Cisco NCS 1010 System Setup and Software Installation Guide, IOS XR Release 7.11.x

First Published: 2023-12-08

Last Modified: 2024-04-16

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

CONTENTS

Full Cisco Trademarks with Software License ?

CHAPTER 1 **Cisco NCS 1010 Optical Line System - An Overview** 1

NCS 1010 Chassis and Line Cards 1

Line Cards 2

OLT-C Line Card 2

OLT-R-C Line Card 2

ILA-C Line Card 3

ILA-R-C Line Card 3

ILA-2R-C Line Card 3

OLT-L Line Card 4

ILA-L Line Card 4

External Interface Timing Unit 4

Cisco NCS 1000 Passive Modules 5

Cisco NCS 1000 Breakout Patch Panel 5

NCS1K-BRK-8 5

NCS1K-BRK-24 6

Cisco NCS 1000 32-Channel Mux/Demux Patch Panels 6

Document Objective 7

Document Organization 7

CHAPTER 2 **Bring-up Cisco NCS 1010** 9

Boot NCS 1010 9

Boot NCS 1010 Using USB Drive 10

DHCP Configuration 11

Introduction to DHCP Relay 11

Prerequisites for Configuring DHCP Relay Agent 12
Limitations for DHCP Relay Feature 12
Configuring and Enabling the DHCP Relay Agent 13
DHCP Client 13
Boot Using iPXE 14
Setup DHCP Server 14
Boot Using iPXE 15
Boot Using Zero Touch Provisioning 19
Fresh Boot Using DHCP 20
Build your Configuration File 21
Configure ZTP BootScript 22
Invoke ZTP Manually through CLI 24
Invoke ZTP Through Reload 25
ZTP Logging 26
Generate Tech Support Information for ZTP 27
Configure Management Interface 28
Link Layer Discovery Protocol Support on Management Interface 29
Configure Telnet 33
Configure SSH 33
Configure NTP Server 35
Understand NTP 35
Synchronize Clock with NTP Server 35
Verify the Status of the External Reference Clock 37
NTP Troubleshooting Information 38

CHAPTER 3 **Disaster Recovery** 39
Overview 39
CPU Replacement Considerations 39
Health Check of Backup ISO Image 39

CHAPTER 4 **Perform Preliminary Checks** 41
Verify Status of Hardware Components 41
Verify Inventory 42
Verify Software Version 43

Verify Firmware Version 44
Verify Management Interface Status 46
Verify Alarms 47
Verify Environmental Parameters 48
Verify Context 54
Verify Core Files 54
Verify Memory Information 54

CHAPTER 5 Upgrade Software and FPD 57
Upgrade Software 57
Software Upgrade and Downgrade Matrix 59
Install Packages and RPMs 59
NCS 1010 FPD 63
Verify if an FPD Upgrade is Required 68
Upgrade FPDs Manually 70
Upgrade FPDs Automatically 71
Release 7.10.1 Caveats 71

CHAPTER 6 Understanding Remote Node Management Using OSC 73
Prerequisites 73
DHCP Relay Configuration for OLT Node 73
Loopback IP address for OSC Interface 75
OSPF Neighbor Discovery 75
Configure ILA Node 76
Configure OLT Node 76

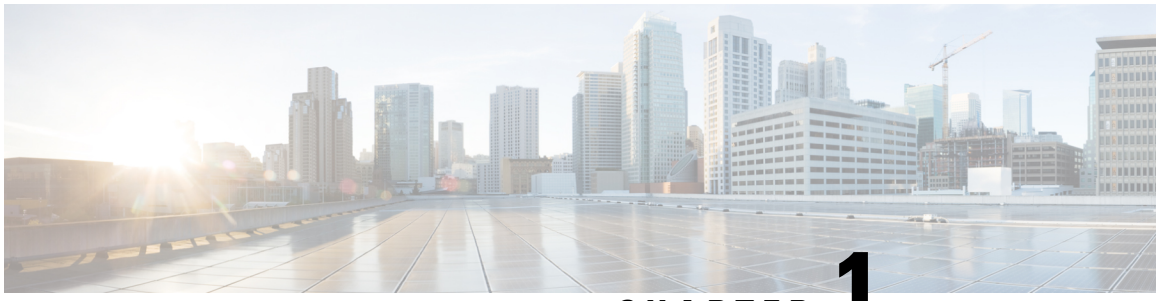
CHAPTER 7 Configuring BGP 77
BGP Overview 77
Prerequisites for Implementing BGP 78
BGP Router Identifier 78
Configuring BGP 79

CHAPTER 8 Configure CDP 83
Enable CDP Globally 84

Disable CDP Globally 84
Enable CDP on Interfaces 84
Modify CDP Default Settings 85
Monitor CDP 86

CHAPTER 9 **Daisy Chain** 89
Daisy Chain Overview 89
Configure Daisy Chain on Management Ports 90
Verify Daisy Chain 91
Enable Storm Control on TOR Switch 92
Disable DAD on Management Port 92

CHAPTER 10 **Configure ACL** 95
Understand Access Control Lists 96
How an ACL Works 97
Apply ACLs 99
Configure an Ingress IPv4 ACL on Management Ethernet Interface 99
Configure an Egress IPv4 ACL on the Management Ethernet Interface 100
Configure an Ingress IPv6 ACL on the Management Ethernet Interface 102
Configure an Egress IPv6 ACL on the Management Ethernet Interface 103
Configure Extended Access Lists 104
Modify ACLs 105



CHAPTER 1

Cisco NCS 1010 Optical Line System - An Overview

This chapter provides an overview for NCS 1010 line system.

- NCS 1010 Chassis and Line Cards, on page 1
- Cisco NCS 1000 Passive Modules, on page 5
- Document Objective, on page 7
- Document Organization, on page 7

NCS 1010 Chassis and Line Cards

Cisco NCS 1010 is a next-generation optical line system optimized for ZR/ZR+ WDM router interfaces. Its salient features are:

- Provides point-to-point connectivity between routers with WDM interfaces.
- Multiplexes the signals received from multiple routers over a single fiber.
- With one MPO port, it can be scaled to 8 Degree.
- Caters to C-band WDM transmission to maximize capacity, and can be enhanced to C+L combined band in the future.

Cisco NCS 1010 is a 3RU chassis that has an in-built External Interface Timing Unit (EITU) and the following field-replaceable modules.

- Controller
- Two power supply units
- Two fan trays
- Fan filter
- Line card

See Hardware Installation Guide for Cisco NCS 1010 and Cisco NCS 1000 Passive Modules for more detailed images.

Line Cards

There are five different variants of the line card:

- OLT-C Line Card: C-band Optical Line Terminal without Raman
- OLT-R-C Line Card: C-band Optical Line Terminal with Raman
- ILA-C Line Card: C-band In-Line Amplifier without Raman
- ILA-R-C Line Card: C-band In-Line Amplifier with one side Raman
- ILA-2R-C Line Card: C-band In-Line Amplifier with both sides Raman
- OLT-L Line Card: L-band Optical Line Terminal
- ILA-L Line Card: L-band In-Line Amplifier

OLT-C Line Card

The C-band Optical Line Terminal without Raman (OLT-C) line card includes the following features:

- 25-dBm line preamplifier True Variable Gain (TVG) Erbium-Doped Fiber Amplifier (EDFA) with two switchable gain ranges
- Dedicated amplification of the odd and even add channels through an embedded Fixed Gain (FG) EDFA
- 23-dBm line boost-amplifier TVG EDFA single gain range
- Dedicated EDFA for noise loading
- Embedded Optical Time Domain Reflectometer (OTDR) for line RX and TX monitoring
- 37 ports Optical Channel Monitoring (OCM)
- Dedicated Tunable Laser (TL) enabling Connection Verification (CV) and patch cord discovery features
- Up to 30 EXP ports
- Embedded Optical Service Channel at Fast Ethernet (FE)
- Multiplexing and demultiplexing of odd and even channels
- C+L combiner for multiplexing and demultiplexing L-band channels
- 2x2 switch to reverse transmit direction of Optical Service Channel (OSC)-C
- Fiber reflectors to support fiber end detection by OTDR

OLT-R-C Line Card

The C-band Optical Line Terminal with Raman (OLT-R-C) line card includes the features of the OLT-C line card along with the Raman amplifier.

The following are the features of the Raman amplifier:

- Five different pump wavelengths for supporting C+L Raman amplification
- Embedded Distributed Feedback (DFB) laser at 1568.77 nm (class 1M) to be used for optical safety (link continuity)

- Full monitoring of pumps, DFB laser and signal power
- Raman pump back-reflection detector
- Meets class 1M Laser safety.
- Additional Photodiode (PD) to monitor remnant pump power at the far end

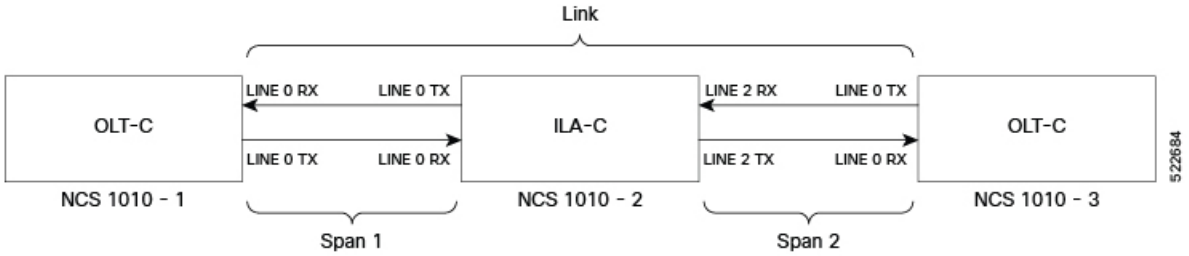
ILA-C Line Card

The C-band In Line Amplifier without Raman (ILA-C) line card includes the following features:

- Two independent TVG EDFA block, covering full operative gain ranging 8–36 dB
- Each EDFA block can provide up to 23 dBm output power
- Dynamic Gain Equalization (DGE) embedded capability to compensate for line tilt and ripple
- Embedded OTDR for line1/2-RX/TX monitoring
- Four-ports OCM for channels monitoring
- Embedded Optical Service Channel at Fast Ethernet (FE)
- C+L combiner for multiplexing/demultiplexing L-band channels
- Dedicated ports for amplifiers output monitoring
- 2x2 switch to reverse transmit direction of OSC-C for both directions
- Fiber reflectors to support fiber end detection by OTDR

The following image displays the port connection between the ILA-C line card and OLT-C line cards.

Figure 1: ILA-C Line Card Port Connection



ILA-R-C Line Card

The C-band In Line Amplifier with Raman (ILA-R-C) line card includes the features of ILA-C and Raman amplifier.

ILA-2R-C Line Card

The C-band In-Line Amplifier with two Raman (ILA-2R-C) line card includes the features of the ILA-C and Raman amplifier on both directions.

OLT-L Line Card

The L-band Optical Line Terminal (OLT-L) line card includes the following features:

- 25-dBm line preamplifier True Variable Gain (TVG) Erbium-Doped Fiber Amplifier (EDFA) with two switchable gain ranges
- Dedicated amplification of the odd and even add channels through an embedded Fixed Gain (FG) EDFA
- 24.5-dBm line boost-amplifier TVG EDFA single gain range
- 15-dBm ADD-side boost-amplifier TVG EDFA with single gain range of 16 dB
- Dedicated EDFA for noise loading
- 37 ports Optical Channel Monitoring (OCM)
- Dedicated Tunable Laser (TL) enabling Connection Verification (CV) and patch cord discovery features
- Up to 30 EXP ports
- Embedded Optical Service Channel at Fast Ethernet (FE) at 184.45 THz (1625.33 nm)
- Multiplexing and demultiplexing of odd and even channels
- 2x2 switch to reverse transmit direction of Optical Service Channel OSC-L

ILA-L Line Card

The L-band In Line Amplifier (ILA-L) line card includes the following features:

- Two independent TVG EDFA block, covering full operative gain ranging 10.8–32.8 dB
- Each EDFA block can provide up to 24.5-dBm total output power
- Dynamic Gain Equalization (DGE) embedded capability to compensate for line tilt and ripple
- Four-ports OCM for channels monitoring
- Embedded Optical Service Channel at Fast Ethernet (FE)
- Dedicated ports for amplifiers output monitoring
- 2x2 switch to reverse transmit direction of OSC-L for both directions

External Interface Timing Unit

The External Interface Timing Unit (EITU) manages the control plane interfaces and includes all user external interfaces (timing and management). It is connected to the controller with a redundant 10G Ethernet bus.

The following is the list of the available user interfaces:

- Coaxial connector for GPS antenna RF input (with +5V antenna power, if necessary)
- Console/Universal Asynchronous Receiver/Transmitter (UART) Interface (1x)
- Two Small Form-Factor Pluggables (SFP) for 1GE optical PTP port (1588 and SyncE)
- Two SFPs for 1GE optical User Data Channels (UDC)

- Three USB 2.0 type A, 1.8A max @5V/12V (with Cisco NCS 1000 Breakout Patch Panel support)
- Coaxial connector for 10MHz sync signal (bidirectional)
- Coaxial connector for 1PPS sync signal (bidirectional)
- RJ45 for 1588 TOD (1x)
- Three 10/100/1000 RJ-45 Ethernet management ports and Interconnection Link (ILINK)

Cisco NCS 1000 Passive Modules

The Cisco NCS 1000 passive modules power the Cisco NCS 1010 chassis to offer an optical line system solution. The passive modules enable the NCS 1010 chassis to implement long-haul and metro topologies. The Cisco NCS 1010 supports the following passive modules:

Cisco NCS 1000 Breakout Patch Panel

Cisco NCS 1000 Breakout Patch Panel is colorless breakout-modular patch panel. It is powered by the NCS 1010 chassis using a single USB 2.0 cable from the NCS 1010 EITU. The breakout panel contains four USB 2.0 connections that power the breakout modules. It allows connections between the OLT-C and OLT-R-C line cards that are installed in the NCS 1010 chassis and the four breakout modules using MPO cables. The breakout panel supports up to 72 colorless Mux/Demux channels and 8-directional interconnections. The breakout panel is 4 RU high and has adjustable fiber guides for fiber routing. The empty slots are covered with dummy covers. The panel is shipped with USB 2.0 connectors that are connected to the corresponding dummy covers. The plastic transparent cover can be installed in front of the panel for fiber protection. The panel is designed to fit a 19-inch rack. The panel can also be installed on ETSI and 23-inch rack using adapter brackets.

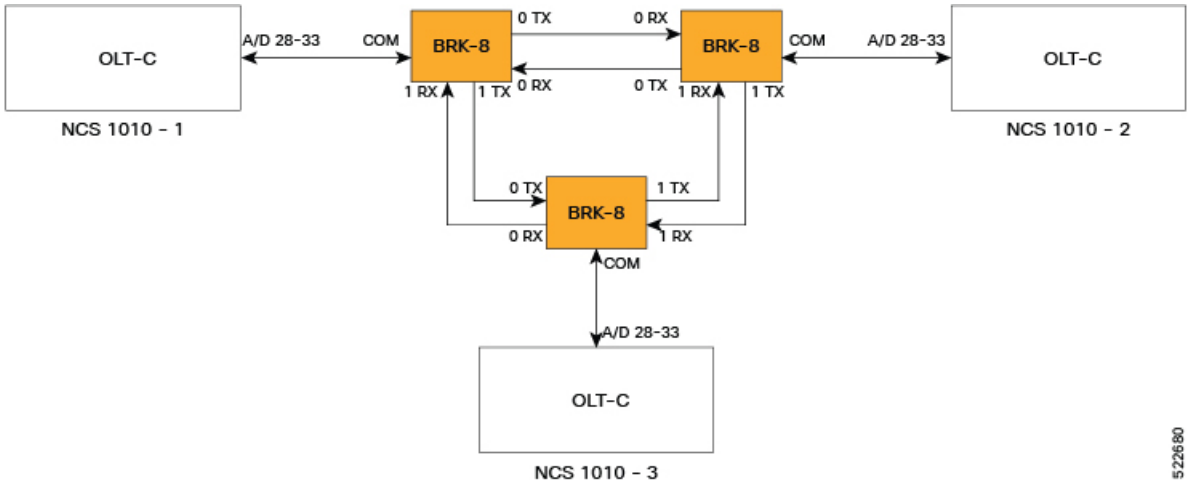
The breakout panel supports the following breakout modules:

NCS1K-BRK-8

The NCS1K-BRK-8 module provides the breakout of 16 fibers from an MPO-24 connector to 8 duplex line card connectors. It essentially performs an optical connection adaptation of MPO-to-LC connectors for the ADD/DROP signals of the MPO ports of OLT line cards. For each port (MPO and LC), power monitors with tone detection capability are available. A filtered optical loopback (191.175 THz) from one MPO input port (fiber-1) to all MPO output ports is available for connection verification.

The following image displays the port connection between BRK-8 and OLT-C cards.

Figure 2: BRK-8 Panel Port Connection with OLT-C Cards

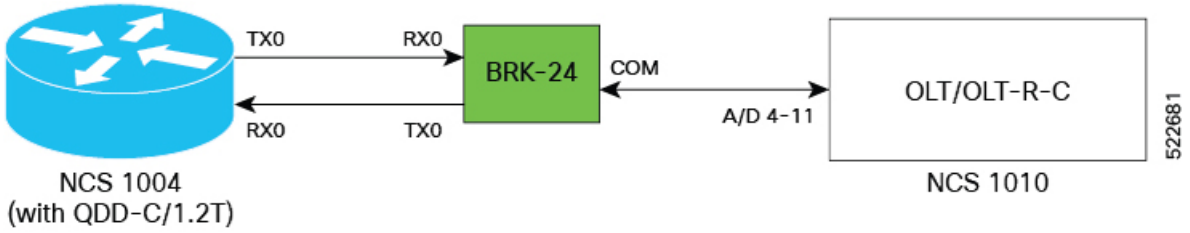


NCS1K-BRK-24

The NCS1K-BRK-24 module provides the breakout of 16 fibers from an MPO-24 connector to 24 duplex LC connectors. The signals on each fiber from the MPO input ports are split over three LC output ports by a 1x3 optical splitter. The signals from the three adjacent input LC ports are combined into a single MPO fiber output port through a 1x3 optical coupler. For each port (MPO and LC), power monitors with tone detection capability are available. A filtered optical loopback (191.175 THz) from one MPO input port (fiber-1) to all MPO output ports is available for connection verification.

The following image displays port connections between BRK-24 panel and NCS 1010 and NCS 1004 chassis.

Figure 3: Port Connections Between BRK-24 Panel and NCS 1010 and NCS 1004 Chassis



Cisco NCS 1000 32-Channel Mux/Demux Patch Panels

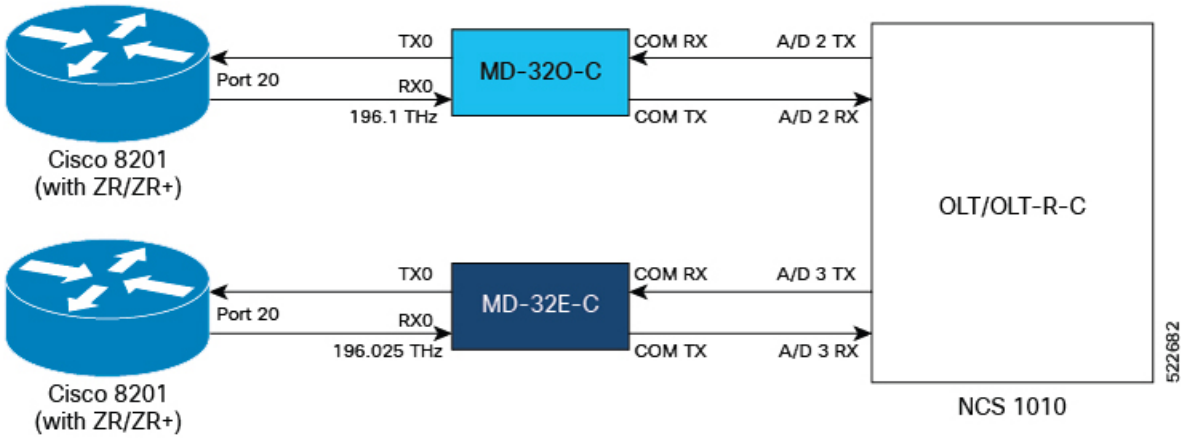
The Cisco NCS 1000 32-Channel Mux/Demux patch panels are a pair of passive Athermal Arrayed Waveguide Grating (AAWG) based modules (PIDs NCS1K-MD-32O-C and NCS1K-MD-32E-C). Each Mux/Demux panel has 32 channels and works as an add/drop unit for the OLT-C and OLT-R-C line cards. Each Mux/Demux panel allows the multiplexing and demultiplexing of 32 channels with 150-GHz spacing. 75-GHz frequency shift exists between the ODD and EVEN panels. When both panels are used on the same OLT (OLT-C and OLT-R-C) line cards, the combined capacity becomes 64 channels with 75-GHz spacing. Each Mux/Demux panel provides a wide optical pass-band support. When used as a standalone, each panel acts as an add/drop unit for 32 channels at 140 GBd.

