Step 12	<b>ipv6 route <i>ipv6-prefix/prefix-length</i> 128</b> <b>Example:</b> Router(config)# ipv6 route 2001:1234:1234::3/128 Cellular0/1/0	

	Command or Action	Purpose
<b>Step 13</b>	<b>End</b> <b>Example:</b> Router(config-if)#end	Exits to global configuration mode.

### Examples

The following example shows the Cellular IPv6 configuration for NIM-LTEA-EA and NIM-LTEA-LA modules.

```
Router(config)# interface Cellular0/1/0
ip address negotiated
load-interval 30
dialer in-band
dialer idle-timeout 0
lte dialer-group 1
no peer default ip address
ipv6 address autoconfig
!
interface Cellular0/1/1
ip address negotiated
load-interval 30
dialer in-band
dialer idle-timeout 0
dialer-group 1
no peer default ip address
ipv6 address autoconfig
```

The following example shows the Cellular IPv6 configuration for P-LTEAP18-GL, P-LTEA-XX, and P-LTE-XX modules.

```
Router(config)# interface Cellular0/2/0
ip address negotiated
load-interval 30
dialer in-band
dialer idle-timeout 0
lte dialer-group 1
no peer default ip address
ipv6 enable
!
interface Cellular0/2/1
ip address negotiated
load-interval 30
dialer in-band
dialer idle-timeout 0
dialer-group 1
no peer default ip address
ipv6 enable
```





## CHAPTER 21

# Radio Aware Routing

Radio-Aware Routing (RAR) is a mechanism that uses radios to interact with the routing protocol OSPFv3 to signal the appearance, disappearance, and link conditions of one-hop routing neighbors.

In a large mobile networks, connections to the routing neighbors are often interrupted due to distance and radio obstructions. When these signals do not reach the routing protocols, protocol timers are used to update the status of a neighbor. Routing protocols have lengthy timer, which is not recommended in mobile networks.

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## Benefits of Radio Aware Routing

The Radio Aware Routing feature offers the following benefits:

- Provides faster network convergence through immediate recognition of changes.
- Enables routing for failing or fading radio links.
- Allows easy routing between line-of-sight and non-line-of-sight paths.
- Provides faster convergence and optimal route selection so that delay-sensitive traffic, such as voice and video, is not disrupted
- Provides efficient radio resources and bandwidth usage.
- Reduces impact on the radio links by performing congestion control in the router.
- Allows route selection based on radio power conservation.
- Enables decoupling of the routing and radio functionalities.
- Provides simple Ethernet connection to RFC 5578, R2CP, and DLEP compliant radios.

# Restrictions and Limitations

The Radio Aware Routing feature has the following restrictions and limitations:

- The DLEP and R2CP protocols are not supported on Cisco Catalyst 8300 Edge Platform.
- Multicast traffic is not supported in aggregate mode.
- Cisco High Availability (HA) technology is not supported.

# License Requirements

This feature is made available with the AppX license.

# System Components

The Radio Aware Routing (RAR) feature is implemented using the MANET (Mobile adhoc network) infrastructure comprising of different components such as PPPoE, Virtual multipoint interface (VMI), QoS, routing protocol interface and RAR protocols.

## Point-to-Point Protocol over Ethernet PPPoE or PPPoE

PPPoE is a well-defined communication mechanism between the client and the server. In the RAR implementation, radio takes the role of the PPPoE client and router takes the role of the PPPoE server. This allows a loose coupling of radio and router, while providing a well-defined and predictable communication mechanism.

As PPPoE is a session or a connection oriented protocol, it extends the point-to-point radio frequency (RF) link from an external radio to an IOS router.

## PPPoE Extensions

PPPoE extensions are used when the router communicates with the radio. In the Cisco IOS implementation of PPPoE, each individual session is represented by virtual access interface (connectivity to a radio neighbor) on which, QoS can be applied with these PPPoE extensions.

RFC5578 provides extensions to PPPoE to support credit-based flow control and session-based real time link metrics, which are very useful for connections with variable bandwidth and limited buffering capabilities (such as radio links).

## Virtual Multipoint Interface (VMI)

Though PPPoE Extensions provides the most of the setup to communicate between a router and a radio, VMI addresses the need to manage and translate events that higher layers (example, routing protocols) consume. In addition, VMI operates in the Bypass mode.

In Bypass mode, every Virtual Access Interface (VAI) representing a radio neighbor is exposed to routing protocols OSPFv3 and EIGRP, so that, the routing protocol directly communicates with the respective VAI for both unicast and multicast routing protocol traffic.

In Aggregate mode, VMI is exposed to the routing protocols (OSPF) so that the routing protocols can leverage VMI for their optimum efficiency. When the network neighbors are viewed as a collection of networks on a point-to-multipoint link with broadcast and multicast capability at VMI, VMI helps in aggregating the multiple virtual access interfaces created from PPPoE. VMI presents a single multi access layer 2 broadcast capable interface. The VMI layer handles re-directs unicast routing protocol traffic to the appropriate P2P link (Virtual-Access interface), and replicates any Multicast/Broadcast traffic that needs to flow. Since the routing protocol communicates to a single interface, the size of the topology database is reduced, without impacting the integrity of the network.

## QoS Provisioning on PPPoE Extension Session

The following example describes QoS provisioning on PPPoE extension session:

```
policy-map rar_policer
  class class-default
    police 10000 2000 1000 conform-action transmit exceed-action drop violate-action drop
policy-map rar_shaper
  class class-default
    shape average percent 1

interface Virtual-Template2
  ip address 192.0.2.7 255.255.255.0
  no peer default ip address
  no keepalive
  service-policy input rar_policer
end
```

## Example: Configuring the RAR Feature in Bypass Mode

The following example is an end-to-end configuration of RAR in the bypass mode:



**Note** Before you begin the RAR configuration, you must first configure the **subscriber authorization enable** command to bring up the RAR session. Without enabling authorization, the Point-to-Point protocol does not recognize this as a RAR session and may not tag *manet\_radio* in presentation of a PPPoE Active Discovery Initiate (PADI). By default, bypass mode does not appear in the configuration. It appears only if the mode is configured as bypass.

### Configure a Service for RAR

```
policy-map type service rar-lab
  pppoe service manet_radio //note: Enter the pppoe service policy name as manet_radio
!
```

### Configure Broadband

```
bba-group pppoe VMI2
  virtual-template 2
  service profile rar-lab
!
interface GigabitEthernet0/0/0
```

```
description Connected to Client1
negotiation auto
pppoe enable group VMI2
!
```

### Configure a Service for RAR

```
policy-map type service rar-lab
  pppoe service manet_radio //note: Enter the pppoe service policy name as manet_radio
!
```

### Configuration in Bypass Mode

- IP Address Configured under Virtual-Template Explicitly

```
interface Virtual-Template2
ip address 192.0.2.7 255.255.255.0
no ip redirects
peer default ip address pool PPPoEpool2
ipv6 enable
ospfv3 1 network manet
ospfv3 1 ipv4 area 0
ospfv3 1 ipv6 area 0
no keepalive
service-policy input rar_policer Or/And
service-policy output rar_shaper
```

- VMI Unnumbered Configured under Virtual Template

```
interface Virtual-Template2
ip unnumbered vmi2
no ip redirects
peer default ip address pool PPPoEpool2
ipv6 enable
ospfv3 1 network manet
ospfv3 1 ipv4 area 0
ospfv3 1 ipv6 area 0
no keepalive
service-policy input rar_policer Or/And
service-policy output rar_shaper
```

### Configure the Virtual Multipoint Interface in Bypass Mode

```
interface vmi2 //configure the virtual multi interface
ip address 192.0.2.5 255.255.255.0
physical-interface GigabitEthernet0/0/0
mode bypass

interface vmi3//configure the virtual multi interface
ip address 192.0.2.6 255.255.255.0
physical-interface GigabitEthernet0/0/1
mode bypass
```

### Configure OSPF Routing

```
router ospfv3 1
router-id 192.0.2.1
```

```

!
address-family ipv4 unicast
  redistribute connected metric 1 metric-type 1
  log-adjacency-changes
exit-address-family
!
address-family ipv6 unicast
  redistribute connected metric-type 1
  log-adjacency-changes
exit-address-family
!
ip local pool PPPoEpool12 192.0.2.8 192.0.2.4

```

## Example: Configuring the RAR Feature in Aggregate Mode

The following example is an end-to-end configuration of RAR in the aggregate mode:




---

**Note** Before you begin the RAR configuration, you must first configure the **subscriber authorization enable** command to bring up the RAR session. Without enabling authorization, the Point-to-Point protocol does not recognize this as a RAR session and may not tag *manet\_radio* in PADI.

---

### Configure a Service for RAR

```

policy-map type service rar-lab
  pppoe service manet_radio //note: Enter the pppoe service policy name as manet_radio
!

```

### Configure Broadband

```

bba-group pppoe VMI2
  virtual-template 2
  service profile rar-lab

!
interface GigabitEthernet0/0/0
  description Connected to Client1
  negotiation auto
  pppoe enable group VMI2

!

```

### Configure a Service for RAR

```

policy-map type service rar-lab
  pppoe service manet_radio //note: Enter the pppoe service policy name as manet_radio
!