The NCS1K-MD-32O/E-C panel operates in C-band.

The Cisco NCS 1000 Mux/Demux patch panels are fully passive. The units are powered with a USB 2.0 connection in the NCS 1010 chassis. The panels are capable of monitoring channel power, verifying connection, detecting tone, and reporting the inventory data.

The following image displays the port connection between the Mux/Demux panels and NCS 1010 and routers.

Figure 4: Port Connection between the Mux/Demux Panels and NCS 1010 and Routers



Document Objective

Cisco Network Convergence System (NCS) 1010 platform has the following configuration guides.

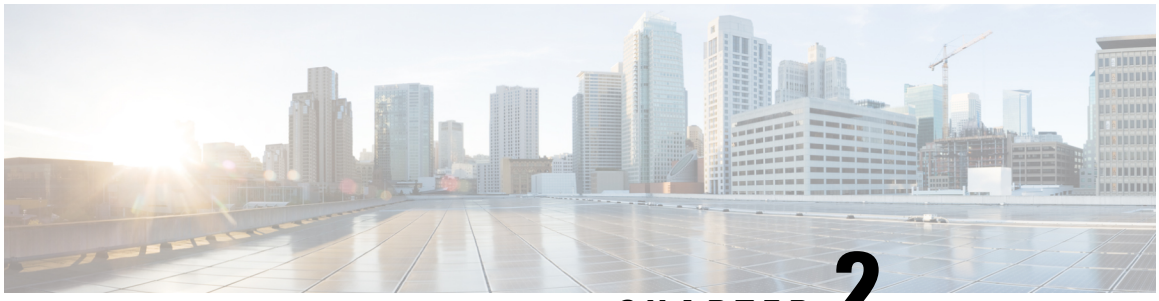
- The *Cisco NCS 1010 System Setup and Software Installation Guide* describes how to bring up the NCS 1010 system and perform the required software installation.
- The *Cisco NCS 1010 Datapath Configuration Guide* describes how to configure various datapaths on NCS 1010.
- The *Cisco NCS 1010 Optical Applications Configuration Guide* describes multiple optical applications on NCS 1010, that help to bring up the link and maintain traffic on the link.

Document Organization

This document is organized into the following chapters:

Chapter	Description
Bring-up Cisco NCS 1010, on page 9	Various methods such as iPXE, Zero Touch Provisioning, and USB drive to boot up the Cisco NCS 1010 system .
Disaster Recovery, on page 39	The disaster recovery process and the health check of backup ISO image.

Chapter	Description
Perform Preliminary Checks, on page 41	Preliminary checks to be performed after successfully logging into the console and the suggested corrective actions if any setup issue is detected.
Upgrade Software and FPD, on page 57	Procedures to upgrade the Cisco IOS XR software and FPDs.
Remote Node Management in NCS 1010	Manage an ILA node remotely in NCS 1010.
Configure CDP	Configures Cisco Discovery Protocol (CDP) in NCS 1010.
Daisy Chain, on page 89	Describes how you can connect NCS 1010 devices in a Daisy Chain topology.
Configure ACL, on page 95	Procedures to configure access control lists (ACL).



CHAPTER 2

Bring-up Cisco NCS 1010

After installing the hardware, boot the Cisco NCS 1010 system. You can connect to the XR console port and power on the system. NCS 1010 completes the boot process using the pre-installed operating system (OS) image. If no image is available, NCS 1010 can be booted using the iPXE boot or an external bootable USB drive.

After booting, create the root username and password, and then use it to log on to the XR console.

Note The output of the examples in the procedures is not from the latest software release. The output will change for any explicit references to the current release.

- Boot NCS 1010, on page 9
- Configure Management Interface, on page 28
- Configure Telnet, on page 33
- Configure SSH, on page 33
- Configure NTP Server, on page 35

Boot NCS 1010

Use the console port to connect to NCS 1010. By default, the console port connects to the XR mode. If necessary, you can establish subsequent connections through the management port, after it is configured.

Step 1 Connect a terminal to the console port of the RP.

Step 2 Start the terminal emulation program on your workstation.

The console settings are 115,200 bps, 8 data bits, 1 stop bit and no parity.

Step 3 Power on NCS 1010.

To power on the shelves, install the AC or DC power supplies and cables. As NCS 1010 boots up, you can view the boot process details at the console of the terminal emulation program.

Step 4 Press **Enter**.

The boot process is complete when the system prompts you to enter the root-system username. If the prompt does not appear, wait for a while to give NCS 1010 more time to complete the initial boot procedure; then press **Enter**.

Important If the boot process fails, it may be because the preinstalled image on the NCS 1010 is corrupt. In this case, you can boot NCS 1010 using an external bootable USB drive.

Boot NCS 1010 Using USB Drive

The bootable USB drive is used to reimage NCS 1010 for system upgrade or to boot the NCS 1010 in case of boot failure. A bootable USB drive is created by copying a compressed boot file into a USB drive. The USB drive becomes bootable after the contents of the compressed file are extracted.

You can complete this task using the Windows, Linux, or MAC operating systems available on your local machine. The exact operation to be performed for each generic step that is outlined here depends on the operating system in use.

Use this task to boot the NCS 1010 using the USB drive.

Before you begin

- You need a USB drive with a storage capacity of at least 4 GB.
- The USB drive should have a single partition.
- NCS 1010 software image can be downloaded from Software Download page on Cisco.com.
- Copy the compressed boot file from the software download page at Cisco.com to your local machine. The filename for the compressed boot file is in the format *ncs1010-usb-boot-<release_number>.zip*.

Step 1 Connect the USB drive to your local machine and format it with the FAT32 file system.

Step 2 Copy the compressed boot file to the USB drive.

Step 3 Verify that the copy operation is successful. To verify, compare the file size at source and destination. Also, verify the MD5 checksum value.

Step 4 Extract the content of the compressed boot file by unzipping it in the USB drive. This makes the USB drive a bootable drive.

Note You must extract the contents of the zipped file ("EFI" and "boot" directories) directly in the root folder of the USB drive. If the unzipping application places the extracted files in a new folder, move the "EFI" and "boot" directories to the root folder of the USB drive.

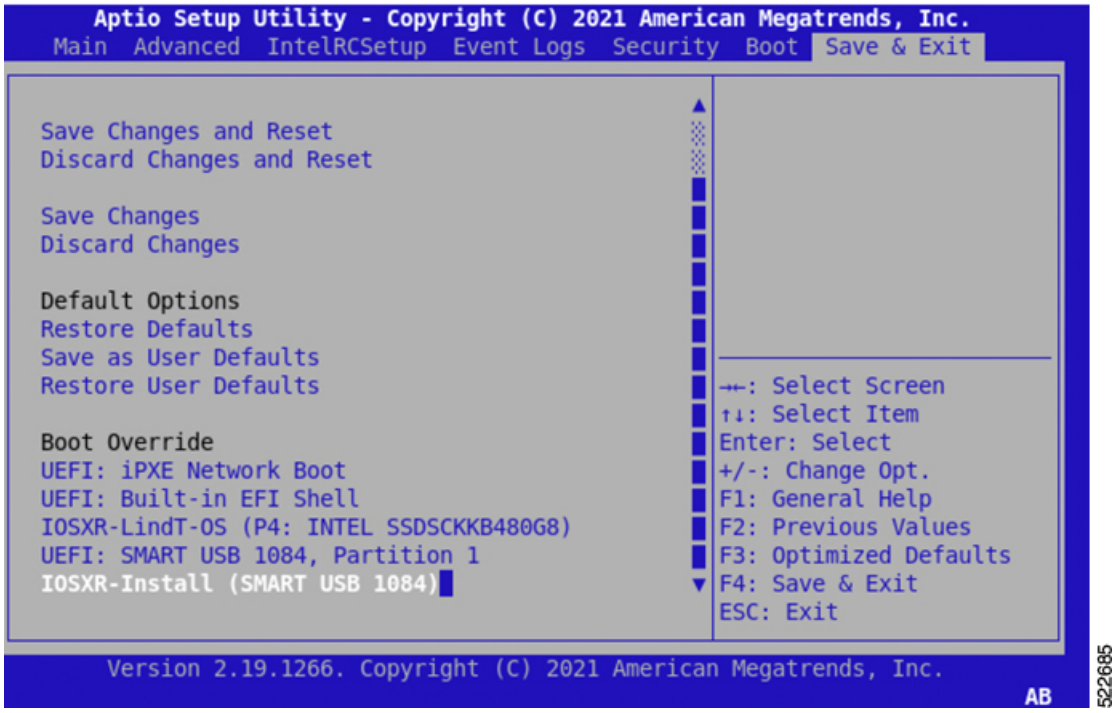
Step 5 Insert the USB drive in one of the USB ports of NCS 1010 line card/controller card.

Step 6 Reboot NCS 1010 using power cycle or console.

Note Use the **reload bootmedia usb noprompt** command to boot the NCS 1010 from the USB. If you are using the **reload bootmedia usb noprompt** command, then you can skip the remaining steps.

Step 7 Press **Esc** to enter BIOS.

Step 8 Select the **Save & Exit** tab of BIOS.



Step 9 Choose **IOS -XR Install**.

The BIOS UI displays the USB drive vendor in the brackets, in this case, SMART USB 1084.

The system detects USB and boots the image from USB.

```
Booting from USB..
Loading Kernel..
Verifying (loop)/boot/bzImage...
(loop)/boot/bzImage verified using attached signature.
Loading initrd..
Verifying (loop)/boot/initrd.img...
```

Step 10 Remove the USB drive after the `Rebooting the system after installation` message is displayed. The NCS 1010 reboots automatically.

Note The USB must be removed only after the image is loaded successfully.

DHCP Configuration

DHCP configuration is required for both manual configuration and ZTP configuration. Follow the below sections to set up DHCP for booting NCS 1010 using ZTP and iPXE.

Introduction to DHCP Relay

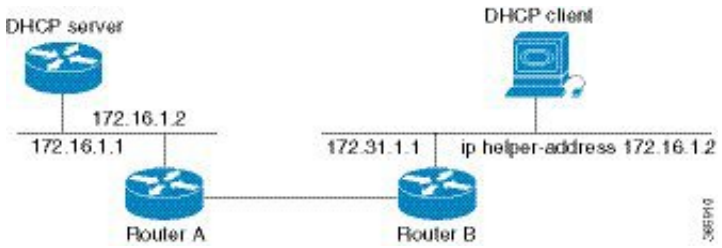
A DHCP relay agent is a host that forwards DHCP packets between clients and servers that do not reside on a shared physical subnet. Relay agent forwarding is distinct from the normal forwarding of an IP router where IP datagrams are switched between networks transparently.

DHCP clients use User Datagram Protocol (UDP) broadcasts to send DHCPDISCOVER messages when they lack information about the network to which they belong.

If a client is on a network segment that does not include a server, a relay agent is needed on that network segment to ensure that DHCP packets reach the servers on another network segment. UDP broadcast packets are not forwarded, because most routers are not configured to forward broadcast traffic. You can configure a DHCP relay agent to forward DHCP packets to a remote server by configuring a DHCP relay profile and configure one or more helper addresses in it. You can assign the profile to an interface or a VRF.

The figure below demonstrates the process. The DHCP client broadcasts a request for an IP address and additional configuration parameters on its local LAN. Acting as a DHCP relay agent, Router B picks up the broadcast, changes the destination address to the DHCP server's address and sends the message out on another interface. The relay agent inserts the IP address of the interface, on which the DHCP client's packets are received into the gateway address (giaddr) field of the DHCP packet, which enables the DHCP server to determine which subnet should receive the offer and identify the appropriate IP address range. The relay agent unicasts the messages to the server address, in this case 172.16.1.2 (which is specified by the helper address in the relay profile).

Figure 5: Forwarding UDP Broadcasts to a DHCP Server Using a Helper Address



Prerequisites for Configuring DHCP Relay Agent

The following are the prerequisites to configure a DHCP relay agent:

- You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.
- A configured and running DHCP client and DHCP server.
- Connectivity between the relay agent and DHCP server

Limitations for DHCP Relay Feature

These are the limitations for implementing DHCP relay feature:

- The multicast addresses are not supported. The **helper-address** command in DHCP relay profile submode supports valid unicast IP address as the helper address.

Note Configuring the **helper-address** command directly (not using profile) under a interface (such as BVI interface) is not supported.

- Only interface-id and remote-id DHCP option code are added by a relay agent while forwarding the packet to a DHCP server.

Note Configuring DHCP option code is not supported in DHCP relay profile submode.

Configuring and Enabling the DHCP Relay Agent

Configuration Example

```
RP/0/RP0/CPU0:ios# configure
RP/0/RP0/CPU0:ios(config)# dhcp ipv4
RP/0/RP0/CPU0:ios(config-dhcpv4)# profile r1 relay
RP/0/RP0/CPU0:ios(config-dhcpv4-relay-profile)#  helper-address vrf default 198.51.100.1
giaddr 198.51.100.3
RP/0/RP0/CPU0:ios(config-dhcpv4-relay-profile)# !
RP/0/RP0/CPU0:ios(config-dhcpv4-relay-profile)# interface GigabitEthernet0/0/0/2 relay
profile r1
RP/0/RP0/CPU0:ios(config-dhcpv4)# commit
```

Running Configuration

```
RP/0/RP0/CPU0:ios# show running-config dhcp ipv4
Tue Aug 29 07:30:50.677 UTC
dhcp ipv4
 profile r1 relay
  helper-address vrf default 198.51.100.1 giaddr 198.51.100.3
 !
 interface GigabitEthernet0/0/0/2 relay profile r1
!
```

DHCP Client

The Dynamic Host Configuration Protocol (DHCP) client functionality enables the router interfaces to dynamically acquire the IPv4 or DHCPv4 or DHCPv6 server, and forwards the responses back to the correct Layer 2 address so that the correct device gets the correct configuration information.

DHCP has the ability to allocate IP addresses only for a configurable period of time, called the lease period. If the client is required to retain this IP address for a longer period beyond the lease period, the lease period must be renewed before the IP address expires. The client renews the lease based on configuration that was sent from the server. The client unicasts a REQUEST message using the IP address of the server. When a server receives the REQUEST message and responds with an ACK message. The lease period of the client is extended by the lease time configured in the ACK message.

Enabling DHCP Client on an Interface

You can enable both the DHCPv4 and DHCPv6 clients at an interface level. The DHCP component receives a notification when DHCPv4 or DHCPv6 is enabled or disabled on an interface.

```
RP/0/RP0/CPU0:ios# configure
Tue Aug 29 09:26:12.468 UTC
RP/0/RP0/CPU0:ios(config)# int mgmtEth 0/RP0/CPU0/0
RP/0/RP0/CPU0:ios(config-if)# ipv4 address dhcp
RP/0/RP0/CPU0:ios(config-if)# commit
Tue Aug 29 09:26:21.715 UTC
RP/0/RP0/CPU0:ios(config-if)# exit
RP/0/RP0/CPU0:ios(config)# int mgmtEth 0/RP0/CPU0/0
RP/0/RP0/CPU0:ios(config-if)# ipv6 address dhcp
```

```
dhcp  dhcp-client-options
RP/0/RP0/CPU0:ios(config-if)# ipv6 address dhcp
RP/0/RP0/CPU0:ios(config-if)# commit
Tue Aug 29 09:26:50.159 UTC
```

Boot Using iPXE

iPXE is a pre-boot execution environment that is included in the network card of the management interfaces and works at the system firmware (UEFI) level of the chassis. iPXE is used to reimage the system, and boot the chassis in case of boot failure or in the absence of a valid bootable partition. iPXE downloads the ISO image, proceeds with the installation of the image, and finally bootstraps inside the new installation.

Note The time taken for iPXE to download the ISO image depends on the network speed. Ensure that the network speed is sufficient to complete the image download in less than 10 minutes. The chassis reloads if the image is not downloaded by 10 minutes.

iPXE acts as a bootloader and provides the flexibility to choose the image that the system will boot based on the Platform Identifier (PID), the Serial Number, or the management MAC-address. You must define iPXE in the DHCP server configuration file.

Note To initiate the iPXE boot process, perform one of the following methods:

- Use the **reload bootmedia network location all** command. This method is the preferred method.
- Power cycle the NCS 1010 chassis and start the iPXE boot process in the BIOS interface.

Setup DHCP Server

A DHCP server must be configured for IPv4, IPv6, or both communication protocols.

Note For DHCPv6, a routing advertisement (RA) message must be sent to all nodes in the network that indicates which method is to be used to obtain the IPv6 address. Configure Router-advertise-daemon (radvd, install using yum install radvd) to allow the client to send the DHCP request. For example:

```
interface eth3
{
        AdvSendAdvert on;
        MinRtrAdvInterval 60;
        MaxRtrAdvInterval 180;
        AdvManagedFlag on;
        AdvOtherConfigFlag on;
        prefix 2001:1851:c622:1::/64
        {
                AdvOnLink on;
                AdvAutonomous on;
                AdvRouterAddr off;
        };
};
```

To setup a DHCP server:

1. Create the `dhcpd.conf` file (for IPv4, IPv6 or both communication protocols), `dhcpv6.conf` file (for IPv6) or both in the `/etc/` directory. This configuration file stores the network information such as the path to the script, location of the ISO install file, location of the provisioning configuration file, serial number, MAC address of the chassis.
2. Test the server once the DHCP server is running:

   For example, for ipv4:

   a. Use MAC address of the chassis:

   ```
   host ncs1010
   {
   hardware ethernet ab:cd:ef:01:23:45;
   fixed-address <ip address>;
   filename "http://<httpserver-address>/<path-to-image>/ncs1010-mini-x.iso";
   }
   ```

   Ensure that the above configuration is successful.

   b. Use serial number of the chassis:

   ```
   host demo {
   option dhcp-client-identifier "<chassis-serial-number>";
     filename "http://<IP-address>/<hardware-platform>-mini-x.iso";
     fixed-address <IP-address>;
   }
   ```

   The serial number of the chassis is derived from the BIOS and is used as an identifier.

   Example

   ```
   host 10.89.205.202 {
          hardware ethernet 40:55:39:56:0c:e8;
           option dhcp-client-identifier "<FCB2437B066>";
             if exists user-class and option user-class = "iPXE" {
             filename "http://10.89.205.127/box1/ncs1010-x64.iso";
          } else {
              filename "http://10.89.205.127/box1/StartupConfig.cfg";
          }
          fixed-address 10.89.205.202;
       }
   ```

Boot Using iPXE

Before you use the iPXE boot, ensure that:

- DHCP server is set and is running.
- Management port of the NCS 1010 chassis is in *UP* state.