```

### Configuration in Aggregate Mode

```

interface Virtual-Template2
  ip unnumbered vmi2
  no ip redirects

```

```
no peer default ip address
ipv6 enable
no keepalive
service-policy input rar_policer Or/And
service-policy output rar_shaper
```

### Configure the Virtual Multipoint Interface in Aggregate Mode

```
interface vmi2 //configure the virtual multi interface
ip address 192.0.2.8 255.255.255.0
physical-interface GigabitEthernet0/0/0
mode aggregate

interface vmi3//configure the virtual multi interface
ip address 192.0.2.4 255.255.255.0
no ip redirects
no ip split-horizon eigrp 1
physical-interface GigabitEthernet0/0/1
mode aggregate
```

### Configure OSPF Routing

```
router ospfv3 1
router-id 192.0.2.1
!
address-family ipv4 unicast
redistribute connected metric 1 metric-type 1
log-adjacency-changes
exit-address-family
!
address-family ipv6 unicast
redistribute connected metric-type 1
log-adjacency-changes
exit-address-family
!
ip local pool PPPoEpool2 192.0.2.4 192.0.2.8
ip local pool PPPoEpool3 192.0.2.6 192.0.2.2
```

## Verifying RAR Session Details

To retrieve RAR session details, use the following show commands:

```
Router#show pppoe session packets all
Total PPPoE sessions 2

session id: 9
local MAC address: 006b.f10e.a5e0, remote MAC address: 0050.56bc.424a
virtual access interface: Vi2.1, outgoing interface: Gi0/0/0
    1646 packets sent, 2439363 received
    176216 bytes sent, 117250290 received

PPPoE Flow Control Stats
Local Credits: 65535 Peer Credits: 65535 Local Scaling Value 64 bytes
Credit Grant Threshold: 28000 Max Credits per grant: 65535
Credit Starved Packets: 0
PADG xmit Seq Num: 32928 PADG Timer index: 0
PADG last rcvd Seq Num: 17313
```

```

PADG last nonzero Seq Num: 17306
PADG last nonzero rcvd amount: 2
PADG Timers: (ms)  [0]-1000  [1]-2000  [2]-3000  [3]-4000  [4]-5000
PADG xmit: 33308  rcvd: 17313
PADG rcvd: 17313  rcvd: 19709
In-band credit pkt xmit: 7  rcvd: 2434422
Last credit packet snapshot
  PADG xmit: seq_num = 32928, fcn = 0, bcn = 65535
  PADG rcvd: seq_num = 32928, fcn = 65535, bcn = 65535
  PADG rcvd: seq_num = 17313, fcn = 0, bcn = 65535
  PADG xmit: seq_num = 17313, fcn = 65535, bcn = 65535
  In-band credit pkt xmit: fcn = 61, bcn = 65533
  In-band credit pkt rcvd: fcn = 0, bcn = 65534
  ==== PADQ Statistics ====
  PADQ xmit: 0  rcvd: 0

```

```

session id: 10
local MAC address: 006b.f10e.a5e1, remote MAC address: 0050.56bc.7dcb
virtual access interface: Vi2.2, outgoing interface: Gi0/0/1
  1389302 packets sent, 1852 received
  77869522 bytes sent, 142156 received

```

```

PPPoE Flow Control Stats
Local Credits: 65535  Peer Credits: 65535  Local Scaling Value 64 bytes
Credit Grant Threshold: 28000  Max Credits per grant: 65535
Credit Starved Packets: 0
PADG xmit Seq Num: 18787  PADG Timer index: 0
PADG last rcvd Seq Num: 18784
PADG last nonzero Seq Num: 18768
PADG last nonzero rcvd amount: 2
PADG Timers: (ms)  [0]-1000  [1]-2000  [2]-3000  [3]-4000  [4]-5000
PADG xmit: 18787  rcvd: 18784
PADG rcvd: 18784  rcvd: 18787
In-band credit pkt xmit: 1387764  rcvd: 956
Last credit packet snapshot
  PADG xmit: seq_num = 18787, fcn = 0, bcn = 65535
  PADG rcvd: seq_num = 18787, fcn = 65535, bcn = 65535
  PADG rcvd: seq_num = 18784, fcn = 0, bcn = 65535
  PADG xmit: seq_num = 18784, fcn = 65535, bcn = 65535
  In-band credit pkt xmit: fcn = 0, bcn = 64222
  In-band credit pkt rcvd: fcn = 0, bcn = 65534
  ==== PADQ Statistics ====
  PADQ xmit: 0  rcvd: 1

```

**Router#show pppoe session packets**

Total PPPoE sessions 2

SID	Pkts-In	Pkts-Out	Bytes-In	Bytes-Out
9	2439391	1651	117252098	176714
10	1858	1389306	142580	77869914

**Router#show vmi counters**

Interface vmi2: - Last Clear Time =

Input Counts:

```

Process Enqueue      =          0 (VMI)
Fastswitch           =          0
VMI Punt Drop:
  Queue Full         =          0

```

Output Counts:

```

Transmit:
  VMI Process DQ =          4280
  Fastswitch VA  =           0
  Fastswitch VMI =           0
Drops:
  Total          =           0
  QOS Error      =           0
  VMI State Error =           0
  Mcast NBR Error =           0
  Ucast NBR Error =           0
Interface vmi3: - Last Clear Time =

Input Counts:
  Process Enqueue =           0 (VMI)
  Fastswitch      =           0
  VMI Punt Drop:
    Queue Full    =           0

Output Counts:
  Transmit:
    VMI Process DQ =          2956
    Fastswitch VA  =           0
    Fastswitch VMI =           0
  Drops:
    Total          =           0
    QOS Error      =           0
    VMI State Error =           0
    Mcast NBR Error =           0
    Ucast NBR Error =           0
Interface vmi4: - Last Clear Time =

Input Counts:
  Process Enqueue =           0 (VMI)
  Fastswitch      =           0
  VMI Punt Drop:
    Queue Full    =           0

Output Counts:
  Transmit:
    VMI Process DQ =           0
    Fastswitch VA  =           0
    Fastswitch VMI =           0
  Drops:
    Total          =           0
    QOS Error      =           0
    VMI State Error =           0
    Mcast NBR Error =           0
    Ucast NBR Error =           0
Router#

Router#show vmi neighbor details
1 vmi2 Neighbors
  1 vmi3 Neighbors
  0 vmi4 Neighbors
  2 Total Neighbors

vmi2  IPV6 Address=FE80::21E:E6FF:FE43:F500
      IPV6 Global Addr:::
      IPV4 Address=192.0.2.6, Uptime=05:15:01
      Output pkts=89, Input pkts=0
      No Session Metrics have been received for this neighbor.
      Transport PPPoE, Session ID=9
      INTERFACE STATS:

```



```

    VMI Interface=vmi2,
      Input qcount=0, drops=0, Output qcount=0, drops=0
    V-Access intf=Virtual-Access2.1,
      Input qcount=0, drops=0, Output qcount=0, drops=0
    Physical intf=GigabitEthernet0/0/0,
      Input qcount=0, drops=0, Output qcount=0, drops=0

PPPoE Flow Control Stats
Local Credits: 65535 Peer Credits: 65535 Local Scaling Value 64 bytes
Credit Grant Threshold: 28000 Max Credits per grant: 65535
Credit Starved Packets: 0
PADG xmit Seq Num: 33038 PADG Timer index: 0
PADG last rcvd Seq Num: 17423
PADG last nonzero Seq Num: 17420
PADG last nonzero rcvd amount: 2
PADG Timers: (ms) [0]-1000 [1]-2000 [2]-3000 [3]-4000 [4]-5000
PADG xmit: 33418 rcvd: 17423
PADG xmit: 17423 rcvd: 19819
In-band credit pkt xmit: 7 rcvd: 2434446
Last credit packet snapshot
  PADG xmit: seq_num = 33038, fcn = 0, bcn = 65535
  PADG rcvd: seq_num = 33038, fcn = 65535, bcn = 65535
  PADG rcvd: seq_num = 17423, fcn = 0, bcn = 65535
  PADG xmit: seq_num = 17423, fcn = 65535, bcn = 65535
  In-band credit pkt xmit: fcn = 61, bcn = 65533
  In-band credit pkt rcvd: fcn = 0, bcn = 65534
  ==== PADQ Statistics ====
  PADQ xmit: 0 rcvd: 0

vmi3 IPV6 Address=FE80::21E:7AFF:FE68:6100
IPV6 Global Addr=:
IPV4 Address=192.0.2.10, Uptime=05:14:55
Output pkts=6, Input pkts=0
METRIC DATA: Total rcvd=1, Avg arrival rate (ms)=0
  CURRENT: MDR=128000 bps, CDR=128000 bps
             Lat=0 ms, Res=100, RLQ=100, load=0
  MDR Max=128000 bps, Min=128000 bps, Avg=128000 bps
  CDR Max=128000 bps, Min=128000 bps, Avg=128000 bps
  Latency Max=0, Min=0, Avg=0 (ms)
  Resource Max=100%, Min=100%, Avg=100%
  RLQ Max=100, Min=100, Avg=100
  Load Max=0%, Min=0%, Avg=0%
Transport PPPoE, Session ID=10
INTERFACE STATS:
  VMI Interface=vmi3,
    Input qcount=0, drops=0, Output qcount=0, drops=0
  V-Access intf=Virtual-Access2.2,
    Input qcount=0, drops=0, Output qcount=0, drops=0
  Physical intf=GigabitEthernet0/0/1,
    Input qcount=0, drops=0, Output qcount=0, drops=0

PPPoE Flow Control Stats
Local Credits: 65535 Peer Credits: 65535 Local Scaling Value 64 bytes
Credit Grant Threshold: 28000 Max Credits per grant: 65535
Credit Starved Packets: 0
PADG xmit Seq Num: 18896 PADG Timer index: 0
PADG last rcvd Seq Num: 18894
PADG last nonzero Seq Num: 18884
PADG last nonzero rcvd amount: 2
PADG Timers: (ms) [0]-1000 [1]-2000 [2]-3000 [3]-4000 [4]-5000
PADG xmit: 18896 rcvd: 18894
PADG xmit: 18894 rcvd: 18896
In-band credit pkt xmit: 1387764 rcvd: 961

```

```

Last credit packet snapshot
PADG xmit: seq_num = 18896, fcn = 0, bcn = 65535
PADG rcvd: seq_num = 18896, fcn = 65535, bcn = 65535
PADG rcvd: seq_num = 18894, fcn = 0, bcn = 65535
PADG xmit: seq_num = 18894, fcn = 65535, bcn = 65535
In-band credit pkt xmit: fcn = 0, bcn = 64222
In-band credit pkt rcvd: fcn = 0, bcn = 65534
==== PADQ Statistics ====
PADQ xmit: 0 rcvd: 1

```

```
Router#show vmi neighbor details vmi 2
```

```
1 vmi2 Neighbors
```

```

vmi2  IPV6 Address=FE80::21E:E6FF:FE43:F500
      IPV6 Global Addr:::
      IPV4 Address=192.0.2.4, Uptime=05:16:03
      Output pkts=89, Input pkts=0
      No Session Metrics have been received for this neighbor.
      Transport PPPoE, Session ID=9
      INTERFACE STATS:
        VMI Interface=vmi2,
          Input qcount=0, drops=0, Output qcount=0, drops=0
        V-Access intf=Virtual-Access2.1,
          Input qcount=0, drops=0, Output qcount=0, drops=0
        Physical intf=GigabitEthernet0/0/0,
          Input qcount=0, drops=0, Output qcount=0, drops=0

```

```
PPPoE Flow Control Stats
```

```

Local Credits: 65535 Peer Credits: 65535 Local Scaling Value 64 bytes
Credit Grant Threshold: 28000 Max Credits per grant: 65535
Credit Starved Packets: 0
PADG xmit Seq Num: 33100 PADG Timer index: 0
PADG last rcvd Seq Num: 17485
PADG last nonzero Seq Num: 17449
PADG last nonzero rcvd amount: 2
PADG Timers: (ms) [0]-1000 [1]-2000 [2]-3000 [3]-4000 [4]-5000
PADG xmit: 33480 rcvd: 17485
PADG rcvd: 17485 rcvd: 19881
In-band credit pkt xmit: 7 rcvd: 2434460
Last credit packet snapshot
PADG xmit: seq_num = 33100, fcn = 0, bcn = 65535
PADG rcvd: seq_num = 33100, fcn = 65535, bcn = 65535
PADG rcvd: seq_num = 17485, fcn = 0, bcn = 65535
PADG xmit: seq_num = 17485, fcn = 65535, bcn = 65535
In-band credit pkt xmit: fcn = 61, bcn = 65533
In-band credit pkt rcvd: fcn = 0, bcn = 65534
==== PADQ Statistics ====
PADQ xmit: 0 rcvd: 0

```

```
Router#show platform hardware qfp active feature ess session
```

```

Current number sessions: 2
Current number TC flow: 0
Feature Type: A=Accounting D=Policing(DRL) F=FFR M=DSCP Marking L=L4redirect P=Portbundle
T=TC

```

Session	Type	Segment1	SegType1	Segment2	SegType2	Feature	Other
21	PPP	0x0000001500001022	PPPOE	0x0000001500002023	LTERM	-----	
24	PPP	0x0000001800003026	PPPOE	0x0000001800004027	LTERM	-----	

```

Router#show platform software subscriber pppoe_fctl evsi 21
PPPoE Flow Control Stats
Local Credits: 65535 Peer Credits: 65535 Local Scaling Value 64 bytes
Credit Grant Threshold: 28000 Max Credits per grant: 65535
Credit Starved Packets: 0
PADG xmit Seq Num: 33215 PADG Timer index: 0
PADG last rcvd Seq Num: 17600
PADG last nonzero Seq Num: 17554
PADG last nonzero rcvd amount: 2
PADG Timers: (ms) [0]-1000 [1]-2000 [2]-3000 [3]-4000 [4]-5000
PADG xmit: 33595 rcvd: 17600
PADC xmit: 17600 rcvd: 19996
In-band credit pkt xmit: 7 rcvd: 2434485
Last credit packet snapshot
PADG xmit: seq_num = 33215, fcn = 0, bcn = 65535
PADC rcvd: seq_num = 33215, fcn = 65535, bcn = 65535
PADG rcvd: seq_num = 17600, fcn = 0, bcn = 65535
PADC xmit: seq_num = 17600, fcn = 65535, bcn = 65535
In-band credit pkt xmit: fcn = 61, bcn = 65533
In-band credit pkt rcvd: fcn = 0, bcn = 65534

BQS buffer statistics
Current packets in BQS buffer: 0
Total en-queue packets: 0 de-queue packets: 0
Total dropped packets: 0

Internal flags: 0x0

```

```

Router#show platform hardware qfp active feature ess session id 21
Session ID: 21

EVSI type: PPP
SIP Segment ID: 0x1500001022
SIP Segment type: PPPOE
FSP Segment ID: 0x1500002023
FSP Segment type: LTERM
QFP if handle: 16
QFP interface name: EVSI21
SIP TX Seq num: 0
SIP RX Seq num: 0
FSP TX Seq num: 0
FSP RX Seq num: 0
Condition Debug: 0x00000000
session

```

```

Router#show ospfv3 neighbor

```

```

OSPFv3 1 address-family ipv4 (router-id 192.0.2.3)
Neighbor ID Pri State Dead Time Interface ID Interface
192.0.2.1 0 FULL/ - 00:01:32 19 Virtual-Access2.1

OSPFv3 1 address-family ipv6 (router-id 192.0.2.3)
Neighbor ID Pri State Dead Time Interface ID Interface
192.0.2.1 0 FULL/ - 00:01:52 19 Virtual-Access2.1
Router#

```

```
Router#sh ip route
```

```
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
a - application route
+ - replicated route, % - next hop override, p - overrides from PfR
```

```
Gateway of last resort is not set
```

```

          192.0.2.8/8 is variably subnetted, 3 subnets, 2 masks
C          192.0.2.5/24 is directly connected, Virtual-Access2.1
O          192.0.2.6/32 [110/1] via 192.0.2.22, 00:00:03, Virtual-Access2.1
L          192.0.2.7/32 is directly connected, Virtual-Access2.1
          192.0.2.12/32 is subnetted, 1 subnets
C          192.0.2.20 is directly connected, Virtual-Access2.1
```

## Troubleshooting Radio Aware Routing

To troubleshoot the RAR, use the following debug commands:

- **debug pppoe errors**
- **debug pppoe events**
- **debug ppp error**
- **debug vmi error**
- **debug vmi neighbor**
- **debug vmi packet**
- **debug vmi pppoe**
- **debug vmi registries**
- **debug vmi multicast**
- **debug vtemplate cloning**
- **debug vtemplate event**
- **debug vtemplate error**
- **debug plat hard qfp ac feature subscriber datapath pppoe detail**



## CHAPTER 22

# Configuring Voice Functionality

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This chapter provides information about configuring the voice functionality in the Cisco Catalyst 8000 Edge Platforms.

This chapter includes these sections:

- [Call Waiting, on page 323](#)
- [Feature Group D Configuration, on page 323](#)
- [Media and Signaling Authentication and Encryption, on page 325](#)
- [Multicast Music-on-Hold, on page 325](#)
- [TLS 1.2 support on SCCP Gateways, on page 326](#)

## Call Waiting

With the Call Waiting feature, you can receive a second call while you are on the phone attending to another call. When you receive a second call, you hear a call-waiting tone (a tone with a 300 ms duration). Caller ID appears on phones that support caller ID. You can use hookflash to answer a waiting call and place the previously active call on hold. By using hookflash, you can toggle between the active and a call that is on hold. If the Call Waiting feature is disabled, and you hang up the current call, the second call will hear a busy tone. For more information on Call Waiting, see the <https://www.cisco.com/c/en/us/td/docs/ios-xml/ios/voice/sip/configuration/15-mt/sip-config-15-mt-book/voi-sip-hookflash.html>

## Call Transfers

Call transfers are when active calls are put on hold while a second call is established between two users. After you establish the second call and terminate the active call, the call on hold will hear a ringback. The Call Transfer feature supports all three types of call transfers—blind, semi-attended, and attended.