Use anyone of the following methods to invoke the iPXE boot process:

- via CLI terminal:

  Run the following command to invoke the iPXE boot process to reimage the chassis:

  ```
  reload bootmedia network location all
  ```

  Example:

```
RP/0/RP0/CPU0:ios# reload bootmedia network location all
Wed Jul  6 15:11:33.791 UTC
Reload hardware module ? [confirm]
```

The following example shows the output of the command:

```
Preparing system for backup. This may take a few minutes especially for large
configurations.
        Status report: node0_RP0_CPU0: BACKUP INPROGRESS
RP/0/RP0/CPU0:P1D_DT#   Status report: node0_RP0_CPU0: BACKUP HAS COMPLETED SUCCESSFULLY

[Done]
[FAILED] Failed unmounting /mnt/fuse/parser_server.
[  OK  ] Unmounted /mnt/fuse/ftp.
[  OK  ] Unmounted /mnt/fuse/nvgen_server.
[  OK  ] Unmounted /boot/efi.
[  OK  ] Unmounted /selinux.
.
.
Output Snipped
.
.
..         *** Sirius ***
System Initializing..
..

ERROR: Class:0; Subclass:10000; Operation: 1004

Shelf Assembly Reset
Shelf Assembly Reset for P1


..         *** Sirius ***
System Initializing..
..

ERROR: Class:0; Subclass:10000; Operation: 1004
.
.
Output Snipped
.
.

NCS1010, Initializing Devices

Booting from Primary Flash
Aldrin: Programmed MI 10
.
.
Output Snipped
.
.
Version 2.19.1266. Copyright (C) 2022 American Megatrends, Inc.
BIOS Date: 05/20/2022 10:47:39 Ver: 0ACHI0410
Press <DEL> or <ESC> to enter setup.
TAM Chipguard Validate Observed DB Error: 0x48

WARNING!!! TAM: Empty Chip DB


Software Boot OK, Validated

iPXE initialising devices...ok
```

```
iPXE 1.0.0+ (c2215) -- Open Source Network Boot Firmware -- http://ipxe.org
Features: DNS HTTP TFTP VLAN EFI ISO9660 ISO9660_grub Menu
Trying net0-2051,net0-2052 and net0-2053...
net0-2051: 68:9e:0b:b8:71:1e using NII on NII-PCI06:00.0 (open)
  [Link:down, TX:0 TXE:0 RX:0 RXE:0]
  [Link status: Unknown (http://ipxe.org/1a086194)]
Configuring (net0-2051 68:9e:0b:b8:71:1e)................... Error 0x040ee186
(http://ipxe.org/040ee186)
net0-2052: 68:9e:0b:b8:71:1f using NII on NII-PCI06:00.0 (open)
  [Link:up, TX:0 TXE:0 RX:18 RXE:14]
  [RXE: 8 x "Operation not supported (http://ipxe.org/3c086083)"]
  [RXE: 3 x "Error 0x440e6083 (http://ipxe.org/440e6083)"]
  [RXE: 3 x "The socket is not connected (http://ipxe.org/380f6093)"]
Configuring (net0-2052 68:9e:0b:b8:71:1f).................. ok
net0: fe80::6a9e:bff:feb8:711e/64
net1: fe80::6a9e:bff:feb8:7121/64 (inaccessible)
net2: fe80::6a9e:bff:feb8:7122/64 (inaccessible)
net3: fe80::6a9e:bff:feb8:7123/64 (inaccessible)
net0-2051: fe80::6a9e:bff:feb8:711e/64
net0-2051: 2001:420:5446:2014::281:0/119 gw fe80::676:b0ff:fed8:c100 (no address)
net0-2051: 2002:420:54ff:93:6a9e:bff:feb8:711e/64 gw fe80::fa4f:57ff:fe72:a640
net0-2052: 10.4.33.44/255.255.0.0 gw 10.4.33.1
net0-2052: fe80::6a9e:bff:feb8:711e/64
net0-2053: fe80::6a9e:bff:feb8:711e/64
Filename: http://10.4.33.51/P1D_DT_05/ncs1010-x64.iso
http://10.4.33.51/P1D_DT_05/ncs1010-x64.iso... ok
.
.
Output Snipped
.
.
User Access Verification

Username: cisco
Password:
```

- via BIOS interface:

  1. Reboot NCS 1010 using power cycle or console.
  2. Press **Esc** to enter BIOS.
  3. Select the **Save & Exit** tab of BIOS.
  4. Choose **UEFI: iPXE Network Boot**.

     The following example shows the output of the command:

     ```
     Preparing system for backup. This may take a few minutes especially for large
     configurations.
             Status report: node0_RP0_CPU0: BACKUP INPROGRESS
     RP/0/RP0/CPU0:P1D_DT#   Status report: node0_RP0_CPU0: BACKUP HAS COMPLETED
     SUCCESSFULLY
     [Done]
     [FAILED] Failed unmounting /mnt/fuse/parser_server.
     [  OK  ] Unmounted /mnt/fuse/ftp.
     [  OK  ] Unmounted /mnt/fuse/nvgen_server.
     [  OK  ] Unmounted /boot/efi.
     [  OK  ] Unmounted /selinux.
     .
     .
     Output Snipped
     .
     .
     ```

```
..         *** Sirius ***
System Initializing..
..

ERROR: Class:0; Subclass:10000; Operation: 1004

Shelf Assembly Reset
Shelf Assembly Reset for P1


..         *** Sirius ***
System Initializing..
..

ERROR: Class:0; Subclass:10000; Operation: 1004
.
.
Output Snipped
.
.

NCS1010, Initializing Devices

Booting from Primary Flash
Aldrin: Programmed MI 10
.
.
Output Snipped
.
.
Version 2.19.1266. Copyright (C) 2022 American Megatrends, Inc.
BIOS Date: 05/20/2022 10:47:39 Ver: 0ACHI0410
Press <DEL> or <ESC> to enter setup.
TAM Chipguard Validate Observed DB Error: 0x48

WARNING!!! TAM: Empty Chip DB


Software Boot OK, Validated

iPXE initialising devices...ok


iPXE 1.0.0+ (c2215) -- Open Source Network Boot Firmware -- http://ipxe.org
Features: DNS HTTP TFTP VLAN EFI ISO9660 ISO9660_grub Menu
Trying net0-2051,net0-2052 and net0-2053...
net0-2051: 68:9e:0b:b8:71:1e using NII on NII-PCI06:00.0 (open)
  [Link:down, TX:0 TXE:0 RX:0 RXE:0]
  [Link status: Unknown (http://ipxe.org/1a086194)]
Configuring (net0-2051 68:9e:0b:b8:71:1e).................. Error 0x040ee186
(http://ipxe.org/040ee186)
net0-2052: 68:9e:0b:b8:71:1f using NII on NII-PCI06:00.0 (open)
  [Link:up, TX:0 TXE:0 RX:18 RXE:14]
  [RXE: 8 x "Operation not supported (http://ipxe.org/3c086083)"]
  [RXE: 3 x "Error 0x440e6083 (http://ipxe.org/440e6083)"]
  [RXE: 3 x "The socket is not connected (http://ipxe.org/380f6093)"]
Configuring (net0-2052 68:9e:0b:b8:71:1f).................. ok
net0: fe80::6a9e:bff:feb8:711e/64
net1: fe80::6a9e:bff:feb8:7121/64 (inaccessible)
net2: fe80::6a9e:bff:feb8:7122/64 (inaccessible)
net3: fe80::6a9e:bff:feb8:7123/64 (inaccessible)
net0-2051: fe80::6a9e:bff:feb8:711e/64
net0-2051: 2001:420:5446:2014::281:0/119 gw fe80::676:b0ff:fed8:c100 (no address)
net0-2051: 2002:420:54ff:93:6a9e:bff:feb8:711e/64 gw fe80::fa4f:57ff:fe72:a640
```

```
net0-2052: 10.4.33.44/255.255.0.0 gw 10.4.33.1
net0-2052: fe80::6a9e:bff:feb8:711e/64
net0-2053: fe80::6a9e:bff:feb8:711e/64
Filename: http://10.4.33.51/P1D_DT_05/ncs1010-x64.iso
http://10.4.33.51/P1D_DT_05/ncs1010-x64.iso... ok
.
.
Output Snipped
.
.
User Access Verification

Username: cisco
Password:
```

Boot Using Zero Touch Provisioning

ZTP allows you to provision the network device with day 0 configurations and supports both management ports and data ports.

ZTP provides multiple options, such as:

- Automatically apply specific configuration in a large-scale environment.
- Download and install specific IOS XR image.
- Install specific application package or third party applications automatically.
- Deploy containers without manual intervention.
- Upgrade or downgrade software versions effortlessly on thousands of network devices at a time

Benefits of Using ZTP

ZTP helps you manage large-scale service providers infrastructures effortlessly. Following are the added benefits of using ZTP:

- ZTP helps you to remotely provision a router anywhere in the network. Thus eliminates the need to send an expert to deploy network devices and reduces IT cost.
- Automated provisioning using ZTP can remove delay and increase accuracy and thus is cost-effective and provides better customer experience.

  By automating repeated tasks, ZTP allows network administrators to concentrate on more important stuff.
- ZTP process helps you to quickly restore service. Rather than troubleshooting an issue by hand, you can reset a system to well-known working status.

Prerequisites:

ZTP does not execute, if a username is already configured in the system.

ZTP is initiated in one of the following ways:

- **Automated Fresh Boot:**

  Fresh Boot: When you boot the device, the ZTP process initiates automatically if the device does not have a prior configuration. During the process, the router receives the details of the configuration file

from the DHCP server. Use this method for devices that has no pre-loaded configuration. See Fresh Boot Using DHCP, on page 20.

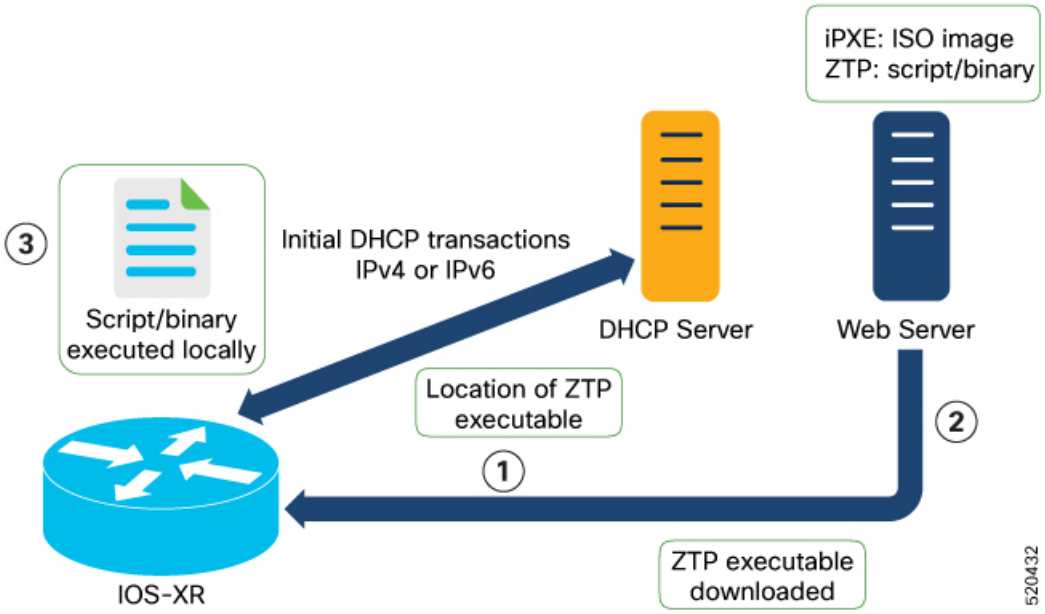
You must define the configuration file or the bootscript that is downloaded from the DHCP server:

- **Configuration File**: The first line of the file must contain **!! IOS XR configuration**", to process the file as a configuration. If you are trying to bring up ten new nodes, you have to define ten configuration files. See Build your Configuration File, on page 21.
- **ZTP Bootscript**: Define the script to be executed on every boot. See Configure ZTP BootScript, on page 22 .
- **Manual Invocation using CLI:** Use this method when you want to forcefully initiate ZTP on a fully configured device, using CLI. See Invoke ZTP Manually through CLI, on page 24.

Fresh Boot Using DHCP

The ZTP process initiates when you boot the network-device with an IOS-XR image. The process starts only on the device that doesn't have a prior configuration.

This image depicts the high-level work flow of the ZTP process:



1. ZTP sends DHCP request to fetch the ZTP configuration file or user script. To help the Bootstrap server uniquely identify the device, ZTP sends below DHCP option.
   - DHCP(v4/v6) client-id=Serial Number
   - DHCPv4 option 124: Vendor, Platform, Serial-Number
   - DHCPv6 option 16: Vendor, Platform, Serial-Number

   The following is the default sequential flow of the ZTP process:
   - ZTP sends IPv4 DHCP request first on all the management port. In case there is a failure, then ZTP sends IPv6 DHCP request on all the management port.

- ZTP sends IPv4 DHCP request first on all the data port. In case there is a failure, then ZTP sends IPv6 DHCP request on all the data port.

  The default sequential flow is defined in configuration file and you can modify the sequence using the configuration file.

2. DHCP server identifies the device and responds with DHCP response using one of the following options:

   DHCP server should be configured to respond with the DHCP options.

   - DHCPv4 using BOOTP filename to supply script/config location.
   - DHCPv4 using Option 67 (bootfile-name) to supply script/config location.
   - DHCPv6 using Option 59 (OPT_BOOTFILE_URL) to supply script/config location

3. The network device downloads the file from the web server using the URL location that is provided in the DHCP response.
4. The device receives a configuration file or script file from the HTTP server.

Note

- If the downloaded file content starts with !! IOS XR it is considered as a configuration file.
- If the downloaded file content starts with #! /bin/bash, #! /bin/sh or #!/usr/bin/python it is considered as a script file.

5. The device applies the configuration file or executes the script or binary in the default bash shell.
6. The Network device is now up and running.

Build your Configuration File

Based on the business need, you can use a configuration or script file to initiate the ZTP process.

The configuration file content starts with !! IOS XR.

The following is the sample configuration file. You can automate all the configurations. For more information on creating ZTP configuration file, refer ZTP Configuration Files Creation.

```
Tue May 4 18:08:59.544 UTC
Building configuration...
!! IOS XR Configuration 7.7.1.22I
!! Last configuration change at Tue May 4 17:12:47 2021 by cisco
!
line console
exec-timeout 0 0
!
line default
exec-timeout 0 0
session-timeout 0
!
vty-pool default 0 20
alias alarms show alarms brief system active
interface MgmtEth0/RP0/CPU0/0
ipv4 address dhcp
no shut
!
```

```
interface MgmtEth0/RP0/CPU0/1
description noshut-interface-ztp
ipv4 address 10.127.60.160 255.255.255.0
no shut
!
interface MgmtEth0/RP0/CPU0/2
description noshut-interface-ztp
no shut
!
interface PTP0/RP0/CPU0/0
description noshut-interface-ztp
no shut
Cisco NCS 1010 System Setup and Software Installation Guide, IOS XR Release 7.7.x
19
Bring-up Cisco NCS 1010
Build your Configuration File
!
telnet vrf default ipv4 server max-servers 100a
ssh server v2
ssh server netconf vrf default
netconf-yang agent
ssh
!
netconf agent tty
grpc
router static
address-family ipv4 unicast
0.0.0.0/0 10.127.60.1
end
```

Configure ZTP BootScript

ZTP downloads and executes the script files. These script files include a programmatic approach to complete a task. For example, scripts created using IOS XR commands to perform patch upgrades. The first line of the file must contain #! /bin/bash or #! /bin/sh for ZTP to process the file as script. You can either use the ZTP bash script or the ZTP configuration file.

You can either use the ZTP bash script or the ZTP configuration file.

If you want to hardcode a script to be executed every boot, configure the following.

```
Router#configure
Router(config)#ztp bootscript /disk0:/myscript
Router(config)#commit
```

The above configuration waits for the first data-plane interface to be configured and then wait an extra minute for the management interface to be configured with an IP address, to ensure that we have connectivity in the third-party namespace for applications to use. If the delay is not desired, use:

```
Router#configure
Router(config)#ztp bootscript preip /disk0:/myscript
Router(config)#commit
```

Note When the above command is first configured, you will be prompted if you wish to invoke it now. The prompt helps with testing.

This is the example content of **/disk0:/myscript**:

```
host ncs1010_P1B_DT_08_ETH0 {
#hardware ethernet 68:9e:0b:b8:6f:5c ;
option dhcp-client-identifier "FCB2437B05N" ;
if exists user-class and option user-class = "iPXE" {
filename "http://10.33.0.51/P1B_DT_08/ncs1010-x64.iso";
} else {
filename "http://10.33.0.51/P1B_DT_08/startup.cfg";
}
fixed-address 10.33.0.19;
}
```

The following is the sample content of the ZTP bash script.

```
#! /bin/bash
#
# NCS1010 Demo Sample
# ZTP installation of config and day-0 SMU's
#
source ztp_helper

wget http://downloads.sourceforge.net/project/yourcode/application.tgz
#install the downloaded application.tgz

#Run XR CLI's from the script
`xrcmd "show version"`
```

The following is the sample content of the ZTP configuration file.

```
Tue May 4 18:08:59.544 UTC
Building configuration...
!! IOS XR Configuration 7.7.1.22I
!! Last configuration change at Tue May 4 17:12:47 2021 by cisco
!
line console
exec-timeout 0 0
!
line default
exec-timeout 0 0
session-timeout 0
!
vty-pool default 0 20
alias alarms show alarms brief system active
interface MgmtEth0/RP0/CPU0/0
ipv4 address dhcp
no shut
!
interface MgmtEth0/RP0/CPU0/1
description noshut-interface-ztp
ipv4 address 10.127.60.160 255.255.255.0
no shut
!
interface MgmtEth0/RP0/CPU0/2
description noshut-interface-ztp
no shut
!
interface PTP0/RP0/CPU0/0
description noshut-interface-ztp
no shut
!
interface PTP0/RP0/CPU0/1
description noshut-interface-ztp
no shut
end
```

Invoke ZTP Manually through CLI

Manual ZTP can be invoked through CLI commands. This manual way helps you to provision the router in stages. Ideal for testing out ZTP configuration without a reboot. If you want to invoke a ZTP on an interface (data ports or management port), you don't have to bring up and configure the interface first. You can execute the ztp initiate command, even if the interface is down, ZTP script brings it up and invoke dhclient. So ZTP could run over all interfaces no matter it is up or down.

Use the ztp initiate, ztp terminate, and ztp clean commands to force ZTP to run over more interfaces.

- ztp initiate—Invokes a new ZTP DHCP session. Logs can be found in /disk0:/ztp/ztp.log.
- ztp terminate—Terminates any ZTP session in progress.
- ztp clean—Removes only the ZTP state files.

The log file ztp.log is saved in /var/log/ztp.log folder, and a copy of log file is available at /disk0:/ztp/ztp.log location using a soft link. However, executing ztp clean clears files saved on disk and not on /var/logztp.log folder where current ZTP logs are saved. In order to have a log from current ZTP run, you must manually clear the ZTP log file from /var/log/ztp.log folder.

Step 1 (optional) **ztp clean**

Example:

```
RP/0/RP0/CPU0:ios#ztp clean
Fri Apr 29 06:49:29.760 UTC
This would remove all ZTP temporary files.
Would you like to proceed? [no]: yes
All ZTP operation files have been removed.
ZTP logs are present in /var/log/ztp*.log for logrotate.
Please remove manually if needed.
If you now wish ZTP to run again from boot, do 'conf t/commit replace' followed by reload.
```

Removes all the ZTP logs and saved settings.

Step 2 **ztp initiate**

Example:

```
RP/0/RP0/CPU0:ios#ztp initiate
Fri Jun 17 11:44:08.791 UTC
Initiating ZTP may change your configuration.
Interfaces might be brought up if they are in shutdown state
Would you like to proceed? [no]: yes
ZTP will now run in the background.
Please use "show logging" or look at /var/log/ztp.log to check progress.
RP/0/RP0/CPU0:ios#
```

Use the **show logging** command or see the /var/log/ztp.log to check progress.

Reboots the Cisco NCS 1010 system.