## Feature Group D Configuration

To configure the Feature Group D signaling, perform these steps:

**Before you begin**

Feature Group D service is a trunk side connection that enables telephone customers to choose their long distance network and use the same number of digits irrespective of carrier they use. Routers interface with interexchange carriers using Feature Group D to support voice traffic in the carrier environment.

Before you attempt this configuration, ensure that you meet these prerequisites:

- The platform must be using Digital T1/E1 Packet Voice Trunk Network Modules.
- The Digital T1/E1 Packet Voice Trunk Network Module can have one or two slots for voice/WAN Interface Network Modules (NIMs); NIM supports one to eight ports. Only the dual-mode (voice/WAN) multiple trunk cards are supported in the digital E1 packet voice trunk network module, not older VICs.
- Drop-and-Insert capability is supported only between two ports on the same multiple card.

**SUMMARY STEPS**

1. **configure terminal** *{ip-address | interface-type interface-number [ip-address]}*
2. **voice-card slot/subslot**
3. **controller T1/E1 slot/subslot/port**
4. **framing** *{sf | esf }*
5. **linecode** *{b8zs | ami}*
6. **ds0-group ds0-group-notimeslots timeslot-list type{e&m-fgd | fgd-eana}**
7. **no shutdown**
8. **exit**

**DETAILED STEPS**

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <i>{ip-address   interface-type interface-number [ip-address]}</i>  <b>Example:</b>  Router(config)# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	<b>voice-card slot/subslot</b>  <b>Example:</b>  Router(config)# <b>voice-card slot/subslot</b>	Enters voice card interface configuration mode and specify the slot location by using a value from 0 to 5, depending upon your router.
<b>Step 3</b>	<b>controller T1/E1 slot/subslot/port</b>  <b>Example:</b>  Router(config)# <b>controller T1 slot/subslot/port</b>	Enters controller configuration mode for the T1 controller at the specified slot/port location. Valid values for slot and port are 0 and 1.
<b>Step 4</b>	<b>framing</b> <i>{sf   esf }</i>  <b>Example:</b>  Router(config)# <b>framing {sf   esf}</b>	Sets the framing according to your service provider's instructions. Choose Extended Superframe (ESF) format or Superframe (SF) format.

	Command or Action	Purpose
Step 5	<code>linecode {b8zs   ami}</code>	Sets the line encoding according to your service provider's instructions. Bipolar-8 zero substitution (B8ZS) encodes a sequence of eight zeros in a unique binary sequence to detect line coding violations. Alternate mark inversion (AMI) represents zeros using a 01 during each bit cell, and ones are represented by 11 or 00, alternately, during each bit cell. AMI requires that the sending device maintain ones density. Ones density is not maintained independent of the data stream.
Step 6	<code>ds0-group ds0-group-notimeslots timeslot-list type{e&amp;m-fgd   fgd-eana}</code>	Defines the T1 channels for use by compressed voice calls as well as the signaling method the router uses to connect to the PBX or CO. ds0-group-no is a value from 0 to 23 that identifies the DS0 group. Note The ds0-group command automatically creates a logical voice port that is numbered as follows: slot/port.ds0-group-no. Although only one voice port is created, applicable calls are routed to any channel in the group. timeslot-list is a single number, numbers separated by commas, or a pair of numbers separated by a hyphen to indicate a range of timeslots. For T1, allowable values are from 1 to 24. To map individual DS0 timeslots, define additional groups. The system maps additional voice ports for each defined group. The signaling method selection for type depends on the connection that you are making. The e&m-fgd setting allows E&M interface connections for PBX trunk lines (tie lines) and telephone equipment to use feature group D switched-access service. The fgd-eana setting supports the exchange access North American (EANA) signaling.
Step 7	<code>no shutdown</code>	Activates the controller.
Step 8	<code>exit</code>	Exits controller configuration mode. Skip the next step if you are not setting up Drop and Insert .

## Media and Signaling Authentication and Encryption

The Media and Signaling Authentication and Encryption Feature for Cisco IOS MGCP Gateways feature implements voice security features that include signaling authentication along with media and signaling encryption on MGCP gateways. For more information on Media and Signaling Authentication and Encryption Feature, see the <http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/voice/mgcp/configuration/15-mt/vm-15-mt-book/vm-gw-med-sig.html>

## Multicast Music-on-Hold

The Music-on-Hold (MOH) feature enables you to subscribe to a music streaming service when you are using a Cisco IOS MGCP voice gateway. Music streams from an MOH server to the voice interfaces of on-net and

off-net callers that have been placed on hold. Cisco Communications Manager supports the capability to place callers on hold with music supplied from a streaming multicast MOH server.

By means of a preconfigured multicast address on the Cisco Unified Communications Manager or gateway, the gateway can "listen" for Real-Time Transport Protocol (RTP) packets that are broadcast from a default router in the network and can relay the packets to designated voice interfaces in the network. You can initiate the call on hold. However, you cannot initiate music on hold on a MGCP controlled analog phone. Whenever a called party places a calling party on hold, Cisco Communications Manager requests the MOH server to stream RTP packets to the "on-hold" interface through the preconfigured multicast address. In this way, RTP packets are relayed to appropriately configured voice interfaces that have been placed on hold. When you configure a multicast address on a gateway, the gateway sends an Internet Gateway Management Protocol (IGMP) "join" message to the default router, indicating to the default router that the gateway is ready to receive RTP multicast packets.

Multiple MOH servers can be present in the same network, but each server must have a different Class D IP address, and the address must be configured in Cisco Communications Manager and the MGCP voice gateways. For more information on configuring MOH, see the <http://www.cisco.com/c/en/us/td/docs/ios-xml/ios/voice/cminterop/configuration/15-0m/vc-15-0m-book/vc-ucm-mgcp-gw.html#GUID-A3461142-2F05-4420-AEE6-032FCA3B7952>

## TLS 1.2 support on SCCP Gateways

The TLS 1.2 support on SCCP Gateways feature details the configuration of TLS 1.2 on SCCP protocol for digital signal processor (DSP) farm including Unicast conference bridge

(CFB), Media Termination Point (MTP), and SCCP telephony control (STC) application (STCAPP).

DSP on gateways can be used as media resources for transrating or transcoding. Each media resource uses Secure Skinny Client Control Protocol (SCCP) to communicate with Cisco Unified Communications Manager. Currently SSL 3.1, which is equivalent to TLS1.0, is used for sending secure signals. This feature enhances the support to TLS 1.2. From Cisco IOS XE Cupertino 17.7.1a, TLS 1.2 is enhanced to support the Next-Generation Encryption (NGE) cipher suites.



**Note** Cisco Unified Communications Manager (CUCM) Version 14SU2 has been enhanced to support Secured SCCP gateways with the Subject Name field (CN Name) with or without colons, for example, AA:22:BB:44:55 or AA22BB4455.

CUCM checks the CN field of the incoming certificate from the SCCP Gateway and verifies it against the DeviceName configured in CUCM for this gateway. DeviceName contains MAC address of the gateway. CUCM converts the MAC address in the DeviceName to MAC address with colons (for example: AA:22:BB:44:55) and validates with the CN name in the Gateway's certificate. Therefore, CUCM mandates Gateway to use MAC address with colons for the CN field in the certificate, that is, subject name.

Due to new guidelines from Defense Information Systems Agency (DISA), it is a requirement not to use colons for the subject name field CN. For example, AA22BB4455.

### SCCP TLS connection

CiscoSSL is based on OpenSSL. SCCP uses CiscoSSL to secure the communication signals.



If a resource is configured in the secure mode, the SCCP application initiates a process to complete Transport Layer Security (TLS) handshaking. During the handshake, the server sends information to CiscoSSL about the TLS version and cipher suites supported. Previously, only SSL3.1 was supported for SCCP secure signalling. SSL3.1 is equivalent to TLS 1.0. The TLS 1.2 Support feature introduces TLS1.2 support to SCCP secure signalling.

After TLS handshaking is complete, SCCP is notified and SCCP kills the process.

If the handshaking is completed successfully, a REGISTER message is sent to Cisco Unified Communications Manager through the secure tunnel. If handshaking fails and a retry is needed, a new process is initiated.



---

**Note** For SCCP-based signalling, only TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA cipher suite is supported.

---

### Cipher Suites

For SCCP-based signaling, TLS\_RSA\_WITH\_AES\_128\_CBC\_SHA cipher suite is supported.

From Cisco IOS XE Cupertino 17.7.1a, the following NGE cipher suites are also supported:

- ECDHE-RSA-AES128-GCM-SHA256
- ECDHE-RSA-AES256-GCM-SHA384

These cipher suites enable secure voice signaling for both the STCAPP analog phone and the SCCP DSPFarm conferencing service. The cipher suite selection is negotiated between gateway and CUCM.

The following prerequisites are applicable for using NGE cipher suites:

- Configure TLS 1.2. For more information, see [Configuring TLS Version for STC application, on page 327](#).
- Use CUCM Release 14.1 SU1 or later, and Voice Gateways or platforms that support TLS 1.2.
- From the CUCM Web UI, navigate to **Cipher Management** and set the **CIPHER switch** as NGE. For more information, see [Cipher Management](#).