Step 3 (Optional) **ztp terminate**

Example:

```
RP/0/RP0/CPU0:ios#ztp terminate
Fri Apr 29 06:38:59.238 UTC
This would terminate active ZTP session if any (this may leave your system in a partially configured
 state)
```

```
Would you like to proceed? [no]: yes
Terminating ZTP
No ZTP process running
```

Terminates the ZTP process.

Invoke ZTP Through Reload

The ZTP process can be automatically invoked by using the reload command.

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:P2B_DT_02#configure
```

Enters the configuration mode.

Step 2 **commit replace**

Example:

```
Fri Apr 29 06:48:46.236 UTC
RP/0/RP0/CPU0:P2B_DT_02(config)#commit replace
Fri Apr 29 06:48:53.199 UTC

This commit will replace or remove the entire running configuration. This
operation can be service affecting.
Do you wish to proceed? [no]: yes
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#end
```

Removes the entire running configuration.

Step 3 **ztp clean**

Example:

```
RP/0/RP0/CPU0:ios#ztp clean
Fri Apr 29 06:49:29.760 UTC
This would remove all ZTP temporary files.
Would you like to proceed? [no]: yes
All ZTP operation files have been removed.
ZTP logs are present in /var/log/ztp*.log for logrotate.
Please remove manually if needed.
If you now wish ZTP to run again from boot, do 'conf t/commit replace' followed by reload.
```

Removes all the ZTP logs and saved settings.

Step 4 **reload**

Example:

```
RP/0/RP0/CPU0:ios#reload
Fri Apr 29 06:50:12.312 UTC
Proceed with reload? [confirm]

RP/0/RP0/CPU0:ios#
Preparing system for backup. This may take a few minutes especially for large configurations.
 Status report: node0_RP0_CPU0: BACKUP INPROGRESS
 Status report: node0_RP0_CPU0: BACKUP HAS COMPLETED SUCCESSFULLY
[Done]
```

After the node comes up, you can check that the ZTP is initiated and the configuration has been restored successfully.

```
RP/0/RP0/CPU0:Apr 29 06:55:33.242 UTC: pyztp2[377]: %INFRA-ZTP-4-CONFIG_INITIATED : ZTP has initiated
 config load and commit operations
RP/0/RP0/CPU0:Apr 29 06:55:39.263 UTC: ifmgr[381]: %PKT_INFRA-LINK-3-UPDOWN : Interface
GigabitEthernet0/0/0/0, changed state to Down
RP/0/RP0/CPU0:Apr 29 06:55:39.287 UTC: osa_driver[183]: %PKT_INFRA-FM-4-FAULT_MINOR : ALARM_MINOR
:PROV-INPROGRESS :DECLARE :GigabitEthernet0/0/0/0:
RP/0/RP0/CPU0:Apr 29 06:55:39.287 UTC: osa_driver[183]: %PKT_INFRA-FM-4-FAULT_MINOR : ALARM_MINOR
:PROV-INPROGRESS :DECLARE :Osc0/0/0/0:
RP/0/RP0/CPU0:Apr 29 06:55:39.287 UTC: ifmgr[381]: %PKT_INFRA-LINK-3-UPDOWN : Interface
GigabitEthernet0/0/0/0, changed state to Up
RP/0/RP0/CPU0:Apr 29 06:55:39.716 UTC: osa_driver[183]: %PKT_INFRA-FM-4-FAULT_MINOR : ALARM_MINOR
:PROV-INPROGRESS :CLEAR :Osc0/0/0/0:
RP/0/RP0/CPU0:Apr 29 06:55:39.728 UTC: osa_driver[183]: %PKT_INFRA-FM-4-FAULT_MINOR : ALARM_MINOR
:PROV-INPROGRESS :CLEAR :GigabitEthernet0/0/0/0:
RP/0/RP0/CPU0:Apr 29 06:55:47.904 UTC: osa_driver[183]: %PKT_INFRA-FM-4-FAULT_MINOR : ALARM_MINOR
:PROV-INPROGRESS :DECLARE :Ots0/0/0/1:

User Access Verification

Username: cisco
Password:
ios con0/RP0/CPU0 is now available
```

Reboots the Cisco NCS 1010 system.

ZTP Logging

ZTP logs its operation on the flash file system in the directory /disk0:/ztp/. ZTP logs all the transaction with the DHCP server and all the state transition.

The following example displays the execution of a simple configuration script downloaded from a data interface using the command ztp initiate interface Ten 0/0/0/0 verbose, this script unshuts all the interfaces of the system and configure a load interval of 30 seconds on all of them.

```
2022-06-17 11:52:34,682  19292 [Xr           ] INF: Downloading the file to /tmp/ztp.script
2022-06-17 11:52:35,329  19292 [Report       ] INF: User script downloaded successfully.
Provisioning in progress.
2022-06-17 11:52:35,330  19292 [Engine       ] DEB: ZAdmin, current state:active. Processing
 work: Config device work for ZAdmin. done = False
2022-06-17 11:52:35,330  19292 [ZAdmin       ] DEB: Proceeding to provision the router
2022-06-17 11:52:35,331  19292 [Engine       ] DEB: ZAdmin, current state:active. Processing
 work: ZAdmin: Apply configuration. done = False
2022-06-17 11:52:35,331  19292 [Engine       ] INF: ZAdmin, current state:active: state tag
 changed to provision
RP/0/RP0/CPU0:Jun 17 11:52:35.341 UTC: pyztp2[140]: %INFRA-ZTP-4-CONFIG_INITIATED : ZTP has
 initiated config load and commit operations
2022-06-17 11:52:35,339  19292 [Env          ] DEB: No MTU configs detected
2022-06-17 11:52:35,340  19292 [Engine       ] DEB: ZAdmin, current state:active. Processing
 work: ZAdmin: Apply configuration. done = False
2022-06-17 11:52:35,354  19292 [Xr           ] DEB: Will apply the following config:
/disk0:/ztp/customer/config.candidate
2022-06-17 11:52:35,354  19292 [Xr           ] INF: Applying user configurations
2022-06-17 11:52:35,355  19292 [Configuration] INF: Provisioning via config replace
2022-06-17 11:52:54,656  19292 [Configuration] INF: Configuration has been applied
2022-06-17 11:52:54,656  19292 [Engine       ] DEB: ZAdmin, current state:active. Processing
```

```
 work: Sending standby sync message. done = False
2022-06-17 11:52:54,663  19292 [Engine      ] DEB: ZAdmin, current state:active. Processing
 work: [privileged] getting engine status. done = False
2022-06-17 11:52:54,664  19292 [Engine      ] DEB: ZAdmin, current state:active. Processing
 work: ZAdmin: Execute post-configuration script. done = False
2022-06-17 11:52:55,212  19292 [Env         ] INF: Env::cleanup, success:True, exiting:False
2022-06-17 11:52:55,213  19292 [ZtpHelpers   ] DEB: Executing: source /pkg/bin/ztp_helper.sh
 && echo -ne  | xrcmd "show running-config"
2022-06-17 11:52:55,825  19292 [Env          ] INF: Executing command ip netns exec
vrf-default /sbin/dhclient -4 -cf /etc/dhcp/dhclient.conf.ztp -lf
/var/lib/dhcp/dhclient.leases.ztp -sf /etc/dhcp/dhclient-script.ztp2 -r Mg0_RP0_CPU0_0 to
release IP
2022-06-17 11:52:56,968  19292 [Xr           ] INF: Removing linux route with ip 10.33.0.63
2022-06-17 11:52:57,023  19292 [Engine       ] INF: ZAdmin, current state:active, exit
code:success
2022-06-17 11:52:57,023  19292 [Engine       ] INF: ZAdmin, current state:final, exit
code:success: state changed to final
2022-06-17 11:52:59,737  19292 [Engine       ] DEB: ZAdmin, current state:final, exit
code:success. Processing work: Sending standby sync message. done = False
2022-06-17 11:52:59,738  19292 [Engine       ] WAR: ZAdmin, current state:final, exit
code:success: work is ignored: work=<desc='Sending standby sync message' done=False
priv=False>
2022-06-17 11:52:59,738  19292 [Engine       ] DEB: ZAdmin, current state:final, exit
code:success. Processing work: [privileged] getting engine status. done = False
2022-06-17 11:53:04,744  19292 [main     ] DEB: Moved to final state
2022-06-17 11:53:04,745  19292 [main     ] DEB: ZTP completed successfully
2022-06-17 11:53:04,745  19292 [main     ] INF: Exiting SUCCESSFULLY
2022-06-17 11:53:04,746  19292 [main     ] DEB: Exiting. Will not retry now.
2022-06-17 11:53:04,746  19292 [main    ] DEB: Shutting down adaptor. Cleanup False. Exiting
 False
2022-06-17 11:53:04,748  19292 [Engine       ] DEB: ZAdmin, current state:final, exit
code:success. Processing work: [privileged] prepare engine shutdown. done = False
2022-06-17 11:53:04,849  19292 [Engine       ] DEB: ZAdmin, current state:final, exit
code:success. Processing work: [privileged] shutting down ZAdmin engine. done = False
2022-06-17 11:53:04,849  19292 [Engine       ] INF: ZAdmin, current state:final, exit
code:shutdown
2022-06-17 11:53:04,849  19292 [Engine      ] INF: ZAdmin, exit code:shutdown: state changed
 to None
2022-06-17 11:53:04,849  19292 [Engine       ] DEB: ZAdmin, exit code:shutdown: breaking
engine loop after shutdown
2022-06-17 11:53:04,850  19292 [Engine      ] DEB: ZAdmin, exit code:shutdown: end of event
 loop
2022-06-17 11:53:04,850  19292 [Adaptor      ] DEB: Adaptor : Cleanup for admin context on
 Terminate
2022-06-17 11:53:06,119  19292 [main     ] INF: Exiting SUCCESSFULLY
2022-06-17 11:53:06,119  19292 [main     ] INF: ZTP Exited
RP/0/RP0/CPU0:Jun 17 11:53:06.119 UTC: pyztp2[140]: %INFRA-ZTP-4-EXITED : ZTP exited
```

Generate Tech Support Information for ZTP

When you have a problem in the ztp process that you cannot resolve, the resource of last resort is your Cisco Systems technical support representative. To analyze a problem, your technical support representative needs certain information about the situation and the symptoms that you are experiencing. To speed up the problem isolation and resolution process, collect the necessary data before you contact your representative.

Use the **show tech-support ztp** command to collect all debugging information of ztp process.

Example:

```
RP/0/RP0/CPU0:R1#show tech-support ztp
Thu Jul 28 08:33:27.531 UTC
++ Show tech start time: 2022-Jul-28.083327.UTC ++
Thu Jul 28 08:33:28 UTC 2022 Waiting for gathering to complete
```

```
..
Thu Jul 28 08:33:34 UTC 2022 Compressing show tech output
Show tech output available at 0/RP0/CPU0 :
/harddisk:/showtech/showtech-R1-ZTP-2022-Jul-28.083327.UTC.tgz
++ Show tech end time: 2022-Jul-28.083334.UTC ++
RP/0/RP0/CPU0:R1#
```

In the above example, the tech support information is saved as .tgz file in the specified location. This information can be shared with the Cisco Technical Support representatives for troubleshooting the ztp process.

Configure Management Interface

The management interface can be used for system management and remote communication. To use the management interface for system management, you must configure an IP address and subnet mask. To use the management interface for remote communication, you must configure a static route. Use this procedure when NCS 1010 chassis is not booted using ZTP.

Before you begin

- Consult your network administrator to procure IP addresses and a subnet mask for the management interface.
- Ensure that the management interface is connected to the management network.

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:ios#configure
```

Enters IOS XR configuration mode.

Step 2 **interface mgmtEth** *rack/slot/instance/port*

Example:

```
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/0
```

Enters interface configuration mode for the management interface.

Step 3 **ipv4 address** *ipv4-address subnet-mask*

Example:

```
RP/0/RP0/CPU0:ios(config-if)#ipv4 address 10.1.1.1 255.0.0.0
```

Assigns an IP address and a subnet mask to the management interface.

Step 4 **no shutdown**

Example:

```
RP/0/RP0/CPU0:ios(config-if)#no shutdown
```

Places the management interface in an "up" state.

Step 5 **exit**

Example:

```
RP/0/RP0/CPU0:ios(config-if)#exit
```

Exits the management interface configuration mode.

Step 6 **router static address-family ipv4 unicast** *0.0.0.0/0 default-gateway*

Example:

```
RP/0/RP0/CPU0:ios(config)#router static address-family ipv4 unicast 0.0.0.0/0 198.51.100.4
```

Specifies the IP address of the default gateway to configure a static route. This IP address must be used for communication with devices on other networks.

Step 7 Use the **commit** or **end** command.

commit-Saves the configuration changes and remains within the configuration session.

end-Prompts user to take one of these actions:

- **Yes**-Saves configuration changes and exits the configuration session.
- **No**-Exits the configuration session without committing the configuration changes.
- **Cancel**-Remains in the configuration session without committing the configuration changes.

What to do next

Connect the management interface to the Ethernet network. Establish a Configure SSH or Configure Telnet connection to the management interface using its IP address.

Link Layer Discovery Protocol Support on Management Interface

The Link Layer Discovery Protocol (LLDP) support on management interface feature requires a system to form LLDP neighbor relationship over the system management interface, through which it advertises and learns LLDP neighbor information. This information about neighbors used to learn about the neighbors and in turn the topology of the devices for Operations, Administration, and Maintenance (OAM) purposes.

Advantages of LLDP

- Provides support on non-Cisco devices.
- Enables neighbor discovery between non-Cisco devices.

Limitation

- When you disable LLDP globally, the LLDP gets disabled on all the interfaces.

Note By default, LLDP is enabled for NCS 1010. But when you enable and disable LLDP in the global configuration mode, LLDP gets disabled on all the interfaces.

Workaround: You must enable LLDP globally or reload the Router.

Cisco Discovery Protocol (CDP) vs LLDP

The CDP is a device discovery protocol that runs over Layer 2. Layer 2 is also known as the data link layer that runs on all Cisco devices, such as routers, bridges, access servers, and switches. This protocol allows the network management applications to automatically discover and learn about other Cisco devices that connect to the network.

The LLDP is also a device discovery protocol that runs over Layer 2. This protocol allows the network management applications to automatically discover and learn about other non-Cisco devices that connect to the network.

Interoperability between non-Cisco devices using LLDP

LLDP is also a neighbor discovery protocol that is used by network devices to advertise information about themselves to other devices on the network. This protocol runs over the data link layer, which allows two systems running different network layer protocols to learn about each other.

With LLDP, you can also access the information about a particular physical network connection. If you use a non-Cisco monitoring tool (through SNMP), LLDP helps you identify the Object Identifiers (OIDs) that the system supports. The following OIDs are supported:

- 1.0.8802.1.1.2.1.4.1.1.4
- 1.0.8802.1.1.2.1.4.1.1.5
- 1.0.8802.1.1.2.1.4.1.1.6
- 1.0.8802.1.1.2.1.4.1.1.7
- 1.0.8802.1.1.2.1.4.1.1.8
- 1.0.8802.1.1.2.1.4.1.1.9
- 1.0.8802.1.1.2.1.4.1.1.10
- 1.0.8802.1.1.2.1.4.1.1.11
- 1.0.8802.1.1.2.1.4.1.1.12

Neighbor Discovery

System advertises the LLDP TLV (Type Length Value) details over the management network using which other devices in the management network can learn about this device.

Configuring LLDP

- LLDP full stack functionality is supported on all three management interfaces that are supported in NCS 1010.
- You can selectively enable or disable LLDP on any of the management interfaces on demand.
- You can selectively enable or disable LLDP transmit or receive functionality at the management interface level.
- Information gathered using LLDP can be stored in the device Management Information Database (MIB) and queried with the Simple Network Management protocol (SNMP).
- LLDP operational data is available in both CLI and netconf-yang interface.

Enabling LLDP Globally

When you enable LLDP globally, all interfaces that support LLDP are automatically enabled for both transmit and receive operations.

Note You can override this default operation at the interface to disable receive or transmit operations.

The following table describes the global LLDP attributes that you can configure:

Table 1:

Attribute	Default	Range	Description
Holdtime	120	0–65535	Specifies the holdtime (in sec). Holdtime refers to the time or duration that an LLDP device maintains the neighbor information before discarding.
Reinit	2	2–5	Delay (in sec) for LLDP initialization on any interface
Timer	30	5–65534	Specifies the rate at which LLDP packets are sent (in sec)

The following example shows the commands to configure LLDP globally. The global LLDP configuration enables LLDP on all the three management interfaces.

```
RP/0/RP0/CPU0:regen#configure terminal
RP/0/RP0/CPU0:regen(config)#lldp management enable
RP/0/RP0/CPU0:regen(config)#lldp holdtime 30
RP/0/RP0/CPU0:regen(config)#lldp reinit 2
RP/0/RP0/CPU0:regen(config)#commit
```

Verification

You can verify the LLDP configuration using the **show running-config lldp** command.

The output of **show running-config lldp** command is as follows:

```
RP/0/RP0/CPU0:regen#show running-config lldp
Tue Dec 10 10:36:11.567 UTC
lldp
timer 30
reinit 2
holdtime 120
management enable
!
```

You can verify the LLDP data using the **show lldp interface** and **show lldp neighbors** commands.

The output of **show lldp interface** command is as follows:

```
RP/0/RP0/CPU0:regen#show lldp interface
Thu Nov  7 08:45:22.934 UTC
```

```
MgmtEth0/RP0/CPU0/0:
        Tx: enabled
        Rx: enabled
        Tx state: IDLE
        Rx state: WAIT FOR FRAME


MgmtEth0/RP0/CPU0/1:
        Tx: enabled
        Rx: enabled
        Tx state: IDLE
        Rx state: WAIT FOR FRAME
```

The output of **show lldp neighbors** command is as follows:

```
RP/0/RP0/CPU0:M-131#show lldp neighbors
Mon Dec  2 11:01:20.143 CET
Capability codes:
        (R) Router, (B) Bridge, (T) Telephone, (C) DOCSIS Cable Device
        (W) WLAN Access Point, (P) Repeater, (S) Station, (O) Other

Device ID       Local Intf              Hold-time  Capability     Port ID
[DISABLED]      MgmtEth0/RP0/CPU0/0     120        B               gi19
MYS-130         MgmtEth0/RP0/CPU0/1     120        R               MgmtEth0/RP0/CPU0/1
```

where [DISABLED] shows that the LLDP is disabled on the interface MgmtEth0/RP0/CPU0/0.

Enabling LLDP per Management Interface

The following example shows the commands to configure LLDP at the management interface level.

```
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/X
RP/0/RP0/CPU0:ios(config-if)#lldp enable
RP/0/RP0/CPU0:ios(config-if)#commit
```

Disabling LLDP Transmit and Receive Operations

The following example shows the commands to disable the LLDP transmit operations at the specified management interface.

```
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/X
RP/0/RP0/CPU0:ios(config-if)#lldp transmit disable
RP/0/RP0/CPU0:ios(config-if)#commit
```

The following example shows the commands to disable the LLDP receive operations at the specified management interface.

```
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/X
RP/0/RP0/CPU0:ios(config-if)#lldp receive disable
RP/0/RP0/CPU0:ios(config-if)#commit
```

Debugging LLDP Issues

The following commands are used for debugging issues in the LLDP functionality.

- **show lldp traffic**
- **debug lldp all**
- **debug lldp errors**
- **debug lldp events**
- **debug lldp packets**
- **debug lldp tlvs**

- **debug lldp trace**
- **debug lldp verbose**

Configure Telnet

This procedure allows you to establish a telnet session to the management interface using its IP address. Use this procedure when NCS 1010 chassis is not booted using ZTP.

Before you begin

Ensure that two xr-telnet-* rpms are installed. See Install Packages and RPMs, on page 59.

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:ios#configure
```

Enters the configuration mode.

Step 2 **telnet {ipv4 | ipv6} server max-servers** *limit*

Example:

```
RP/0/RP0/CPU0:ios(config)#telnet ipv4 server max-servers 10
```

Specifies the number of allowable telnet servers (up to 100). By default, telnet servers are not allowed. You must configure this command to enable the use of telnet servers.

Step 3 Use the **commit** or **end** command.

commit-Saves the configuration changes and remains within the configuration session.

end-Prompts user to take one of these actions:

- **Yes**-Saves configuration changes and exits the configuration session.
- **No**-Exits the configuration session without committing the configuration changes.
- **Cancel**-Remains in the configuration session without committing the configuration changes.

Configure SSH

This procedure allows you to establish an SSH session to the management interface using its IP address. Use this procedure when NCS 1010 chassis is not booted using ZTP.

Before you begin

- Generate the crypto key for SSH using the **crypto key generate dsa** command.

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:ios#configure
```

Enters the configuration mode.

Step 2 **ssh server v2**

Example:

```
RP/0/RP0/CPU0:ios(config)# ssh server v2
```

Enables the SSH server to accept only SSHv2 client connections.

Step 3 Use the **commit** or **end** command.

commit-Saves the configuration changes and remains within the configuration session.

end-Prompts the user to take one of these actions:

- **Yes**-Saves configuration changes and exits the configuration session.
- **No**-Exits the configuration session without committing the configuration changes.
- **Cancel**-Remains in the configuration session without committing the configuration changes.

Configure NTP Server

Understand NTP

Table 2: Feature History

Feature Name	Release Information	Feature Description
NTP Support	Cisco IOS XR Release 7.11.1	Network Time Protocol (NTP) allows devices to synchronize clocks with the NTP servers, maintaining the most accurate time. NCS 1010 now supports time synchronization. In modern and large networks, time synchronization is critical because every aspect of managing, securing, planning, and debugging a network depends on the time of occurrence of events. Commands added: • **ntp server** • **show ntp associations** • **show ntp status**

NTP uses the User Datagram Protocol (UDP) as its transport protocol. All NTP communication uses Coordinated Universal Time (UTC). An NTP network usually receives its time from an authoritative time source, such as a radio clock or an atomic clock attached to a time server. NTP distributes this time across the network.

NTP uses the concept of a “stratum” to describe how many NTP hops away a machine is from an authoritative time source. A “stratum 1” time server typically has an authoritative time source (such as a radio or atomic clock, or a GPS time source) directly attached, a “stratum 2” time server receives its time through NTP from a “stratum 1” time server, and so on.

The communications between machines running NTP (known as associations) are usually statically configured; each machine is given the IP address of all machines with which it should form associations. Accurate timekeeping is made possible by exchanging NTP messages between each pair of machines with an association.

An NTP broadcast client listens for broadcast messages sent by an NTP broadcast server at a designated IPv4 address. The client synchronizes the local clock using the first received broadcast message.

Synchronize Clock with NTP Server

There is an independent system clock for IOS XR. To ensure that this clock does not deviate from true time, it must be synchronized with the clock of an NTP server.

Before you begin

Configure Management Interface, on page 28

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:ios#configure
```

Enters the configuration mode.

Step 2 **ntp**

Example:

```
RP/0/RP0/CPU0:ios(config)#ntp
```

Enters NTP configuration mode.

Step 3 **server** [**ipv4** | **ipv6**] *ntp-server-ip-address* [**version** *version-number*] [**key** *key-id*] [**minpoll** *interval*] [**maxpoll** *interval*] [**source** *type interface-path-id*] [**prefer**] [**burst**] [**iburst**]

Example:

IPv4:

```
RP/0/RP0/CPU0:ios(config-ntp)#server 4.33.0.51 version 4 prefer iburst
```

IPv6:

```
RP/0/RP0/CPU0:ios(config-ntp)#server 2001:DB8::1 version 4 prefer iburst
```

Synchronizes the console clock with the specified NTP server.

Note The NTP server can also be reached through a VRF if the management interface is in a VRF.

Step 4 Use one of the following commands:

- **end**
- **commit**

Example:

```
RP/0/RP0/CPU0:ios(config-ntp)#end
```

or

```
RP/0/RP0/CPU0:router(config-ntp)#commit
```

Saves configuration changes.

- When you issue the **end** command, the system prompts you to commit changes:

```
Uncommitted changes found, commit them before
  exiting(yes/no/cancel)?
[cancel]:
```

  - Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns to EXEC mode.
  - Entering **no** exits the configuration session and returns to EXEC mode without committing the configuration changes.

- Entering **cancel** leaves the system in the current configuration session without exiting or committing the configuration changes.

- Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 5 **show running-config ntp**

Example:

```
RP/0/RP0/CPU0:ios#show running-config ntp

Sun Nov  5 15:14:24.969 UTC

ntp

 server 4.33.0.51 burst iburst

!
```

Displays the running configuration.

Verify the Status of the External Reference Clock

This task explains how to verify the status of NTP components.

Note The commands can be entered in any order.

Step 1 **show ntp associations [detail] [location** *node-id***]**

Example:

```
RP/0/RP0/CPU0:ios#show ntp associations
Sun Nov 5 15:14:44.128 UTC

address ref clock st when poll reach delay offset disp
*~4.33.0.51 10.64.58.50 2 81 128 377 1.84 7.802 2.129
* sys_peer, # selected, + candidate, - outlayer, x falseticker, ~ configured
```

Displays the status of NTP associations.

Example:

```
RP/0/RP0/CPU0:ios#show ntp associations detail
Sun Nov 5 15:14:48.763 UTC

4.33.0.51 configured, our_master, stratum 2
ref ID 10.64.58.50, time E8F22BB9.79D4A841 (14:56:57.475 UTC Sun Nov 5 2023)
our mode client, peer mode server, our poll intvl 128, peer poll intvl 128
root delay 0.6866 msec, root disp 1.04, reach 377, sync dist 6.2590
delay 1.84 msec, offset 7.802 msec, dispersion 2.129
precision 2**23, version 4
org time E8F22F92.B647E8FC (15:13:22.712 UTC Sun Nov 5 2023)
rcv time E8F22F92.B88F303C (15:13:22.720 UTC Sun Nov 5 2023)
```

```
xmt time E8F22F92.B88F303C (15:13:22.720 UTC Sun Nov 5 2023)
filtdelay = 1.844 1.772 1.983 1.954 1.945 2.000 1.902 1.778
filtoffset = 7.857 7.802 8.065 8.063 8.332 8.397 8.664 8.684
filterror = 0.000 0.060 1.995 2.055 4.050 4.110 6.060 6.120
```

Example:

```
RP/0/RP0/CPU0:ios#show ntp associations detail location 0/RP0/CPU0
Sun Nov 5 15:38:15.744 UTC

4.33.0.51 configured, our_master, stratum 2
ref ID 10.64.58.50, time E8F233C0.5606A159 (15:31:12.336 UTC Sun Nov 5 2023)
our mode client, peer mode server, our poll intvl 128, peer poll intvl 128
root delay 0.7019 msec, root disp 0.47, reach 377, sync dist 5.6762
delay 2.01 msec, offset 7.226 msec, dispersion 3.856
precision 2**23, version 4
org time E8F23563.DE5D42D5 (15:38:11.868 UTC Sun Nov 5 2023)
rcv time E8F23563.E07C296D (15:38:11.876 UTC Sun Nov 5 2023)
xmt time E8F23563.E07C296D (15:38:11.876 UTC Sun Nov 5 2023)
filtdelay = 2.006 1.865 1.936 1.762 1.932 1.875 1.881 2.011
filtoffset = 7.210 7.305 7.372 7.226 7.298 7.258 7.251 7.224
filterror = 0.000 2.025 2.085 4.035 4.095 6.060 6.120 8.070
```

Step 2 **show ntp status [location** *node-id***]**

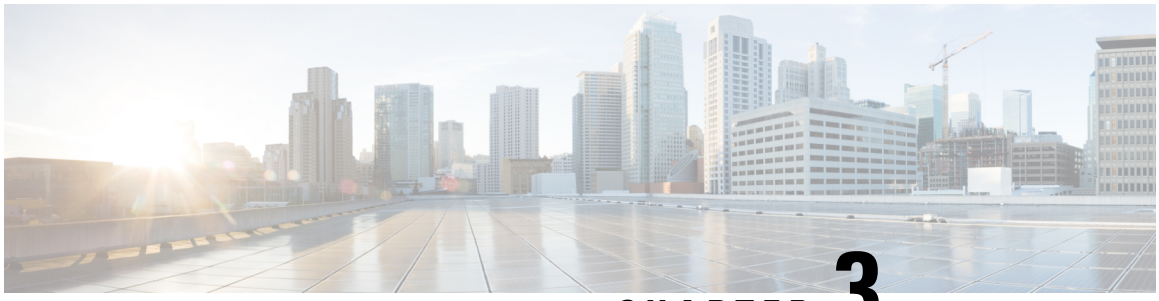
Example:

```
RP/0/RP0/CPU0:ios#show ntp status
Sun Nov 5 15:14:36.949 UTC

Clock is synchronized, stratum 3, reference is 4.33.0.51
nominal freq is 1000000000.0000 Hz, actual freq is 44881851.3383 Hz, precision is 2**24
reference time is E8F22D7A.AB020D97 (15:04:26.668 UTC Sun Nov 5 2023)
clock offset is 9.690 msec, root delay is 2.553 msec
root dispersion is 24.15 msec, peer dispersion is 2.13 msec
loopfilter state is 'CTRL' (Normal Controlled Loop), drift is 0.0000212807 s/s
system poll interval is 128, last update was 610 sec ago
authenticate is disabled, panic handling is disabled,
hostname resolution retry interval is 1440 minutes.
```

Verifies that the clock is synchronized with the NTP server.

NTP Troubleshooting Information

For NTP troubleshooting information, see here.



CHAPTER 3

Disaster Recovery

This chapter describes the disaster recovery process and the health check feature.

- Overview, on page 39
- CPU Replacement Considerations, on page 39
- Health Check of Backup ISO Image, on page 39

Overview

There are two partitions in NCS 1010: RP SSD (CPU partition) and chassis SSD (Disaster Recovery partition). The Disaster Recovery partition contains all the backup configurations such as ISO images, RPMs, and system configuration files. When the node is corrupted, the Disaster Recovery feature allows the CPU to be replaced with the existing configuration. After replacing the CPU, the node reboots and comes up by restoring the software and configuration files from the chassis SSD without traffic loss.

CPU Replacement Considerations

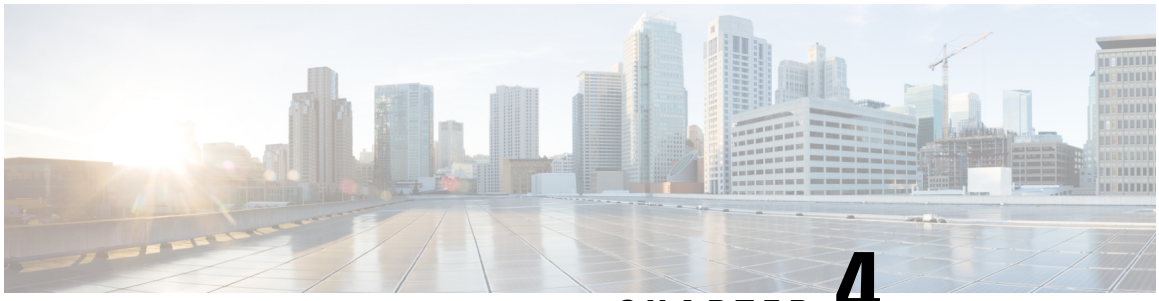
You must consider the following points for CPU replacement.

- When the CPU is removed from the chassis, NCS 1010 chassis runs in headless mode which is non-traffic impacting.
- When the CPU is replaced with another CPU having the same software and RPMs as in the chassis SSD, the configuration is restored from the chassis SSD.
- When the CPU is replaced with another CPU having different software and RPMs as in the chassis SSD, the Disaster recovery process starts. In this case, the node boots with the software from the chassis SSD and the configuration is also restored from the chassis SSD.

Health Check of Backup ISO Image

The Health Check feature ensures error-free booting of NCS 1010 chassis during disaster recovery operations. NCS 1010 has a partition for disaster recovery where the backup ISO image is stored. The backup ISO image is stored in the chassis SSD.

The chassis SSD content is audited against the running software by the install process in the background every 12 hours to detect corruption. If the ISO image is corrupted, the software will recover it by copying from the backup location. If the software fails to synchronize with the chassis SSD, then the **Disaster Recovery ISO Image Corruption** alarm is raised. See the *Troubleshooting Guide for Cisco NCS 1010* to clear the alarm.



CHAPTER 4

Perform Preliminary Checks

After successfully logging into the console, you must perform some preliminary checks to verify the default setup. If any setup issue is detected, take corrective action before making further configurations.

Note The output of the examples in the procedures is not from the latest software release. The output will change for any explicit references to the current release.

- Verify Status of Hardware Components, on page 41
- Verify Inventory, on page 42
- Verify Software Version, on page 43
- Verify Firmware Version, on page 44
- Verify Management Interface Status, on page 46
- Verify Alarms, on page 47
- Verify Environmental Parameters, on page 48
- Verify Context, on page 54
- Verify Core Files, on page 54
- Verify Memory Information, on page 54

Verify Status of Hardware Components

To verify the status of all the hardware components installed on NCS 1010, perform the following procedure.

Before you begin

Ensure that all the required hardware components are installed on NCS 1010. For installation details, see *Cisco Network Convergence System 1010 Hardware Installation Guide*.

show platform

When you execute this command, the status of Cisco IOS XR is displayed.

Example:

```
RP/0/RP0/CPU0:ios#show platform
Wed Apr 27 08:43:40.130 UTC
Node              Type                  State                 Config state
```

```
------------------------------------------------------------------------------
0/RP0/CPU0        NCS1010-CNTLR-K9(Active) IOS XR RUN               NSHUT,NMON
0/PM0             NCS1010-AC-PSU           OFFLINE                  NSHUT,NMON
0/PM1             NCS1010-AC-PSU           OPERATIONAL              NSHUT,NMON
0/FT0             NCS1010-FAN              OPERATIONAL              NSHUT,NMON
0/FT1             NCS1010-FAN              OPERATIONAL              NSHUT,NMON
0/0/NXR0          NCS1K-OLT-C              OPERATIONAL              NSHUT,NMON
0/1               NCS1K-BRK-SA             OPERATIONAL              NSHUT,NMON
0/1/0             NCS1K-BRK-8              OPERATIONAL              NSHUT,NMON
0/1/1             NCS1K-BRK-8              OPERATIONAL              NSHUT,NMON
0/1/2             NCS1K-BRK-24             OPERATIONAL              NSHUT,NMON
0/1/3             NCS1K-BRK-24             OPERATIONAL              NSHUT,NMON
0/2               NCS1K-MD-32E-C           OPERATIONAL              NSHUT,NMON
0/3               NCS1K-MD-32O-C           OPERATIONAL              NSHUT,NMON

RP/0/RP0/CPU0:ios#show platform
Thu Mar  2 12:35:01.883 IST
Node              Type                     State                    Config state
------------------------------------------------------------------------------
0/RP0/CPU0        NCS1010-CNTLR-K9(Active) IOS XR RUN               NSHUT,NMON
0/PM0             NCS1010-AC-PSU           OPERATIONAL              NSHUT,NMON
0/PM1             NCS1010-AC-PSU           OFFLINE                  NSHUT,NMON
0/FT0             NCS1010-FAN              OPERATIONAL              NSHUT,NMON
0/FT1             NCS1010-FAN              OPERATIONAL              NSHUT,NMON
0/0/NXR0          NCS1K-OLT-L              OPERATIONAL              NSHUT,NMON
0/3               NCS1K-BRK-24             OPERATIONAL              NSHUT,NMON
```

Verify that all the components of NCS 1010 are displayed in output. The state must be in the OPERATIONAL state. The various states are:

- OPERATIONAL—Node is operating normally and is fully functional.
- POWERED_ON—Power is on and the node is booting up.
- FAILED—Node is powered on but has encountered an internal failure.
- PRESENT—Node is in intermediate state in the boot sequence.
- POWERED_OFF—Power is off and the node cannot be accessed.
- IOS XR RUN—Node is running IOS XR.
- OFFLINE—Input power is not connected to the power modules.

Verify Inventory

The **show inventory** command displays details of the hardware inventory of NCS 1010.

To verify the inventory information for all the physical entities, perform the following procedure.

show inventory

Displays the details of the physical entities of NCS 1010 along with the details of SFPs.

Example:

```
RP/0/RP0/CPU0:ios#show inventory
Wed Apr 27 08:43:44.222 UTC
```

```
NAME: "Rack 0", DESCR: "NCS1010 - Shelf Assembly"
PID: NCS1010-SA         , VID: V00, SN: FCB2504B0X4

NAME: "0/RP0/CPU0", DESCR: "Network Convergence System 1010 Controller"
PID: NCS1010-CNTLR-K9   , VID: V00, SN: FCB2506B0NX

NAME: "0/1", DESCR: "NCS 1000 shelf for 4 passive modules"
PID: NCS1K-BRK-SA       , VID: V00 , SN: FCB2534B0GR

NAME: "0/1/0", DESCR: "NCS 1000 MTP/MPO to 8 port passive breakout module"
PID: NCS1K-BRK-8        , VID: V00 , SN: MPM25401005

NAME: "0/1/1", DESCR: "NCS 1000 MTP/MPO to 8 port passive breakout module"
PID: NCS1K-BRK-8        , VID: V00 , SN: MPM25401003

NAME: "0/1/2", DESCR: "NCS 1000 MTP/MPO to 24 colorless chs passive breakout module"
PID: NCS1K-BRK-24       , VID: V00 , SN: MPM25141004

NAME: "0/1/3", DESCR: "NCS 1000 MTP/MPO to 24 colorless chs passive breakout module"
PID: NCS1K-BRK-24       , VID: V00 , SN: MPM25371005

NAME: "0/2", DESCR: "NCS 1000 32 chs Even Mux/Demux Patch Panel - 150GHz - C-band"
PID: NCS1K-MD-32E-C     , VID: V00 , SN: ACW2529YE13

NAME: "0/3", DESCR: "NCS 1000 32 chs Odd  Mux/Demux Patch Panel - 150GHz - C-band"
PID: NCS1K-MD-32O-C     , VID: V00 , SN: ACW2529YA13

NAME: "0/FT0", DESCR: "NCS1010 - Shelf Fan"
PID: NCS1010-FAN        , VID: V00, SN: FCB2504B0W3

NAME: "0/FT1", DESCR: "NCS1010 - Shelf Fan"
PID: NCS1010-FAN        , VID: V00, SN: FCB2504B0U8

NAME: "0/PM0", DESCR: "NCS 1010 - AC Power Supply Unit"
PID: NCS1010-AC-PSU     , VID: V00, SN: APS244700D0

NAME: "0/PM1", DESCR: "NCS 1010 - AC Power Supply Unit"
PID: NCS1010-AC-PSU     , VID: V00, SN: APS244700BY
```

Verify Software Version

NCS 1010 is shipped with the Cisco IOS XR software preinstalled. Verify that the latest version of the software is installed. If a newer version is available, perform a Upgrade Software, on page 57. This software upgrade installs the newer version of the software and provide the latest feature set on NCS 1010.

To verify the version of Cisco IOS XR Software running on NCS 1010, perform the following procedure.

show version

Displays the software version and details such as system uptime.

Example:

```
RP/0/RP0/CPU0:ios#show version
Sat Mar 25 11:38:23.614 IST
Cisco IOS XR Software, Version 7.9.1
Copyright (c) 2013-2023 by Cisco Systems, Inc.
```