For more information about verifying cipher suites, see [Verifying TLS Version and Cipher Suites, on page 328](#).

For the SRTP-encrypted media, you can use higher-grade cipher suites - AEAD-AES-128-GCM or AEAD-AES-256-GCM. The selection of these cipher suites is automatically negotiated between GW and CUCM for both secure analog voice and hardware conference bridge voice media. Authenticated Encryption with Associated Data (AEAD) ciphers simultaneously provide confidentiality, integrity, and authenticity, without built-in SHA algorithms to validate message integrity.

### Supported Platforms

The TLS 1.2 support on the SCCP Gateways feature is supported on the following platforms:

- Cisco Catalyst 8200 and 8300 Series Edge Platforms

### Configuring TLS Version for STC application

Perform the following task to configure a TLS version for the STC application:

```
enable
configure terminal
stcapp security tls-version v1.2
exit
```




---

**Note** The `stcapp security tls` command sets the TLS version to v.1.0, v1.1, or v1.2 only. If not configured explicitly, TLS v1.0 is selected by default.

---

### Configuring TLS Version in Secure Mode for DSP Farm Profile

Perform the following task to configure the TLS version in secure mode for DSP farm profile:

```
enable
configure terminal
dspfarm profile 7 conference security
    tls-version v1.2
exit
```




---

**Note** Note: The `tls` command can be configured only in security mode.

---

### Verifying TLS Version and Cipher Suites

Perform the following task to verify the TLS version and cipher suite:

```
# show dspfarm profile 100
Dspfarm Profile Configuration

Profile ID = 100, Service = CONFERENCING, Resource ID = 2
Profile Service Mode : secure
Trustpoint : Overlord_DSPFarm_GW
TLS Version   : v1.2
TLS Cipher    : ECDHE-RSA-AES256-GCM-SHA384
Profile Admin State : UP
Profile Operation State : ACTIVE
Application : SCCP   Status : ASSOCIATED
Resource Provider : FLEX_DSPRM   Status : UP
Total Number of Resources Configured : 10
Total Number of Resources Available : 10
Total Number of Resources Out of Service : 0
Total Number of Resources Active : 0
Maximum conference participants : 8
Codec Configuration: num_of_codecs:6
Codec : g711ulaw, Maximum Packetization Period : 30 , Transcoder: Not Required
Codec : g711alaw, Maximum Packetization Period : 30 , Transcoder: Not Required
Codec : g729ar8, Maximum Packetization Period : 60 , Transcoder: Not Required
Codec : g729abr8, Maximum Packetization Period : 60 , Transcoder: Not Required
Codec : g729r8, Maximum Packetization Period : 60 , Transcoder: Not Required
Codec : g729br8, Maximum Packetization Period : 60 , Transcoder: Not Required
```

### Verifying STCAPP Application TLS Version

Perform the following tasks to verify TLS version of the STCAPP application:

```
Device# show call application voice stcapp
App Status: Active
CCM Status: UP
```

```

CCM Group: 120
Registration Mode: CCM
Total Devices: 0
Total Calls in Progress: 0
Total Call Legs in Use: 0
ROH Timeout: 45
TLS Version: v1.2

# show stcapp dev voice 0/1/0
Port Identifier: 0/1/0
Device Type:      ALG
Device Id:        585
Device Name:      ANB3176C85F0080
Device Security Mode : Encrypted
  TLS version      : TLS version 1.2
  TLS cipher       : ECDHE-RSA-AES256-GCM-SHA384
Modem Capability: None
Device State:     IS
Diagnostic:       None
Directory Number: 80010
Dial Peer(s):    100
Dialtone after remote onhook feature: activated
Busytone after remote onhook feature: not activated
Last Event:      STCAPP_CC_EV_CALL_MODIFY_DONE
Line State:      ACTIVE
Line Mode:       CALL_CONF
Hook State:      OFFHOOK
mwi:             DISABLE
vmwi:           OFF
mwi config:     Both
Privacy:         Not configured
HG Status:       Unknown
PLAR:           DISABLE
Callback State:  DISABLED
CWT Repetition Interval: 0 second(s) (no repetition)
Number of CCBs:  1
Global call info:
  Total CCB count      = 3
  Total call leg count = 6

Call State for Connection 2 (ACTIVE): TsConnected
Connected Call Info:
  Call Reference: 33535871
  Call ID (DSP): 187
  Local IP Addr: 198.51.100.2
  Local IP Port: 8234
  Remote IP Addr: 198.51.100.20
  Remote IP Port: 8154
  Calling Number: 80010
  Called Number:
  Codec:          g711ulaw
  SRTP:          on
  RX Cipher:     AEAD_AES_256_GCM
  TX Cipher:     AEAD_AES_256_GCM

```

Perform the following task to verify the sRTP cipher suite for the DSPfarm connection.

```
# show sccp connection detail
```

```

bridge-info(bid, cid) - Normal bridge information(Bridge id, Calleg id)
mmbridge-info(bid, cid) - Mixed mode bridge information(Bridge id, Calleg id)

sess_id  conn_id  call-id  codec  pkt-period  dtmf_method  type
bridge-info(bid, cid)  mmbridge-info(bid, cid)  srtp_cryptosuite  dscp

```

```

                call_ref  spid      conn_id_tx
16778224 -      125      N/A      N/A      rfc2833_pthru  confmsp  All RTPSPI
  Callegs  All MM-MSP Callegs  N/A      N/A
-      -      -
16778224 16777232 126      g711u   20      rfc2833_pthru  s- rtpspi  (101,125)
          N/A      AEAD_AES_256_GCM 184
          30751576 16777219 -
16778224 16777231 124      g711u   20      rfc2833_pthru  s- rtpspi  (100,125)
          N/A      AEAD_AES_256_GCM 184
          30751576 16777219 -

```

Total number of active session(s) 1, connection(s) 2, and callegs 3

### Verifying Call Information

To display call information for TDM and IVR calls stored in the Forwarding Plane Interface (FPI), use the **showvoipfpi calls** command. You can select a call ID and verify the cipher suite using the **show voip fpi calls confID call\_id\_number** command. In this example, cipher suite 6 is AES\_256\_GCM.

```

#show voip fpi calls
Number of Calls : 2
-----
      confID correlator   AcallID   BcallID           state           event
-----
          1           1           87           88   ALLOCATED  DETAIL_STAT_RSP
          21          21           89           90   ALLOCATED  DETAIL_STAT_RSP

#show voip fpi calls confID 1
-----
VoIP-FPI call entry details:
-----
Call Type       :          TDM_IP   confID         :          1
correlator      :          1         call_state      :          ALLOCATED
last_event      :  DETAIL_STAT_RSP  alloc_start_time :          1796860810
modify_start_time:          0   delete_start_time:          0
Media Type(SideA):          SRTP   cipher suite    :          6
-----
FPI State Machine Stats:
-----
create_req_call_entry_inserted          :          1
.....

```

**Table 37: Feature Information for TLS 1.2 support on SCCP Gateways**

Feature Name	Releases	Feature Information
Support for NGE Cipher Suites	Cisco IOS XE Cupertino 17.7.1a	This feature supports NGE cipher suites for secure voice signaling and secure media. These cipher suites are applicable for both the STCAPP analog phone and the SCCP DSPFarm conferencing service.



## CHAPTER 23

# Support for Software Media Termination Point

The Support for Software Media Termination Point (MTP) feature bridges the media streams between two connections, allowing Cisco Unified Communications Manager (CUCM) to relay the calls that are routed through SIP or H.323 endpoints through Skinny Client Control Protocol (SCCP) commands. These commands allow CUCM to establish an MTP for call signaling.

- [Finding Feature Information, on page 331](#)
- [Information About Support for Software Media Termination Point, on page 331](#)
- [Configuring Support for Software Media Termination Point, on page 332](#)
- [Verifying Software Media Termination Point Configuration , on page 336](#)
- [Feature Information for Support for Software Media Termination Point, on page 339](#)

## Finding Feature Information

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

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to <https://cfng.cisco.com/>. An account on Cisco.com is not required.

## Information About Support for Software Media Termination Point

This feature extends the software MTP support to the Cisco Unified Border Element (Enterprise). Software MTP is an essential component of large-scale deployments of Cisco UCM. This feature enables new capabilities so that the Cisco UBE can function as an Enterprise Edge Cisco Session Border Controller for large-scale deployments that are moving to SIP trunking.

## Prerequisites for Software Media Termination Point

- For the software MTP to function properly, codec and packetization must be configured the same way on both in call legs and out call legs.

## Restrictions for Software Media Termination Point

- RSVP Agent is not supported in software MTP.
- Software MTP for repacketization is not supported.
- Call Threshold is not supported for standalone software MTP.
- Per-call debugging is not supported.
- Multiple concurrent Synchronisation Sources (SSRCs) with the same destination IP and port are not supported.

## SRTP-DTMF Interworking

From Cisco IOS XE 17.10.1a, Secure Real-time Transport Protocol (SRTP) Dual-Tone Multi-Frequency (DTMF) interworking is supported with Software MTP in pass through mode. SMTP supports DTMF Interworking for nonsecure calls, and this feature adds support for SRTP DTMF interworking for secure calls.