```
Build Information:
Built By : ingunawa
Built On : Tue Mar 07 02:22:55 UTC 2023
Build Host : iox-ucs-063
Workspace : /auto/iox-ucs-063-san2/prod/7.9.1.30I.SIT_IMAGE/ncs1010/ws
Version : 7.9.1
Label : 7.9.1
cisco NCS1010 (C3758 @ 2.20GHz)
cisco NCS1010-SA (C3758 @ 2.20GHz) processor with 32GB of memory
OLT-C-R-SITE-1 uptime is 2 weeks, 12 hours, 59 minutes
NCS 1010 - Chassis
```

Verify the software version to determine whether system upgrade is required. If the upgrade is required, see Upgrade Software, on page 57.

Verify Firmware Version

The firmware version on various hardware components of NCS 1010 must be compatible with the installed Cisco IOS XR release. Incompatibility may cause NCS 1010 to malfunction.

To verify the firmware version, perform the following procedure.

Step 1 **show hw-module fpd**

Displays the firmware information of various hardware components of NCS 1010.

Example:

```
RP/0/RP0/CPU0:ios#show hw-module fpd
Thu Mar  2 12:35:06.602 IST

Auto-upgrade:Enabled
Attribute codes: B golden, P protect, S secure, A Anti Theft aware
                                                                 FPD Versions
                                                                 ==============
Location   Card type             HWver FPD device       ATR Status   Running Programd  Reload Loc
-------------------------------------------------------------------------------------------------
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  ADMConfig            CURRENT    3.40    3.40        NOT REQ
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  BIOS              S  CURRENT    4.20    4.20          0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  BIOS-Golden       BS CURRENT            4.10          0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  CpuFpga           S  CURRENT    1.11    1.11          0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  CpuFpgaGolden     BS CURRENT            1.01          0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  SsdIntelS4510     S  CURRENT   11.32   11.32          0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  TamFw             S  CURRENT    6.13    6.13          0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  TamFwGolden       BS CURRENT            6.11          0/RP0
0/PM0      NCS1010-AC-PSU        0.0   AP-PriMCU            CURRENT    1.03    1.03        NOT REQ
0/PM0      NCS1010-AC-PSU        0.0   AP-SecMCU            CURRENT    2.01    2.01        NOT REQ
0/PM1      NCS1010-AC-PSU        0.0   AP-PriMCU            CURRENT    1.03    1.03        NOT REQ
0/PM1      NCS1010-AC-PSU        0.0   AP-SecMCU            CURRENT    2.01    2.01        NOT REQ
0/0/NXR0   NCS1K-OLT-L           1.0   OLT               S  CURRENT    1.02    1.02        NOT REQ
0/Rack     NCS1010-SA            2.1   EITU-ADMConfig       CURRENT    2.10    2.10        NOT REQ
0/Rack     NCS1010-SA            2.1   IoFpga            S  CURRENT    1.12    1.12        NOT REQ
0/Rack     NCS1010-SA            2.1   IoFpgaGolden      BS CURRENT            1.01        NOT REQ
0/Rack     NCS1010-SA            2.1   SsdIntelS4510     S  CURRENT   11.32   11.32         0/Rack
```

Step 2 **show fpd package**

Displays the FPD image version available with this software release for each hardware component.

Example:

```
RP/0/RP0/CPU0:ios#show fpd package
Thu Mar  2 12:37:58.530 IST

================================ ================================================
                                        Field Programmable Device Package
                                 ================================================
                                                  Req      SW       Min Req   Min Req
Card Type            FPD Description             Reload   Ver      SW Ver    Board Ver
================== ========================== ====== ======= ======== =========
--------------------------------------------------------------------------------
NCS1010-AC-PSU       AP-PriMCU                   NO      1.03      1.03      0.0
                     AP-SecMCU                   NO      2.01      2.01      0.0
--------------------------------------------------------------------------------
NCS1010-CNTLR-K9     ADMConfig                   NO      2.30      2.30      0.0
                     ADMConfig                   NO      2.30      2.30      0.0
                     ADMConfig                   NO      3.40      3.40      1.0
                     BIOS                        YES     4.20      4.20      0.0
                     BIOS                        YES     4.20      4.20      0.0
                     BIOS-Golden                 YES     4.10      4.10      0.0
                     BIOS-Golden                 YES     4.10      4.10      0.0
                     CpuFpga                     YES     1.11      1.11      0.0
                     CpuFpga                     YES     1.11      1.11      0.0
                     CpuFpgaGolden               YES     1.01      1.01      0.0
                     CpuFpgaGolden               YES     1.01      1.01      0.0
                     SsdIntelS4510               YES    11.32     11.32      0.0
                     SsdIntelS4510               YES    11.32     11.32      0.0
                     SsdMicron5300               YES     0.01      0.01      0.0
                     SsdMicron5300               YES     0.01      0.01      0.0
                     SsdSmartModular             YES    13.06     13.06      0.0
                     SsdSmartModular             YES    13.06     13.06      0.0
                     TamFw                       YES     6.13      6.13      0.0
                     TamFw                       YES     6.13      6.13      0.0
                     TamFwGolden                 YES     6.11      6.11      0.0
                     TamFwGolden                 YES     6.11      6.11      0.0
--------------------------------------------------------------------------------
NCS1010-SA           EITU-ADMConfig              NO      1.04      1.04      0.0
                     EITU-ADMConfig              NO      2.10      2.10      1.0
                     EITU-ADMConfig              NO      1.04      1.04      0.0
                     EITU-ADMConfig              NO      2.10      2.10      1.0
                     IoFpga                      NO      1.12      1.12      0.0
                     IoFpga                      NO      1.12      1.12      0.0
                     IoFpgaGolden                NO      1.01      1.01      0.0
                     IoFpgaGolden                NO      1.01      1.01      0.0
                     SsdIntelS4510               YES    11.32     11.32      0.0
                     SsdIntelS4510               YES    11.32     11.32      0.0
                     SsdMicron5300               YES     0.01      0.01      0.0
                     SsdMicron5300               YES     0.01      0.01      0.0
                     SsdSmartModular             YES    13.06     13.06      0.0
                     SsdSmartModular             YES    13.06     13.06      0.0
--------------------------------------------------------------------------------
NCS1K-ILA-2R-C       ILA                         NO      1.12      1.12      0.1
                     ILA                         NO      0.28      0.28     99.1
                     Raman-1                     NO      1.04      1.04      0.1
                     Raman-1                     NO      0.28      0.28     99.1
                     Raman-2                     NO      1.04      1.04      0.1
                     Raman-2                     NO      0.28      0.28     99.1
--------------------------------------------------------------------------------
NCS1K-ILA-C          ILA                         NO      1.12      1.12      0.1
                     ILA                         NO      0.28      0.28     99.1
--------------------------------------------------------------------------------
NCS1K-ILA-L          ILA                         NO      1.00      1.00      0.1
--------------------------------------------------------------------------------
NCS1K-ILA-R-C        ILA                         NO      1.12      1.12      0.1
```

```
                    ILA                       NO      0.28      0.28      99.1
                    Raman-1                   NO      1.04      1.04       0.1
                    Raman-1                   NO      0.28      0.28      99.1
--------------------------------------------------------------------------------
NCS1K-OLT-C         OLT                       NO      1.12      1.12       0.1
                    OLT                       NO      0.28      0.28      99.1
--------------------------------------------------------------------------------
NCS1K-OLT-L         OLT                       NO      1.02      1.02       0.1
--------------------------------------------------------------------------------
NCS1K-OLT-R-C       OLT                       NO      1.12      1.12       0.1
                    OLT                       NO      0.28      0.28      99.1
                    Raman-1                   NO      1.04      1.04       0.1
                    Raman-1                   NO      0.28      0.28      99.1
```

Verify Management Interface Status

To verify the management interface status, perform the following procedure.

Step 1 **show interfaces MgmtEth 0/RP0/CPU0/0**

Displays the management interface configuration.

Example:

```
RP/0/RP0/CPU0:ios#show interfaces MgmtEth 0/RP0/CPU0/0
Wed May 25 11:49:18.118 UTC
MgmtEth0/RP0/CPU0/0 is up, line protocol is up
  Interface state transitions: 1
  Hardware is Management Ethernet, address is 38fd.f866.0964 (bia 38fd.f866.0964)
  Internet address is 10.33.0.61/16
  MTU 1514 bytes, BW 1000000 Kbit (Max: 1000000 Kbit)
     reliability 255/255, txload 0/255, rxload 0/255
  Encapsulation ARPA,
  Full-duplex, 1000Mb/s, CX, link type is autonegotiation
  loopback not set,
  Last link flapped 15:05:21
  ARP type ARPA, ARP timeout 04:00:00
  Last input never, output 00:00:00
  Last clearing of "show interface" counters never
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     53138 packets input, 6636701 bytes, 0 total input drops
     0 drops for unrecognized upper-level protocol
     Received 12145 broadcast packets, 40082 multicast packets
              0 runts, 0 giants, 0 throttles, 0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     217288 packets output, 60964220 bytes, 0 total output drops
     Output 1 broadcast packets, 15 multicast packets
     0 output errors, 0 underruns, 0 applique, 0 resets
     0 output buffer failures, 0 output buffers swapped out
     1 carrier transitions
```

Step 2 **show interfaces summary** and **show interfaces brief**

Verifies the management interface status.

Example:

```
RP/0/RP0/CPU0:ios#show interfaces summary
Wed May 25 11:50:02.558 UTC
Interface Type          Total    UP       Down     Admin Down
--------------          -----    --       ----     ----------
ALL TYPES                9        5         0          4
--------------
IFT_GETHERNET           1        1         0          0
IFT_LOOPBACK            2        2         0          0
IFT_ETHERNET            3        1         0          2
IFT_NULL                1        1         0          0
IFT_PTP_ETHERNET        2        0         0          2
```

Example:

```
RP/0/RP0/CPU0:ios#show interfaces brief
Wed May 25 11:50:28.438 UTC

               Intf     Intf        LineP              Encap         MTU        BW
               Name    State       State               Type        (byte)    (Kbps)
-------------------------------------------------------------------------------------------------

                Lo0       up          up             Loopback       1500          0
                Lo3       up          up             Loopback       1500          0
                Nu0       up          up              Null           1500          0
          Gi0/0/0/0       up          up              ARPA           1514    1000000
         Mg0/RP0/CPU0/0    up          up              ARPA           1514    1000000
        Mg0/RP0/CPU0/1    admin-down  admin-down       ARPA  1514    1000000
        Mg0/RP0/CPU0/2    admin-down  admin-down       ARPA  1514    1000000
        PT0/RP0/CPU0/0    admin-down  admin-down       ARPA  1514    1000000
        PT0/RP0/CPU0/1    admin-down  admin-down       ARPA  1514    1000000
```

Example:

```
RP/0/RP0/CPU0:ios#show ipv4 interfaces brief
Tue Jul 12 07:32:42.390 UTC

Interface                      IP-Address      Status          Protocol Vrf-Name
Loopback0                      10.3.3.21        Up              Up       default
Loopback3                      10.1.1.2        Up              Up       default
GigabitEthernet0/0/0/0         10.7.1.20        Up              Up       default
MgmtEth0/RP0/CPU0/0            10.4.33.63       Up              Up       default
PTP0/RP0/CPU0/0                unassigned      Shutdown        Down     default
MgmtEth0/RP0/CPU0/1            unassigned      Down            Down     default
PTP0/RP0/CPU0/1                unassigned      Shutdown        Down     default
MgmtEth0/RP0/CPU0/2            unassigned      Down            Down     default
```

Verify Alarms

You can view the alarm information using the **show alarms** command.

show alarms [**brief** [**card | rack | system**] [**location** *location*] [**active | history**] | **detail** [**card | rack | system**] [**location** *location*] [**active | clients | history | stats**]]

Displays alarms in brief or detail.

Example:

```
RP/0/RP0/CPU0:ios#show alarms brief system active

Thu Apr 28 06:16:50.524 UTC

------------------------------------------------------------------------------------
Active Alarms
------------------------------------------------------------------------------------
Location        Severity     Group            Set Time                  Description
------------------------------------------------------------------------------------
0/RP0/CPU0      Major        Ethernet         04/28/2022 06:03:39 UTC   RP-SW: SPI flash config is incorrect
0/PM0           Major        Environ          04/28/2022 06:03:50 UTC   Power Module Error (PM_VIN_VOLT_OOR)
0/PM0           Major        Environ          04/28/2022 06:03:50 UTC   Power Module Output Disabled
(PM_OUTPUT_DISABLED)
0               Major        Environ          04/28/2022 06:03:50 UTC   Power Group redundancy lost
0/PM0           Major        FPD_Infra        04/28/2022 06:04:08 UTC   One Or More FPDs Need Upgrade Or Not In
Current State
0/PM1           Major        FPD_Infra        04/28/2022 06:04:09 UTC   One Or More FPDs Need Upgrade Or Not In
Current State
0/0             Minor        Environ          04/28/2022 06:04:10 UTC   ILAC_CT_1: Invalid sensor read error.
0/0             Minor        Environ          04/28/2022 06:04:10 UTC   ILAC_CT_2: Invalid sensor read error.
0/0             Minor        Environ          04/28/2022 06:04:10 UTC   ILAC_CT_3: Invalid sensor read error.
0/0             Minor        Environ          04/28/2022 06:04:10 UTC   ILAC_CT_4: Invalid sensor read error.
0/0             Major        Controller       04/28/2022 06:05:12 UTC   Osc0/0/0/0 - Provisioning Failed
0/0             Major        Controller       04/28/2022 06:05:12 UTC   Osc0/0/0/2 - Provisioning Failed
0/0             Major        Controller       04/28/2022 06:05:12 UTC   Ots0/0/0/0 - Provisioning Failed
0/0             Major        Controller       04/28/2022 06:05:12 UTC   Ots0/0/0/2 - Provisioning Failed
```

Note In the maintenance mode, all the alarms are moved from active to suppressed and the **show alarms** command does not display the alarms details.

Verify Environmental Parameters

The **show environment** command displays the environmental parameters of NCS 1010.

To verify that the environmental parameters are as expected, perform the following procedure.

show environment [**alarm-contact** | **all** | **altitude** | **current** | **fan** | **humidity** | **power** | **voltages** [**location** | *location*] | **temperature** [**location** | *location*]]

Displays the environmental parameters of NCS 1010.

Example:

The following example shows a sample output of the **show environment** command with the **fan** keyword.

```
RP/0/RP0/CPU0:ios#show environment fan
Thu May 26 04:15:37.765 UTC
================================================================================
                                                Fan speed (rpm)
Location      FRU Type                          FAN_0    FAN_1   FAN_2
--------------------------------------------------------------------------------

0/PM0        NCS1010-AC-PSU                      5368
0/PM1        NCS1010-AC-PSU                      5336
0/FT0        NCS1010-FAN                        10020   10020   10020
0/FT1        NCS1010-FAN                        10020   10020    9960

================================================================================
```

The following example shows a sample output of the **show environment** command with the **temperatures** keyword for *0/RP0 location*.

```
RP/0/RP0/CPU0:ios#show environment temperature location 0/RP0

Thu May 26 04:16:39.832 UTC
=============================================================================================================
Location  TEMPERATURE                          Value      Crit     Major    Minor    Minor    Major    Crit
          Sensor                             (deg C)     (Lo)      (Lo)     (Lo)     (Hi)     (Hi)     (Hi)
-------------------------------------------------------------------------------------------------------------
0/RP0/CPU0
          RP_TEMP_PCB                          30       -10       -5        0       70       75       80
          RP_TEMP_HOT_SPOT                     33       -10       -5        0       70       75       80
          RP_TEMP_LTM4638                      49       -10       -5        0       80       85       90
          RP_TEMP_LTM4644_0                    36       -10       -5        0       80       85       90
          RP_TEMP_LTM4644_1                    39       -10       -5        0       80       85       90
          RP_JMAC_1V0_VCCP_TMON                33       -10       -5        0       80       85       90
          RP_JMAC_1V0_VNN_TMON                 33       -10       -5        0       80       85       90
          RP_JMAC_1V0_VCC_RAM_TMON             32       -10       -5        0       80       85       90
          RP_JMAC_1V2_DDR_VDDQ_TMON            33       -10       -5        0       80       85       90
=============================================================================================================
```

The following example shows a sample output of the **show environment** command with the **temperatures** keyword for *0/0/NXR0 location*.

```
RP/0/RP0/CPU0:ios#show environment temperature location 0/0/NXR0

Thu May 26 04:16:39.832 UTC
=============================================================================================================
Location  TEMPERATURE                          Value      Crit     Major    Minor    Minor    Major    Crit
          Sensor                             (deg C)     (Lo)      (Lo)     (Lo)     (Hi)     (Hi)     (Hi)
-------------------------------------------------------------------------------------------------------------
0/0/NXR0
          OLTC_LT_P0_iEDFA0                    24        18        19       20       30       31       32
          OLTC_LT_P0_iEDFA1                    25        18        19       20       30       31       32
          OLTC_LT_P0_iEDFA2                    24        18        19       20       30       31       32
          OLTC_LT_P2_iEDFA0                    25        18        19       20       30       31       32
          OLTC_LT_P3_iEDFA0                    25        18        19       20       30       31       32
          OLTC_LT_P0_eEDFA0                    24        18        19       20       30       31       32
          OLTC_CT_1                            32       -10       -7       -5       75       77       80
          OLTC_LT_P0_eEDFA1                    24        18        19       20       30       31       32
          OLTC_CT_2                            27       -10       -7       -5       70       73       75
          OLTC_CT_3                            30       -10       -7       -5       70       73       75
          OLTC_CT_4                            30       -10       -7       -5       70       73       75
          OLTC_FT_P0_iEDFA0                    60        55        57       58       62       64       65
          OLTC_FT_P2_iEDFA0                    60        55        57       58       62       64       65
          OLTC_FT_P3_iEDFA0                    60        55        57       58       62       64       65
          OLTC_FT_P0_eEDFA0                    60        55        57       58       62       64       65
=============================================================================================================
```

The following example shows a sample output of the **show environment** command with the **power** keyword.

```
RP/0/RP0/CPU0:ios#show environment power
Thu May 26 04:17:55.592 UTC
=================================================================================
CHASSIS LEVEL POWER INFO: 0
=================================================================================
   Total output power capacity (Group 0 + Group 1) :    1050W +     1050W
   Total output power required                     :     700W
   Total power input                               :     228W
   Total power output                              :     140W

Power Group 0:
=================================================================================
   Power       Supply         ------Input----   ------Output---     Status
   Module      Type            Volts     Amps    Volts     Amps
=================================================================================
   0/PM0       NCS1010-AC-PSU  228.5     0.5     12.1      5.6      OK
```

```
Total of Group 0:              114W/0.5A         67W/5.6A

Power Group 1:
================================================================================
   Power       Supply         ------Input----   ------Output---     Status
   Module      Type            Volts     Amps    Volts     Amps
================================================================================
   0/PM1       NCS1010-AC-PSU  228.5     0.5     12.1      6.1      OK

Total of Group 1:              114W/0.5A         73W/6.1A

================================================================================
   Location     Card Type                Power       Power        Status
                                         Allocated   Used
                                         Watts       Watts
================================================================================
   0/RP0/CPU0   NCS1010-CNTLR-K9         90          14           ON
   0/FT0        NCS1010-FAN              110         17           ON
   0/FT1        NCS1010-FAN              110         15           ON
   0/0/NXR0     NCS1K-OLT-C              350         61           ON
   0/Rack       NCS1010-SA               40          19           ON


================================================================================
```

The following example shows a sample output of the **show environment** command with the **voltages** keyword.