CUCM support for this feature is expected to be implemented in a later release.

## Restrictions for SRTP-DTMF Interworking

- The SRTP-DTMF Interworking feature supports only the codec-passthrough format.
- The SRTP-DTMF Interworking feature does not support multiple concurrent Synchronised Sources (SSRCs) with the same destination IP and port.
- The calls that support SRTP-DTMF Interworking may have a minor performance impact as compared to calls supported on nonsecure DTMF interworking.

## Supported Platforms for SRTP-DTMF Interworking

From Cisco IOS XE 17.10.1a, the following platforms support SRTP DTMF interworking with SMTP:

- Cisco 4461 Integrated Services Router (ISR)
- Cisco Catalyst 8200 Edge Series Platforms
- Cisco Catalyst 8300 Edge Series Platforms
- Cisco Catalyst 8000V Edge Software

## Configuring Support for Software Media Termination Point

Perform the following tasks to enable and configure the support for Software Media Termination Point feature.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **sccp local** *interface-type interface-number* [**port** *port-number*]

4. **sccp ccm** {*ipv4-address* | *ipv6-address* | *dns*} **identifier** *identifier-number* [**port** *port-number*] **version** *version-number*
5. **sccp**
6. **sccp ccm group** *group-number*
7. **associate ccm** *identifier-number* **priority** *number*
8. **associate profile** *profile-identifier* **register** *device-name*
9. **dspfarm profile** *profile-identifier* {**conference** | **mtp** | **transcode**} [**security**]
10. **trustpoint** *trustpoint-label*
11. **codec** *codec*
12. **maximum sessions** {**hardware** | **software**} *number*
13. **associate application sccp**
14. **no shutdown**

## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b> <b>Example:</b> <pre>Router&gt; enable</pre>	Enables privileged EXEC mode. Enter your password, if prompted.
Step 2	<b>configure terminal</b> <b>Example:</b> <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 3	<b>sccp local</b> <i>interface-type interface-number</i> [ <b>port</b> <i>port-number</i> ] <b>Example:</b> <pre>Router(config)# sccp local gigabitethernet0/0/0</pre>	Selects the local interface that SCCP applications (transcoding and conferencing) use to register with Cisco UCM. <ul style="list-style-type: none"> <li>• <i>interface type</i>: Can be an interface address or a virtual-interface address such as Ethernet.</li> <li>• <i>interface number</i>: Interface number that the SCCP application uses to register with Cisco UCM.</li> <li>• (Optional) <b>port</b> <i>port-number</i>: Port number used by the selected interface. Range is 1025 to 65535. Default is 2000.</li> </ul>
Step 4	<b>sccp ccm</b> { <i>ipv4-address</i>   <i>ipv6-address</i>   <i>dns</i> } <b>identifier</b> <i>identifier-number</i> [ <b>port</b> <i>port-number</i> ] <b>version</b> <i>version-number</i> <b>Example:</b> <pre>Router(config)# sccp ccm 10.1.1.1 identifier 1 version 7.0+</pre>	Adds a Cisco UCM server to the list of available servers and sets the following parameters: <ul style="list-style-type: none"> <li>• <i>ipv4-address</i>: IP version 4 address of the Cisco UCM server.</li> <li>• <i>ipv6-address</i>: IP version 6 address of the Cisco UCM server.</li> <li>• <i>dns</i>: DNS name.</li> </ul>

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>• <b>identifier</b>: Specifies the number that identifies the Cisco UCM server. Range is 1 to 65535.</li> <li>• <b>port</b> <i>port-number</i> (Optional): Specifies the TCP port number. Range is 1025 to 65535. Default is 2000.</li> <li>• <b>version</b> <i>version-number</i>: Cisco UCM version. Valid versions are 3.0, 3.1, 3.2, 3.3, 4.0, 4.1, 5.0.1, 6.0, and 7.0+. There is no default value.</li> </ul>
<b>Step 5</b>	<b>sccp</b> <b>Example:</b> <pre>Router(config)# sccp</pre>	Enables the Skinny Client Control Protocol (SCCP) and its related applications (transcoding and conferencing).
<b>Step 6</b>	<b>sccp ccm group</b> <i>group-number</i> <b>Example:</b> <pre>Router(config)# sccp ccm group 10</pre>	Creates a Cisco UCM group and enters SCCP Cisco UCM configuration mode. <ul style="list-style-type: none"> <li>• <i>group-number</i>: Identifies the Cisco UCM group. Range is 1 to 50.</li> </ul>
<b>Step 7</b>	<b>associate ccm</b> <i>identifier-number</i> <b>priority</b> <i>number</i> <b>Example:</b> <pre>Router(config-sccp-ccm)# associate ccm 10 priority 3</pre>	Associates a Cisco UCM with a Cisco UCM group and establishes its priority within the group: <ul style="list-style-type: none"> <li>• <i>identifier-number</i>: Identifies the Cisco UCM. Range is 1 to 65535. There is no default value.</li> <li>• <b>priority</b> <i>number</i>: Priority of the Cisco UCM within the Cisco UCM group. Range is 1 to 4. There is no default value. The highest priority is 1.</li> </ul>
<b>Step 8</b>	<b>associate profile</b> <i>profile-identifier</i> <b>register</b> <i>device-name</i> <b>Example:</b> <pre>Router(config-sccp-ccm)# associate profile 1 register MTP0011</pre>	Associates a DSP farm profile with a Cisco UCM group: <ul style="list-style-type: none"> <li>• <i>profile-identifier</i>: Identifies the DSP farm profile. Range is 1 to 65535. There is no default value.</li> <li>• <b>register</b> <i>device-name</i>: Device name in Cisco UCM. A maximum of 15 characters can be entered for the device name.</li> </ul>
<b>Step 9</b>	<b>dspfarm profile</b> <i>profile-identifier</i> { <b>conference</b>   <b>mtp</b>   <b>transcode</b> } [ <b>security</b> ] <b>Example:</b> <pre>Router(config-sccp-ccm)# dspfarm profile 1 mtp</pre>	Enters DSP farm profile configuration mode and defines a profile for DSP farm services: <ul style="list-style-type: none"> <li>• <i>profile-identifier</i>: Number that uniquely identifies a profile. Range is 1 to 65535. There is no default.</li> <li>• <b>conference</b>: Enables a profile for conferencing.</li> <li>• <b>mtp</b>: Enables a profile for MTP.</li> <li>• <b>transcode</b>: Enables a profile for transcoding.</li> </ul>



	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>• <b>security</b>(Optional): Enables a profile for secure DSP farm services. For more information on configuration examples, see section <a href="#">#unique_327 unique_327_Connect_42_GUID-5FB6A48E-204C-45AA-AE63-413B075A7871</a>, on page 335.</li> </ul>
<b>Step 10</b>	<b>trustpoint</b> <i>trustpoint-label</i> <b>Example:</b> <pre>Router(config-dspfarm-profile)# trustpoint dspfarm</pre>	(Optional) Associates a trustpoint with a DSP farm profile.
<b>Step 11</b>	<b>codec</b> <i>codec</i> <b>Example:</b> <pre>Router(config-dspfarm-profile)# codec g711ulaw</pre>	Specifies the codecs supported by a DSP farm profile. <ul style="list-style-type: none"> <li>• <b>codec-type</b>: Specifies the preferred codec. Enter ? for a list of supported codecs</li> </ul> Repeat this step for each supported codec.
<b>Step 12</b>	<b>maximum sessions</b> { <b>hardware</b>   <b>software</b> } <i>number</i> <b>Example:</b> <pre>Router(config-dspfarm-profile)# maximum sessions software 10</pre>	Specifies the maximum number of sessions that are supported by the profile. <ul style="list-style-type: none"> <li>• <b>hardware</b>: Number of sessions that MTP hardware resources can support.</li> <li>• <b>software</b>: Number of sessions that MTP software resources can support.</li> <li>• <b>number</b>: Number of sessions that are supported by the profile. Range is 0 to x. Default is 0. The x value is determined at run time depending on the number of resources available with the resource provider.</li> </ul>
<b>Step 13</b>	<b>associate application sccp</b> <b>Example:</b> <pre>Router(config-dspfarm-profile)# associate application sccp</pre>	Associates SCCP to the DSP farm profile.
<b>Step 14</b>	<b>no shutdown</b> <b>Example:</b> <pre>Router(config-dspfarm-profile)# no shutdown</pre>	Changes the status of the interface to the UP state.

## Examples: Support for Software Media Termination Point

The following example shows a sample configuration for the Support for Software Media Termination Point feature:

```
sccp local GigabitEthernet0/0/1
```

```

sccp ccm 10.13.40.148 identifier 1 version 6.0
sccp
!
sccp ccm group 1
  bind interface GigabitEthernet0/0/1
  associate ccm 1 priority 1
  associate profile 6 register RR_RLS6
!
  dspfarm profile 6 mtp
  codec g711ulaw
  maximum sessions software 100
  associate application SCCP
!
!
gateway
media-inactivity-criteria all
timer receive-rtp 400

```

The following example shows a sample configuration for the SRTP-DTMF Interworking feature-with secure dspfarm profile:

```

sccp local GigabitEthernet0/0/0
sccp ccm 172.18.151.125 identifier 1 version 7.0
sccp
!
sccp ccm group 1
  bind interface GigabitEthernet0/0/0
  associate ccm 1 priority 1
  associate profile 1 register Router
!
dspfarm profile 1 mtp security
  trustpoint IOSCA
  codec g711ulaw
  codec pass-through
  tls-version v1.2
  maximum sessions software 5000
  associate application SCCP

```




---

**Note** SR-TP traffic can pass through an SMTP resource when the dspfarm profile is provisioned with codec pass-through, and if it does not have TLS and security-related configuration. For traffic flows that require SRTP-DTMF interworking support, the SMTP dspfarm profile must include the **security** keyword and the TLS and codec pass-through configuration. This dspfarm resource profile can also pass through SRTP traffic independent of SRTP-DTMF interworking support.

---

## Verifying Software Media Termination Point Configuration

To verify and troubleshoot this feature, use the following **show** commands.

- To verify information about SCCP, use the **show sccp** command:

```

Router# show sccp

SCCP Admin State: UP
Gateway IP Address: 10.13.40.157, Port Number: 2000
IP Precedence: 5
User Masked Codec list: None

```

```
Call Manager: 10.13.40.148, Port Number: 2000
                Priority: N/A, Version: 6.0, Identifier: 1
                Trustpoint: N/A
```

- To verify information about the DSPfarm profile, use the **show dspfarm profile** command:

```
Router# show dspfarm profile 6

Dspfarm Profile Configuration
Profile ID = 6, Service = MTP, Resource ID = 1
Profile Description :
Profile Service Mode : Non Secure
Profile Admin State : UP
Profile Operation State : ACTIVE
Application : SCCP   Status : ASSOCIATED
Resource Provider : NONE   Status : NONE
Number of Resource Configured : 100
Number of Resource Available : 100
Hardware Configured Resources : 0
Hardware Available Resources : 0
Software Resources : 100
Codec Configuration
Codec : g711ulaw, Maximum Packetization Period : 30
```

- To verify information about the secure DSPfarm profile status, use the **show dspfarm profile** command and check that the secure service mode is set:

```
Router# show dspfarm profile 2

Dspfarm Profile Configuration
Profile ID = 2, Service = MTP, Resource ID = 2
Profile Service Mode : secure
Trustpoint : IOSCA
TLS Version : v1.2
TLS Cipher : AES128-SHA
Profile Admin State : UP
Profile Operation State : ACTIVE
Application : SCCP   Status : ASSOCIATED
Resource Provider : NONE   Status : NONE
Total Number of Resources Configured : 8000
Total Number of Resources Available : 8000
Total Number of Resources Out of Service : 0
Total Number of Resources Active : 0
Hardware Configured Resources : 0
Hardware Resources Out of Service: 0
Software Configured Resources : 8000
Number of Hardware Resources Active : 0
Number of Software Resources Active : 0
Codec Configuration: num_of_codecs:2
Codec : pass-through, Maximum Packetization Period : 0
Codec : g711ulaw, Maximum Packetization Period : 30
```

- To display statistics for the SCCP connections, use the **show sccp connections** command:

```
Router# show sccp connections

sess_id  conn_id  stype  mode      codec  ripaddr      rport  sport
16808048 16789079 mtp    sendrecv  g711u  10.13.40.20  17510  7242
16808048 16789078 mtp    sendrecv  g711u  10.13.40.157 6900   18050
```

For SMTP secure DTMF, the **show sccp connections** command displays the codec type (pass-th), the s-type (s-mtp), and information about the DTMF method (rfc2833\_pt thru):

```
Router# show sccp connections
```

```
sess_id  conn_id  stype  mode    codec  sport  rport  ripaddr  conn_id_tx  dtmf_method
16791234 16777308 s-mtp  sendrecv pass_th 8006  24610  172.18.153.37  rfc2833_pt thru
16791234 16777306 s-mtp  sendrecv pass_th 8004  17576  172.18.154.2   rfc2833_report
```

```
Total number of active session(s) 1, and connection(s) 2
```

- To display information about RTP connections, use the **show rtpspi call** command:

```
Router# show rtpspi call
```

```
RTP Service Provider info:
```

No.	CallId	dstCallId	Mode	LocalRTP	RmtRTP	LocalIP	RemoteIP	S RTP
1	22	19	Snd-Rcv	7242	17510	0x90D080F	0x90D0814	0
2	19	22	Snd-Rcv	18050	6900	0x90D080F	0x90D080F	0

If S RTP DTMF interworking is active, the S RTP field shows a non-zero value:

```
Router# show rtpspi call
```

```
RTP Service Provider info:
```

No.	CallId	dstCallId	Mode	LocalRTP	RmtRTP	LocalIP	RemoteIP	S RTP
1	13	14	Snd-Rcv	8024	18270	0xA7A5355	0xAC129A02	1
2	14	13	Snd-Rcv	8026	24768	0xA7A5355	0xAC129925	1

- To display information about VoIP RTP connections, use the **show voip rtp connections** command:

```
Router# show voip rtp connections
```

```
VoIP RTP Port Usage Information
```

```
Max Ports Available: 30000, Ports Reserved: 100, Ports in Use: 102
```

```
Port range not configured, Min: 5500, Max: 65499
```

```
VoIP RTP active connections :
```

No.	CallId	dstCallId	LocalRTP	RmtRTP	LocalIP	RemoteIP
1	114	117	19822	24556	10.13.40.157	10.13.40.157
2	115	116	24556	19822	10.13.40.157	10.13.40.157
3	116	115	19176	52625	10.13.40.157	10.13.40.20
4	117	114	16526	52624	10.13.40.157	10.13.40.20

- Additional, more specific, **show** commands that can be used include the following:

- **show sccp connection callid**
- **show sccp connection connid**
- **show sccp connection sessionid**
- **show rtpspi call callid**
- **show rtpspi stat callid**
- **show voip rtp connection callid**
- **show voip rtp connection type**
- **show platform hardware qfp active feature sbc global**

- To isolate specific problems, use the **debug sccp** command:

- **debug sccp [all | config | errors | events | keepalive | messages | packets | parser | tls]**

# Feature Information for Support for Software Media Termination Point

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](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 38: Feature Information for Support for Software Media Termination Point**

Feature Name	Releases	Feature Information
Support for Software Media Termination Point	Cisco IOS XE Release 2.6 S	Software Media Termination Point (MTP) provides the capability for Cisco Unified Communications Manager (Cisco UCM) to interact with a voice gateway via Skinny Client Control Protocol (SCCP) commands. These commands allow the Cisco UCM to establish an MTP for call signaling.
Support for Secure Real-time Transport Protocol (SRTP) Dual-Tone Multi-Frequency (DTMF) Interworking	Cisco IOS XE Dublin 17.10.1a	The Secure Real-time Transport Protocol (SRTP) Dual-Tone Multi-Frequency (DTMF) feature provides support for DTMF interworking between Secure Software MTP in pass-through mode only and CUCM.





## CHAPTER 24

# Dying Gasp Through SNMP, Syslog and Ethernet OAM

---

A dying gasp is a message (or signal) sent by a Customer Premises Equipment (CPE) to equipment managed by an Internet Service Provider to indicate that the CPE has lost power. The message is sent when one of the following occurs:

- System reload
- Interface shutdown
- Power failure—supported on specific platforms

This type of condition is vendor specific. An Ethernet Operations, Administration, and Maintenance (OAM) notification about the condition may be sent immediately.

- [Prerequisites for Dying Gasp Support, on page 341](#)
- [Restrictions for Dying Gasp Support, on page 341](#)
- [Information About Dying Gasp Through SNMP, Syslog and Ethernet OAM, on page 342](#)
- [How to Configure Dying Gasp Through SNMP, Syslog and Ethernet OAM, on page 342](#)
- [Configuration Examples for Dying Gasp Through SNMP, Syslog and Ethernet OAM, on page 343](#)

## Prerequisites for Dying Gasp Support

You must enable Ethernet OAM before configuring Simple Network Management Protocol (SNMP) for dying gasp feature. For more information, see [Enabling Ethernet OAM on an Interface](#).

## Restrictions for Dying Gasp Support

- The dying gasp feature is not supported if you remove the power supply unit (PSU) from the system.
- SNMP trap is sent only on power failure or removal of power supply cable on selected platforms.
- The dying gasp support feature cannot be configured using CLI. To configure hosts using SNMP, refer to the SNMP host configuration examples below.

# Information About Dying Gasp Through SNMP, Syslog and Ethernet OAM

## Dying Gasp

One of the OAM features as defined by IEEE 802.3ah is Remote Failure Indication, which helps in detecting faults in Ethernet connectivity that are caused by slowly deteriorating quality. Ethernet OAM provides a mechanism for an OAM entity to convey these failure conditions to its peer via specific flags in the OAM PDU. One of the failure condition method to communicate is Dying Gasp, which indicates that an unrecoverable condition has occurred; for example, when an interface is shut down. This type of condition is vendor specific. A notification about the condition may be sent immediately and continuously.