```
RP/0/RP0/CPU0:ios#show environment voltage location 0/RP0
Thu May 26 04:19:16.636 UTC
============================================================================================
Location  VOLTAGE                                Value      Crit    Minor    Minor     Crit
          Sensor                                 (mV)       (Lo)    (Lo)     (Hi)      (Hi)
--------------------------------------------------------------------------------------------
0/RP0/CPU0
          RP_ADM1266_12V0                      12094    10800    11280    12720    13200
          RP_ADM1266_1V8_CPU                    1806     1670     1750     1850     1930
          RP_ADM1266_1V24_VCCREF                1238     1150     1200     1280     1330
          RP_ADM1266_1V05_CPU                   1047      980     1020     1080     1120
          RP_ADM1266_1V2_DDR_VDDQ               1204     1120     1160     1240     1280
          RP_ADM1266_1V0_VCC_RAM                 988      650      700     1250     1300
          RP_ADM1266_1V0_VNN                     869      550      600     1250     1300
          RP_ADM1266_1V0_VCCP                   1018      450      500     1250     1300
          RP_ADM1266_0V6_DDR_VTT                 599      560      580      620      640
          RP_ADM1266_3V3_STAND_BY               3301     3070     3200     3400     3530
          RP_ADM1266_5V0                        5004     4650     4850     5150     5350
          RP_ADM1266_3V3                        3325     3070     3200     3400     3530
          RP_ADM1266_2V5_PLL                    2489     2330     2430     2580     2680
          RP_ADM1266_2V5_FPGA                   2502     2330     2430     2580     2680
          RP_ADM1266_1V2_FPGA                   1202     1120     1160     1240     1280
          RP_ADM1266_3V3_CPU                    3332     3070     3200     3400     3530
          RP_ADM1266_2V5_CPU                    2498     2330     2430     2580     2680

============================================================================================
```

The following example shows a sample output of the **show environment** command with the **current** keyword.

```
RP/0/RP0/CPU0:P2C_DT_02#show environment current
Tue Jul  5 08:36:22.132 UTC
============================================================================================
Location  CURRENT                                Value
          Sensor                                 (mA)
--------------------------------------------------------------------------------------------
0/RP0/CPU0
          RP_CURRMON_LTM4638                      395
          RP_CURRMON_LTM4644_0                    179
```

```
          RP_CURRMON_LTM4644_1                  307
          RP_JMAC_1V0_VCCP_IMON                 187
          RP_JMAC_1V0_VNN_IMON                   62
          RP_JMAC_1V0_VCC_RAM_IMON                0
          RP_JMAC_1V2_DDR_VDDQ_IMON             187
0/Rack
          SA_ADM1275_12V_MOD0_IMON             4154
          SA_ADM1275_12V_MOD1_IMON               43
          SA_ADM1275_12V_MOD2_IMON               18
          SA_ADM1275_12V_FAN0_IMON             1356
          SA_ADM1275_12V_FAN1_IMON             1517
          SA_INA230_5V0_IMON                    129
          SA_INA230_3V3_IMON                   2998
          SA_INA230_1V0_XGE_CORE_IMON          2464
          SA_INA230_1V0_FPGA_CORE_IMON          787
          SA_ADM1275_12V_SA_IMON               1668
          SA_ADM1275_12V_CPU_IMON              1147
```

The following example shows a sample output of the **show environment** command with the **altitude** keyword.

```
RP/0/RP0/CPU0:P2C_DT_02#show environment altitude
Tue Jul  5 08:36:51.710 UTC
================================================================================
Location     Altitude Value (Meters)    Source
--------------------------------------------------------------------------------
0            760                     sensor
```

The following example shows a sample output of the **show environment** command with the **all** keyword.

```
RP/0/RP0/CPU0:P2C_DT_02#show environment all

Tue Jul  5 08:37:28.412 UTC
=============================================================================================================================
Location  TEMPERATURE                            Value     Crit    Major    Minor    Minor    Major    Crit
          Sensor                                (deg C)     (Lo)     (Lo)     (Lo)     (Hi)     (Hi)    (Hi)
-----------------------------------------------------------------------------------------------------------------------------
0/RP0/CPU0
          RP_TEMP_PCB                             29      -10       -5        0       70       75       80
          RP_TEMP_HOT_SPOT                        32      -10       -5        0       70       75       80
          RP_TEMP_LTM4638                         45      -10       -5        0       80       85       90
          RP_TEMP_LTM4644_0                       35      -10       -5        0       80       85       90
          RP_TEMP_LTM4644_1                       38      -10       -5        0       80       85       90
          RP_JMAC_1V0_VCCP_TMON                   30      -10       -5        0       80       85       90
          RP_JMAC_1V0_VNN_TMON                    29      -10       -5        0       80       85       90
          RP_JMAC_1V0_VCC_RAM_TMON                30      -10       -5        0       80       85       90
          RP_JMAC_1V2_DDR_VDDQ_TMON               31      -10       -5        0       80       85       90
0/PM0
          Ambient Temp                            29      -10       -5        0       55       60       65
          Secondary HotSpot Temp                  50      -10       -5        0       85       90       95
          Primary HotSpot Temp                    41      -10       -5        0       65       70       75
0/0/NXR0
          ILAC_LT_P0_eEDFA0                       25       18       19       20       30       31       32
          ILAC_LT_P0_eEDFA1                       25       18       19       20       30       31       32
          ILAC_LT_P0_eEDFA2                       25       18       19       20       30       31       32
          ILAC_LT_P2_eEDFA0                       25       18       19       20       30       31       32
          ILAC_LT_P2_eEDFA1                       25       18       19       20       30       31       32
          ILAC_LT_P2_eEDFA2                       25       18       19       20       30       31       32
          ILAC_CT_1                               29      -10       -7       -5       75       77       80
          ILAC_CT_2                               26      -10       -7       -5       70       73       75
          ILAC_CT_3                               28      -10       -7       -5       70       73       75
          ILAC_CT_4                               28      -10       -7       -5       70       73       75
          ILAC_FT_P0_eEDFA0                       59       55       57       58       62       64       65
          ILAC_FT_P0_eEDFA1                       59       55       57       58       62       64       65
0/Rack
          SA_TEMP_AIR_INLET0                      25      -10       -5        0       45       55       60
          SA_TEMP_AIR_INLET1                      25      -10       -5        0       45       55       60
          SA_TEMP_AIR_EXAUST0                     27      -10       -5        0       75       85       90
          SA_TEMP_AIR_EXAUST1                     26      -10       -5        0       75       85       90
          SA_TEMP_PCB_HOT_SPOT0                   28      -10       -5        0       80       85       90
          SA_TEMP_PCB_HOT_SPOT1                   32      -10       -5        0       80       85       90
```

```
        SA_TEMP_PCB_HOT_SPOT2                28      -10       -5        0       80       85       90
        SA_TEMP_PCB_HOT_SPOT3                30      -10       -5        0       80       85       90

==============================================================================================================
Location  VOLTAGE                              Value      Crit     Minor     Minor      Crit
          Sensor                               (mV)       (Lo)     (Lo)      (Hi)       (Hi)
--------------------------------------------------------------------------------------------------------------
0/RP0/CPU0
          RP_ADM1266_12V0                    12094    10800    11280    12720    13200
          RP_ADM1266_1V8_CPU                  1801     1670     1750     1850     1930
          RP_ADM1266_1V24_VCCREF              1238     1150     1200     1280     1330
          RP_ADM1266_1V05_CPU                 1054      980     1020     1080     1120
          RP_ADM1266_1V2_DDR_VDDQ             1207     1120     1160     1240     1280
          RP_ADM1266_1V0_VCC_RAM               988      650      700     1250     1300
          RP_ADM1266_1V0_VNN                   858      550      600     1250     1300
          RP_ADM1266_1V0_VCCP                 1008      450      500     1250     1300
          RP_ADM1266_0V6_DDR_VTT               603      560      580      620      640
          RP_ADM1266_3V3_STAND_BY             3310     3070     3200     3400     3530
          RP_ADM1266_5V0                      4996     4650     4850     5150     5350
          RP_ADM1266_3V3                      3328     3070     3200     3400     3530
          RP_ADM1266_2V5_PLL                  2489     2330     2430     2580     2680
          RP_ADM1266_2V5_FPGA                 2500     2330     2430     2580     2680
          RP_ADM1266_1V2_FPGA                 1197     1120     1160     1240     1280
          RP_ADM1266_3V3_CPU                  3332     3070     3200     3400     3530
          RP_ADM1266_2V5_CPU                  2502     2330     2430     2580     2680
0/Rack
          SA_ADM1266_12V_BUS_EITU            12057    10800    11280    12720    13200
          SA_ADM1266_5V0                      5022     4650     4800     5200     5350
          SA_ADM1266_1V8_ZARLINK_DPLL         1806     1670     1730     1870     1930
          SA_ADM1266_1V0_PHY                  1009      930      960     1040     1070
          SA_ADM1266_1V0_ALDRIN_CORE           982      910      930     1070     1090
          SA_ADM1266_1V0_ALDRIN_SERDES        1007      930      960     1040     1070
          SA_ADM1266_1V0_FPGA                 1008      930      960     1040     1070
          SA_ADM1266_1V2_FPGA                 1205     1120     1150     1250     1280
          SA_ADM1266_1V8                      1804     1670     1730     1870     1930
          SA_ADM1266_2V5                      2505     2330     2400     2600     2680
          SA_ADM1266_3V3                      3323     3070     3170     3430     3530
          SA_ADM1275_12V_SA_BP               12058    10800    11280    12720    13200
          SA_ADM1275_12V_CPU_BP              12032    10800    11280    12720    13200
          SA_ADM1275_12V_MOD0_BP             12063    10800    11280    12720    13200
          SA_ADM1275_12V_MOD1_BP             12048    10800    11280    12720    13200
          SA_ADM1275_12V_MOD2_BP             12027    10800    11280    12720    13200
          SA_ADM1275_12V_FAN0_BP             12032    10800    11280    12720    13200
          SA_ADM1275_12V_FAN1_BP             12042    10800    11280    12720    13200
==============================================================================================================
Location  CURRENT                              Value
          Sensor                               (mA)
--------------------------------------------------------------------------------------------------------------
0/RP0/CPU0
          RP_CURRMON_LTM4638                   395
          RP_CURRMON_LTM4644_0                 179
          RP_CURRMON_LTM4644_1                 307
          RP_JMAC_1V0_VCCP_IMON                125
          RP_JMAC_1V0_VNN_IMON                  62
          RP_JMAC_1V0_VCC_RAM_IMON               0
          RP_JMAC_1V2_DDR_VDDQ_IMON            156
0/Rack
          SA_ADM1275_12V_MOD0_IMON            3412
          SA_ADM1275_12V_MOD1_IMON              30
          SA_ADM1275_12V_MOD2_IMON              43
          SA_ADM1275_12V_FAN0_IMON            1418
          SA_ADM1275_12V_FAN1_IMON            1394
          SA_INA230_5V0_IMON                   129
          SA_INA230_3V3_IMON                  3020
```

```
          SA_INA230_1V0_XGE_CORE_IMON          2464
          SA_INA230_1V0_FPGA_CORE_IMON          787
          SA_ADM1275_12V_SA_IMON               1640
          SA_ADM1275_12V_CPU_IMON              1157
==============================================================================
                                          Fan speed (rpm)
Location      FRU Type                    FAN_0    FAN_1    FAN_2
------------------------------------------------------------------------------

0/PM0        NCS1010-AC-PSU                5424
0/FT0        NCS1010-FAN                   9960    9960    9960
0/FT1        NCS1010-FAN                  10020   10020   10020
==============================================================================
Location     Altitude Value (Meters)    Source
------------------------------------------------------------------------------
0            760                    sensor

==============================================================================
CHASSIS LEVEL POWER INFO: 0
==============================================================================
   Total output power capacity (Group 0 + Group 1) :    1050W +        0W
   Total output power required                     :     700W
   Total power input                               :     159W
   Total power output                              :     129W

Power Group 0:
==============================================================================
   Power       Supply         ------Input----   ------Output---     Status
   Module      Type            Volts     Amps    Volts     Amps
==============================================================================
   0/PM1       NCS1010-AC-PSU  0.0       0.0     0.0       0.0       OFFLINE

Total of Group 0:                0W/0.0A         0W/0.0A

Power Group 1:
==============================================================================
   Power       Supply         ------Input----   ------Output---     Status
   Module      Type            Volts     Amps    Volts     Amps
==============================================================================
   0/PM0       NCS1010-AC-PSU  228.5     0.7     12.1      10.7      OK

Total of Group 1:              159W/0.7A         129W/10.7A

==============================================================================
   Location     Card Type               Power       Power        Status
                                        Allocated   Used
                                        Watts       Watts
==============================================================================
   0/RP0/CPU0   NCS1010-CNTLR-K9        90          14           ON
   0/FT0        NCS1010-FAN            110         17           ON
   0/FT1        NCS1010-FAN            110         16           ON
   0/0/NXR0     NCS1K-ILA-C            350         54           ON
   0/Rack       NCS1010-SA             40          19           ON
```

Environment parameter anomalies are logged in the syslog. As a result, if an environment parameter that is displayed in the **show environment** command output is not as expected, check the syslog using the **show logging** and **show alarms brief system active** command. The syslog provides details on any logged problems.

Verify Context

The **show context** command displays core dump context information of NCS 1010. Core dump is a result of abnormal exit of any process running in the system.

show context

Displays the core dump context information of NCS 1010.

Example:

```
RP/0/RP0/CPU0:ios# show context
Mon Sep 27 17:21:59.219 UTC

node: node0_RP0_CPU0
------------------------------------------------------------------
No context
```

The command output is empty during system upgrade.

Verify Core Files

Use the **run** command to go to the hard disk location and check for the core dumps of NCS 1010.

run

Example:

```
RP/0/RP0/CPU0:ios# run
Mon Sep 27 17:29:11.163 UTC
[xr-vm_node0_RP0_CPU0:~]$cd /misc/disk1/
[xr-vm_node0_RP0_CPU0:/misc/disk1]$ls -lrt *.tgz
```

Verify Memory Information

You can view the memory information using the show watchdog memory-state command.

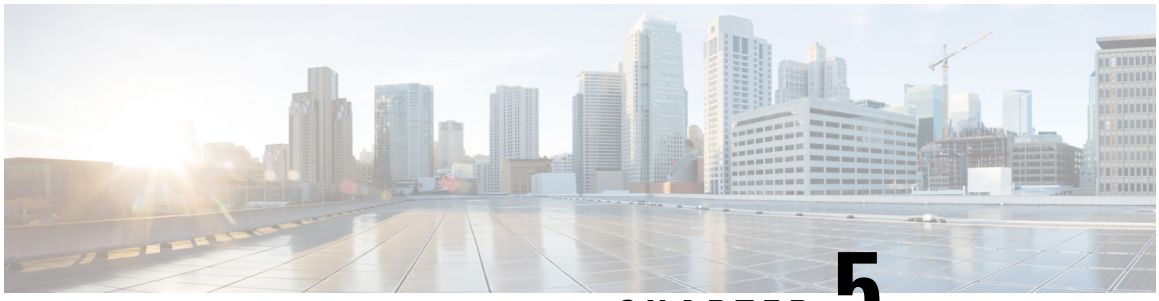
show watchdog memory-state location all

Displays memory snapshot in brief.

Example:

```
RP/0/RP0/CPU0:ios#show watchdog memory-state location all
Thu Jun 16 08:36:44.436 UTC
---- node0_RP0_CPU0 ----
Memory information:
    Physical Memory     : 31935.167 MB
```

```
Free Memory          : 29236.0   MB
Memory State         :   Normal
```



CHAPTER 5

Upgrade Software and FPD

This chapter describes the procedures to upgrade software and FPDs.

Note The output of the examples in the procedures is not from the latest software release. The output will change for any explicit references to the current release.

- Upgrade Software, on page 57
- Software Upgrade and Downgrade Matrix, on page 59
- Install Packages and RPMs, on page 59
- NCS 1010 FPD, on page 63
- Release 7.10.1 Caveats, on page 71

Upgrade Software

Upgrading the software is the process of installing a new version of the Cisco IOS XR operating system on NCS 1010. NCS 1010 is preinstalled with the Cisco IOS XR image. However, you can install a new version to keep features up to date. You can perform the software upgrade operation using an ISO image from the XR mode.

Before you begin

- Configure Management Interface
- Copy the ISO image to be installed either on the NCS 1010 hard disk or on a network server to which NCS 1010 has access.

Step 1 Execute one of these commands:

- **install replace /harddisk:**/*iso-image-name*
- **install package replace** *<ftp or http or https protocol>/package_path/ filename1 filename2 ...*

Note The **install package replace** command upgrades the ISO image but doesn't reload the RP automatically. But the **install replace** command upgrades the ISO image and reloads the RP.

Example:

```
RP/0/RP0/CPU0:ios#install replace /harddisk:/ncs1010-x64.iso
Mon Jul  4 10:15:07.697 UTC
Once the packaging dependencies have been determined, the install operation may have to reload the
system.
If you want to control the timing of system reload, you must not continue, but use the 'install
package replace' command instead, followed by 'install apply'.
Continue? [yes/no]:[yes] yes
Install replace operation 1.1 has started
Install operation will continue in the background
....................
....................
ios con0/RP0/CPU0 is now available
```

Installs the new ISO image from the harddisk or from the network server. The install operation takes between 20–40 minutes to complete.

Note Boot time FPD upgrade happens before XR boot. All the FPDs belonging to the RP location are upgraded during the boot time FPD upgrade.

Note Automatic FPD upgrade is enabled by default.. When the automatic FPD upgrade is enabled, the install operation also upgrades the FPDs (except the Golden FPDs) that need to be upgraded.

Step 2 **show install request**

Example:

```
RP/0/RP0/CPU0:ios#show install request
Mon May  9 15:16:27.486 UTC
User request: install replace /harddisk:/ncs1010-x64.iso
Operation ID: 1.1
State:        In progress since 2022-05-09 15:13:08 UTC
Current activity:    Package add or other package operation
Next activity:       Apply
Time started:        2022-05-09 15:14:34 UTC
Timeout in:          38m 6s
Locations responded: 0/1
Location          Packaging operation stage Notification Phase Clients responded
----------------- ------------------------- ------------------ ------------------
0/RP0/CPU0        Package operations        None in progress                N/A
```

Displays the current status of the install operation.

When the install operation completes successfully, the device automatically reloads.

Note In case of the **install package replace** command, you'll be prompted to enter the next command (**install apply reload** command).

Step 3 **install commit**

Example:

```
RP/0/RP0/CPU0:ios#install commit
Mon May  9 15:24:28.581 UTC
Install commit operation 1 has started
Install operation will continue in the background
```

Commits the new ISO image.

Step 4 **show install committed**

Example:

```
RP/0/RP0/CPU0:ios#show install committed
Mon May  9 15:24:55.672 UTC
Software Hash: 9dfe3b29058bd85eccc3910fb6ea66bf7bf9ccaa9e7ef38c8e3499ab1d0e91f8
Package                          Version
------------------------------------------------- --------------------------
xr-aaa                           7.9.1
xr-acl                           7.9.1
xr-apphosting                    7.9.1
xr-appmgr                        7.9.1
xr-bcdl                          7.9.1
xr-bfd                           7.9.1
```

Displays the list of committed packages.

Software Upgrade and Downgrade Matrix

The following table lists the upgrade and downgrade paths supported for Cisco NCS 1010.

Upgrade Path		Downgrade Path	
Source Release	**Destination Release**	**Source Release**	**Destination Release**
R7.7.1, R7.9.1, R7.10.1	R7.11.1	R7.11.1	R7.10.1, R7.9.1, R7.7.1

Install Packages and RPMs

Complete this task to install additional packages or rpm files. The rpm files that need to be installed must be placed in a folder.

Note This task can be used to install SMUs as well.

Before you begin

- Configure and connect to the management interface. You can access the installable file through the management interface. For details about configuring the management interface, see Configure Management Interface, on page 28.
- Copy the package or rpm to be installed either on the NCS 1010 hard disk or on a network server to which NCS 1010 has access.

Step 1 **install package add source /harddisk:/** *iso-image-name or rpm-folder-name*

Example:

```
RP/0/RP0/CPU0:ios#install package add source /harddisk:/rpm/
Mon Jul  4 11:37:31.526 UTC
Install add operation 2.1.1 has started
Install operation will continue in the background
```

Ensure to add the respective packages or rpm files as appropriate. This operation may take time depending on the size of the files that are added. The operation takes place in an asynchronous mode. The **install package add source** command runs in the background, and the EXEC prompt is returned.

Step 2 **show install request**

Example:

```
RP/0/RP0/CPU0:ios#show install request

Mon Jul  4 11:44:48.411 UTC

User request: install package add source file:///harddisk:/rpm/
Operation ID: 2.1.1
State:        Success since 2022-07-04 11:38:57 UTC