## How to Configure Dying Gasp Through SNMP, Syslog and Ethernet OAM

### Dying Gasp Trap Support for Different SNMP Server Host/Port Configurations




---

**Note** You can configure up to five different SNMP server host/port configurations.

---

### Environmental Settings on the Network Management Server

```
setenv SR_TRAP_TEST_PORT UDP port
setenv SR_UTIL_COMMUNITY public
setenv SR_UTIL_SNMP_VERSION v2c
setenv SR_MGR_CONF_DIR Path to the executable snmpinfo.DAT file
```

The following example shows SNMP trap configuration on the host:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
Router(config)# snmp-server host 192.0.2.12 vrf Mgmt-intf version 2c public udp-port 6264
Router(config)#
Router(config)# ^Z
Router#
```

After performing a power cycle, the following output is displayed on the router console:



```
Router#
system Bootstrap, Version 17.3(1.2r), RELEASE SOFTWARE
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1994-2020 by cisco Systems, Inc.
Current image running: Boot ROM0
Last reset cause: LocalSoft
C8300-2N2S-4T2X platform with 8388608 Kbytes of main memory
rommon 1 >

=====
Dying Gasp Trap Received for the Power failure event:
-----
    Trap on the Host
+++++++

snmp-server host = 192.0.2.12 (nms1-lnx) and SR_TRAP_TEST_PORT=6264
/auto/sw/packages/snmp/192.0.2.9/bin> /auto/sw/packages/snmp/192.0.2.9/bin/traprcv
Waiting for traps.
Received SNMPv2c Trap:
Community: public
From: 192.0.2.34
snmpTrapOID.0 = ciscoMgmt.305.1.3.5.0.2
ciscoMgmt.305.1.3.6 = Dying Gasp - Shutdown due to power loss
```

## Message Displayed on the Peer Router on Receiving Dying Gasp Notification

```
001689: *May 30 14:16:47.746 IST: %ETHERNET_OAM-6-RFI: The client on interface Gi0/0/0 has
received a remote failure indication from its remote peer(failure reason = remote client
power failure action = )
```

## Displaying SNMP Configuration for Receiving Dying Gasp Notification

Use the show running-config command to display the SNMP configuration for receiving dying gasp notification:

```
Router# show running-config | i snmp
snmp-server community public RW
snmp-server host 192.0.2.20 vrf Mgmt-intf version 2c public udp-port 6264
Router#
```

# Configuration Examples for Dying Gasp Through SNMP, Syslog and Ethernet OAM

## Example: Configuring SNMP Community Strings on a Router

Setting up the community access string to permit access to the SNMP:

```
Router> enable
Router# configure terminal
Router(config)# snmp-server community public RW
Router(config)# exit
```

For more information on command syntax and examples, refer to the Cisco IOS Network Management Command Reference.

## Example: Configuring SNMP-Server Host Details on the Router Console

Specifying the recipient of a SNMP notification operation:

```
Router> enable
Router# configure terminal
Router(config)# snmp-server host X.X.X.XXX vrf mgmt-intf version 2c public udp-port 9800
Router(config)# exit
```

For more information on command syntax and examples, refer to the Cisco IOS Network Management Command Reference.



## CHAPTER 25

# Troubleshooting

- [Troubleshooting, on page 345](#)

## Troubleshooting

### System Report

System reports or crashinfo files save information that helps Cisco technical support representatives to debug problems that caused the Cisco IOS image to crash. It is necessary to collect critical crash information quickly and reliably and bundle it in a way that it can be identified with a specific crash occurrence. System reports are generated and saved into the '/core' directory, either on harddisk: or flash: filesystem. The system does not generate reports in case of a reload.

In case of a system crash, the following details are collected:

1. Full process core
  - IOSd core file and IOS crashinfo file if there was an IOSd process crash
2. Tracelogs
3. System process information
4. Bootup logs
5. Certain types of /proc information

This report is generated before the router goes down to rommon/bootloader. The information is stored in separate files which are then archived and compressed into the tar.gz bundle. This makes it convenient to get a crash snapshot in one place, and can be then moved off the box for analysis.

Device hostname, the ID of the module that generated the system report and its creation timestamp are embedded in the file name:

```
<hostname>_<moduleID>-system-report_<timestamp>.tar.gz
```

Example:

Router1\_RP\_0-system-report\_20210204-163559-UTC

A device with hostname Router1 experienced an unexpected reload of RP0 module and the system-report was generated on 4th February 2021 at 4:39:59 PM UTC.

```
├── bootflash/
│   ├── pd_info/
│   │   ├── dmesg_output-20210204-163538-UTC.log
│   │   ├── filesystems-20210204-163538-UTC.log
│   │   ├── memaudit-20210204-163538-UTC.log
│   │   ├── proc_cpuinfo-20210204-163538-UTC.log
│   │   ├── proc_diskstats-20210204-163538-UTC.log
│   │   ├── proc_interrupts-20210204-163538-UTC.log
│   │   ├── proc_oom_stats-20210204-163538-UTC.log
│   │   ├── proc_softirqs-20210204-163538-UTC.log
│   │   ├── system_report_trigger.log
│   │   └── top_output-20210204-163538-UTC.log
│   ├── harddisk/
│   │   ├── core/
│   │   │   └── Router1_RP_0_hman_17716_20210212-123836-UTC.core.gz
│   │   └── tracelogs/
│   ├── tmp/
│   │   ├── fp/
│   │   │   └── trace/
│   │   ├── maroon_stats/
│   │   ├── rp/
│   │   │   └── trace/
│   │   └── Router1_RP_0-bootuplog-20210204-163559-UTC.log
│   └── var/
│       ├── log/
│       │   └── audit/
│       │       └── audit.log
```



## APPENDIX **A**

# Unsupported Commands

---

The C8000 Series routers contain a series of commands with the **logging** or **platform** keywords that either produce no output or produce output that is not useful for customer purposes. Such commands that are not useful for customer purposes are considered as unsupported commands. You will not find any further Cisco documentation for the unsupported commands.

The following is a list of unsupported commands for the C8000 Series routers:

- backplaneswitchport
- clear logging onboard slot f0 dram
- clear logging onboard slot f0 voltage
- clear logging onboard slot f0 temperature
- show logging onboard slot f0 dram
- show logging onboard slot f0 serdes
- show logging onboard slot f0 status
- show logging onboard slot f0 temperature
- show logging onboard slot f0 uptime
- show logging onboard slot f0 uptime latest
- show logging onboard slot f0 voltage
- show logging onboard slot 0 dram
- show logging onboard slot 0 serdes
- show logging onboard slot 0 status
- show logging onboard slot 0 temperature
- show logging onboard slot 0 uptime
- show logging onboard slot 0 uptime latest
- show logging onboard slot 0 voltage
- show platform software adjacency r0 special

- show platform software adjacency rp active special
- show platform hardware backplaneswitch-manager RP active summary
- show platform hardware backplaneswitch-manager RP active subslot GEO statistics
- show platform software backplaneswitch-manager RP [active [detail]]
- show platform hardware backplaneswitch-manager [R0 [status] | RP]
- show platform hardware backplaneswitch-manager RPactive CP statistics
- platform hardware backplaneswitch-manager rp active subslot GEO statistics
- show platform software ethernet rp active l2cp
- show platform software ethernet rp active l2cp interface GigabitEthernet0
- show platform software ethernet rp active loopback
- show platform software ethernet rp active vfi
- show platform software ethernet r0 vfi
- show platform software ethernet r0 vfi id 0
- show platform software ethernet r0 vfi name GigabitEthernet0
- show platform software ethernet r0 l2cp
- show platform software ethernet r0 l2cp interface GigabitEthernet0
- show platform software ethernet r0 bridge-domain statistics
- show platform software flow r0 exporter name GigabitEthernet0
- show platform software flow r0 exporter statistics
- show platform software flow r0 global
- show platform software flow r0 flow-def
- show platform software flow r0 interface
- show platform software flow r0 ios
- show platform software flow r0 monitor
- show platform software flow r0 sampler
- show platform hardware qfp active classification feature-manager label GigabitEthernet 0 0
- show platform software interface f0 del-track
- show platform software interface fp active del-track
- show platform software rg r0 services
- show platform software rg r0 services rg-id 0
- show platform software rg r0 services rg-id 0 verbose
- show platform software rg r0 services verbose

- show platform software rg r0 statistics
- show platform software rg rp active services
- show platform software rg rp active services rg-id 0
- show platform software rg rp active services rg-id 0 verbose
- show platform software rg rp active statistics
- show platform hardware slot 0 dram statistics
- show platform hardware slot f0 dram statistics
- show platform hardware slot 0 eobc interface primary rmon
- show platform hardware slot 0 eobc interface primary status
- show platform hardware slot 0 eobc interface standby rmon
- show platform hardware slot 0 eobc interface standby status
- show platform hardware slot f0 eobc interface primary rmon
- show platform hardware slot f0 eobc interface primary status
- show platform hardware slot f0 eobc interface standby rmon
- show platform hardware slot f0 eobc interface standby status
- show platform hardware slot f0 sensor consumer
- show platform hardware slot f0 sensor producer