Current activity:    Await user input
Time started:        2022-07-04 11:38:57 UTC

The following actions are available:
    install package add
    install package remove
    install package upgrade
    install package downgrade
    install package abort latest
    install package abort all-since-apply
    install apply restart
    install apply reload

Least impactful apply method: install apply restart
```

Displays the current status of the install operation.

Step 3 **install apply reload**

Example:

```
RP/0/RP0/CPU0:ios#install apply reload

Mon Jul  4 11:45:18.434 UTC
Install apply operation 2.1 has started
Install operation will continue in the background
```

Enables NCS 1010 to reload.

Step 4 **show install request**

Example:

```
RP/0/RP0/CPU0:ios#show install request

Mon Jul  4 11:47:32.221 UTC

User request: install apply reload
Operation ID: 2.1
State:        Success since 2022-07-04 11:46:03 UTC

Current activity:    Await user input
Time started:        2022-07-04 11:46:03 UTC

The following actions are available:
    install package add
    install package remove
    install package upgrade
    install package downgrade
```

```
    install package replace
    install package rollback
    install replace
    install rollback
    install source
    install commit
```

Displays the current status of the install operation.

Step 5 **install commit**

Example:

```
RP/0/RP0/CPU0:ios#install commit
Mon Jul  4 11:48:47.745 UTC
Install commit operation 2 has started
Install operation will continue in the background
```

Commits the package or rpm files.

Step 6 **show install request**

Example:

```
RP/0/RP0/CPU0:ios#show install request

User request: install commit
Operation ID: 2
State:        In progress since 2022-07-04 11:48:48 UTC

Current activity:    Commit transaction
Next activity:       Transaction complete
Time started:        2022-07-04 11:48:48 UTC

No per-location information.
```

Displays the current status of the install operation. The above output indicates that the install operation is in progress.

Example:

```
RP/0/RP0/CPU0:ios#show install request

User request: install commit
Operation ID: 2
State:        Success since 2022-07-04 11:50:32 UTC

Current activity:    No install operation in progress

The following actions are available:
    install package add
    install package remove
    install package upgrade
    install package downgrade
    install package replace
    install package rollback
    install replace
    install rollback
    install source
```

Displays the current status of the install operation. The above output indicates that the install operation is complete.

Step 7 **show install active summary**

Example:

```
RP/0/RP0/CPU0:ios#show install active summary
```

```
Mon Jul  4 11:52:24.823 UTC
Active Packages:    XR: 145    All: 1265
Label:              7.9.1
Software Hash:      3ce63ce432d50358d7a0d654ec61e4377abccf265013132e310b4d34a7259b90

Optional Packages                                                Version
---------------------------------------------------- ----------------------------
xr-bgp                                                            7.9.1
xr-ipsla                                                          7.9.1
xr-is-is                                                          7.9.1
xr-lldp                                                           7.9.1
xr-mpls-oam                                                       7.9.1
xr-netsim                                                         7.9.1
xr-olc                                                            7.9.1
xr-ospf                                                           7.9.1
xr-perfmgmt                                                       7.9.1
xr-telnet                                                         7.9.1
xr-track                                                          7.9.1
```

Displays the list of active packages and rpm files.

Step 8 **show install committed summary**

Example:

```
RP/0/RP0/CPU0:ios#show install committed summary

Mon Jul  4 11:54:04.178 UTC
Committed Packages: XR: 145    All: 1265
Label:              7.9.1
Software Hash:      3ce63ce432d50358d7a0d654ec61e4377abccf265013132e310b4d34a7259b90

Optional Packages                                                Version
---------------------------------------------------- ----------------------------
xr-bgp                                                            7.9.1
xr-ipsla                                                          7.9.1
xr-is-is                                                          7.9.1
xr-lldp                                                           7.9.1
xr-mpls-oam                                                       7.9.1
xr-netsim                                                         7.9.1
xr-olc                                                            7.9.1
xr-ospf                                                           7.9.1
xr-perfmgmt                                                       7.9.1
xr-telnet                                                         7.9.1
xr-track                                                          7.9.1
```

Displays the list of committed packages and rpm files.

Related Commands

The following commands can be used to track the status of the install operation.

Related Commands	Purpose
show install active	Displays the list of active packages.
show install committed	Displays the list of committed packages.
show install log	Displays the log information for the install operation. This information is used for troubleshooting in case of installation failure.

Related Commands	Purpose
show install package	Displays the details of the packages that are added to the repository. Use this command to identify individual components of a package.
show install request	Displays the current status of the install operation.
show install which	Displays the package information on an installed file.

NCS 1010 FPD

Table 3: Feature History

Feature Name	Release Information	Feature Description
FPD Upgrade for Passive Modules	Cisco IOS XR Release 7.10.1	You can now perform FPD upgrade of the breakout modules and multiplexer/demultiplexer modules. It is essential to upgrade the passive modules to ensure the proper functioning of the modules. You can upgrade the FPD on all passive modules simultaneously or selectively upgrade the required modules.

A Field Programmable Device (FPD) refers to any programmable hardware device on a chassis, which includes a Field Programmable Gate Array (FPGA). NCS 1010 uses several FPDs that are necessary for chassis, route processor, line cards, and power modules to function properly.

From Release 7.10.1, you can perform FPD upgrade for the breakout and multiplexer/demultiplexer modules. For the breakout modules, you can perform the FPD upgrade in both direct and indirect connections. You can upgrade all the passive modules at once or selectively upgrade the necessary modules as needed.

Note If the FPD in a given SSD is not supported by the current IOS XR software release, the status is displayed as *NOT READY*. The status will change once FPD support for these SSDs is enabled in future releases.

The following table lists the NCS 1010 FPDs that are distributed across route processor (RP), power modules (PM), line cards (LC), and Rack.

Table 4: NCS 1010 FPDs

Location	FPDs
RP	• ADMConfig • CpuFpga • CpuFpgaGolden • BIOS • BIOS-Golden • SsdIntelS4510 • SsdMicron5300 • SsdSmartModular • TamFw • TamFwGolden
PM0 and PM1	• AP-PrimMCU • AP-SecMCU
LC	• ILA • OLT • Raman-1 • Raman-2
Rack	• IoFpga • IoFpgaGolden • EITU-ADMConfig • SsdIntelS4510 • SsdMicron5300 • SsdSmartModular
Breakout module	• BRK-8 • BRK-24
Multiplexer and demultiplexer modules	• MD-32-ACC • MD-32-NEO

Golden FPDs serve as backup FPDs for the primary FPDs. For example, **BIOS-Golden** is the backup Golden FPD for the **BIOS** primary FPD. If a primary FPD is corrupted, NCS 1010 boots with the corresponding Golden FPD. The Golden FPDs cannot be upgraded.

Retrieve FPD Information

There are multiple types of FPDs for each type of module. The **show hw-module fpd** command provides information about each FPD.

```
RP/0/RP0/CPU0:ios#show hw-module fpd
```

The following output shows the types of FPDs for each module.

```
Thu Mar  2 12:35:06.602 IST

Auto-upgrade:Enabled
Attribute codes: B golden, P protect, S secure, A Anti Theft aware
                                                                                FPD Versions
                                                                               ==============
Location   Card type             HWver FPD device       ATR Status   Running Programd
Reload Loc
-----------------------------------------------------------------------------------------------
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  ADMConfig            CURRENT    3.40    3.40
NOT REQ
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  BIOS             S   CURRENT    4.20    4.20
  0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  BIOS-Golden      BS  CURRENT            4.10
  0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  CpuFpga          S   CURRENT    1.11    1.11
  0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  CpuFpgaGolden    BS  CURRENT            1.01
  0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  SsdIntelS4510    S   CURRENT   11.32   11.32
  0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  TamFw            S   CURRENT    6.13    6.13
  0/RP0
0/RP0/CPU0 NCS1010-CNTLR-K9      1.11  TamFwGolden      BS  CURRENT            6.11
  0/RP0
0/PM0      NCS1010-AC-PSU        0.0   AP-PriMCU            CURRENT    1.03    1.03
NOT REQ
0/PM0      NCS1010-AC-PSU        0.0   AP-SecMCU            CURRENT    2.01    2.01
NOT REQ
0/PM1      NCS1010-AC-PSU        0.0   AP-PriMCU            CURRENT    1.03    1.03
NOT REQ
0/PM1      NCS1010-AC-PSU        0.0   AP-SecMCU            CURRENT    2.01    2.01
NOT REQ
0/0/NXR0   NCS1K-OLT-L           1.0   OLT              S   CURRENT    1.02    1.02
NOT REQ
0/Rack     NCS1010-SA            2.1   EITU-ADMConfig       CURRENT    2.10    2.10
NOT REQ
0/Rack     NCS1010-SA            2.1   IoFpga           S   CURRENT    1.12    1.12
NOT REQ
0/Rack     NCS1010-SA            2.1   IoFpgaGolden     BS  CURRENT            1.01
NOT REQ
0/Rack     NCS1010-SA            2.1   SsdIntelS4510    S   CURRENT   11.32   11.32
 0/Rack
```

The following output highlights the types of FPDs for the new controller card, new OLT line card, breakout module, and multiplexer/demultiplexer module.

```
Fri Feb 17 11:43:28.878 UTC

Auto-upgrade:Enabled
```

```
Attribute codes: B golden, P protect, S secure, A Anti Theft aware
                                                                                FPD Versions
                                                                                ============
Location   Card type             HWver FPD device       ATR Status   Running Programd
Reload Loc
-----------------------------------------------------------------------------------------------
0/RP0/CPU0 NCS1010-CTLR-B-K9     1.0   ADMConfig              CURRENT    2.30    2.30
NOT REQ
0/RP0/CPU0 NCS1010-CTLR-B-K9     1.0   BIOS             S     CURRENT    4.40    4.40
  0/RP0
0/RP0/CPU0 NCS1010-CTLR-B-K9     1.0   BIOS-Golden      BS    CURRENT            4.40
  0/RP0
0/RP0/CPU0 NCS1010-CTLR-B-K9     1.0   CpuFpga          S     CURRENT    1.11    1.11
  0/RP0
0/RP0/CPU0 NCS1010-CTLR-B-K9     1.0   CpuFpgaGolden    BS    CURRENT            1.01
  0/RP0
0/RP0/CPU0 NCS1010-CTLR-B-K9     1.0   SsdIntelS4510    S     CURRENT   11.32   11.32
  0/RP0
0/RP0/CPU0 NCS1010-CTLR-B-K9     1.0   TamFw            S     CURRENT    6.13    6.13
  0/RP0
0/RP0/CPU0 NCS1010-CTLR-B-K9     1.0   TamFwGolden      BS    CURRENT            6.11
  0/RP0
0/PM0      NCS1010-AC-PSU        0.0   AP-PriMCU              CURRENT    1.03    1.03
NOT REQ
0/PM0      NCS1010-AC-PSU        0.0   AP-SecMCU              CURRENT    2.01    2.01
NOT REQ
0/PM1      NCS1010-AC-PSU        0.0   AP-PriMCU              CURRENT    1.03    1.03
NOT REQ
0/PM1      NCS1010-AC-PSU        0.0   AP-SecMCU              NEED UPGD  1.06    1.06
NOT REQ
0/0/NXR0   NCS1K-E-OLT-R-C       1.0   OLT              S     CURRENT    1.16    1.16
NOT REQ
0/0/NXR0   NCS1K-E-OLT-R-C       1.0   Raman-1          S     CURRENT    1.04    1.04
NOT REQ
0/Rack     NCS1010-SA            0.1   EITU-ADMConfig         CURRENT    1.04    1.04
NOT REQ
0/Rack     NCS1010-SA            0.1   IoFpga           S     CURRENT            1.12
NOT REQ
0/Rack     NCS1010-SA            0.1   IoFpgaGolden     BS    NEED UPGD  1.12    0.08
NOT REQ
0/Rack     NCS1010-SA            0.1   SsdIntelS4510    S     CURRENT   11.32   11.32
 0/Rack
0/1        NCS1K-MD-32E-C        0.1   MD-32-NEO        S     CURRENT    2.02    2.02
NOT REQ
0/2        NCS1K-MD-32O-C        10.2  MD-32-ACC        S     CURRENT    2.18    2.18
NOT REQ
0/3/0      NCS1K-BRK-8           1.0   BRK-8            S     CURRENT    2.08    2.08
NOT REQ
0/3/3      NCS1K-BRK-24          1.0   BRK-24           S     CURRENT    2.08    2.08
NOT REQ
```

The following table describes the significant fields in the output of the **show hw-module fpd** command.

Table 5: Description of Fields in show hw-module fpd Command

Field	Description
Location	Location of the FPD.
Card type	PID of the modules such as chassis, card, CPU, and PSU.

Field	Description
HWver	Hardware version where the FPD resides.
FPD device	Name of the FPD.
ATR	Attribute codes. The possible values are: • B - Golden Image • S - Secure Image • P - Protect Image The attribute code of the primary FPDs is S and the Golden FPDs is BS.
Status	Status of the FPD. See Table 6: Description of FPD Status Values in show hw-module fpd Command, on page 67.
Running	FPD image version that has been activated and currently running in the FPD device.
Programd	FPD image version that has been programmed into the FPD device, but might not be activated.
Reload Loc	Indicates whether reload of the location is required or not.

The following table describes the possible values of the Status field in the output of the **show hw-module fpd** command.

Table 6: Description of FPD Status Values in show hw-module fpd Command

FPD Status	Description
NOT READY	The driver that owns the FPD device has not initialized the FPD client to handle this device.
CURRENT	FPD version is up to date and upgrade is not required.
NEED UPGD	Upgrade is required for this FPD. Check the output of the **show fpd package** command to determine the recommended FPD version.
UPGD PREP	FPD is preparing for upgrade.
IN QUEUE	Upgrade of this FPD is in queue.
UPGD SKIP	FPD upgrade is not required. For example, • FPD version is up to date and compatible. • FPD image is protected.

FPD Status	Description
UPGRADING	FPD upgrade started and the driver did not report the upgrade progress information yet.
%UPGD	Percentage of FPD upgrade completion.
RLOAD REQ	FPD upgrade is successfully completed and the FPD must be reloaded for the new version to take effect.
UPGD FAIL	FPD upgrade has failed. Check the syslog for failure reason. It could be a timeout or a failure that is reported by the driver.
UPGD DONE	FPD upgrade is successfully completed.

Verify if an FPD Upgrade is Required

Step 1 Use the **show hw-module fpd** command to check whether all the FPDs are in the Current state.

If the status of any FPD is **NEED UPGD**, then the upgrade is required for that FPD.

Step 2 Use the **show fpd package** command to determine the FPDs that are supported with the current software release and the minimum hardware requirements for each FPD.

```
RP/0/RP0/CPU0:ios#show fpd package
```

The following output highlights the FPD packages for the breakout and multiplexer/demultiplexer modules.

```
Thu Mar  2 12:37:58.530 IST

============================== ================================================
                                      Field Programmable Device Package
                                ================================================
                                             Req     SW      Min Req   Min Req
Card Type            FPD Description         Reload  Ver     SW Ver  Board Ver
==================== ======================= ====== ======= ======== =========
--------------------------------------------------------------------------------
NCS1010-AC-PSU       AP-PriMCU                NO      1.03      1.03      0.0
                     AP-SecMCU                NO      2.01      2.01      0.0
--------------------------------------------------------------------------------
NCS1010-CNTLR-K9     ADMConfig                NO      2.30      2.30      0.0
                     ADMConfig                NO      2.30      2.30      0.0
                     ADMConfig                NO      3.40      3.40      1.0
                     BIOS                     YES     4.20      4.20      0.0
                     BIOS                     YES     4.20      4.20      0.0
                     BIOS-Golden              YES     4.10      4.10      0.0
                     BIOS-Golden              YES     4.10      4.10      0.0
                     CpuFpga                  YES     1.11      1.11      0.0
                     CpuFpga                  YES     1.11      1.11      0.0
                     CpuFpgaGolden            YES     1.01      1.01      0.0
                     CpuFpgaGolden            YES     1.01      1.01      0.0
                     SsdIntelS4510            YES    11.32     11.32      0.0
                     SsdIntelS4510            YES    11.32     11.32      0.0
                     SsdMicron5300            YES     0.01      0.01      0.0
                     SsdMicron5300            YES     0.01      0.01      0.0
                     SsdSmartModular          YES    13.06     13.06      0.0
                     SsdSmartModular          YES    13.06     13.06      0.0
```

```
                    TamFw                       YES     6.13      6.13      0.0
                    TamFw                       YES     6.13      6.13      0.0
                    TamFwGolden                 YES     6.11      6.11      0.0
                    TamFwGolden                 YES     6.11      6.11      0.0
--------------------------------------------------------------------------------
NCS1010-SA          EITU-ADMConfig              NO      1.04      1.04      0.0
                    EITU-ADMConfig              NO      2.10      2.10      1.0
                    EITU-ADMConfig              NO      1.04      1.04      0.0
                    EITU-ADMConfig              NO      2.10      2.10      1.0
                    IoFpga                      NO      1.12      1.12      0.0
                    IoFpga                      NO      1.12      1.12      0.0
                    IoFpgaGolden                NO      1.01      1.01      0.0
                    IoFpgaGolden                NO      1.01      1.01      0.0
                    SsdIntelS4510               YES    11.32     11.32      0.0
                    SsdIntelS4510               YES    11.32     11.32      0.0
                    SsdMicron5300               YES     0.01      0.01      0.0
                    SsdMicron5300               YES     0.01      0.01      0.0
                    SsdSmartModular             YES    13.06     13.06      0.0
                    SsdSmartModular             YES    13.06     13.06      0.0
--------------------------------------------------------------------------------
NCS1K-ILA-2R-C      ILA                         NO      1.12      1.12      0.1
                    ILA                         NO      0.28      0.28     99.1
                    Raman-1                     NO      1.04      1.04      0.1
                    Raman-1                     NO      0.28      0.28     99.1
                    Raman-2                     NO      1.04      1.04      0.1
                    Raman-2                     NO      0.28      0.28     99.1
--------------------------------------------------------------------------------
NCS1K-ILA-C         ILA                         NO      1.12      1.12      0.1
                    ILA                         NO      0.28      0.28     99.1
--------------------------------------------------------------------------------
NCS1K-ILA-L         ILA                         NO      1.00      1.00      0.1
--------------------------------------------------------------------------------
NCS1K-ILA-R-C       ILA                         NO      1.12      1.12      0.1
                    ILA                         NO      0.28      0.28     99.1
                    Raman-1                     NO      1.04      1.04      0.1
                    Raman-1                     NO      0.28      0.28     99.1
--------------------------------------------------------------------------------
NCS1K-OLT-C         OLT                         NO      1.12      1.12      0.1
                    OLT                         NO      0.28      0.28     99.1
--------------------------------------------------------------------------------
NCS1K-OLT-L         OLT                         NO      1.02      1.02      0.1
--------------------------------------------------------------------------------
NCS1K-OLT-R-C       OLT                         NO      1.12      1.12      0.1
                    OLT                         NO      0.28      0.28     99.1
                    Raman-1                     NO      1.04      1.04      0.1
                    Raman-1                     NO      0.28      0.28     99.1
--------------------------------------------------------------------------------
NCS1K-BRK-24        BRK-24                      NO      2.08      2.08      0.0
--------------------------------------------------------------------------------
NCS1K-BRK-8         BRK-8                       NO      2.08      2.08      0.0
--------------------------------------------------------------------------------
NCS1K-MD-32E-C      MD-32-ACC                   NO      2.18      2.18      0.0
                    MD-32-NEO                   NO      2.02      2.02      0.0
--------------------------------------------------------------------------------
NCS1K-MD-32O-C      MD-32-ACC                   NO      2.18      2.18      0.0
                    MD-32-NEO                   NO      2.02      2.02      0.0
--------------------------------------------------------------------------------
```

The following table describes the fields in the output of the **show fpd package** command.

Table 7: Description of Fields in show fpd package Command

Field	Description
Card Type	PID of the modules such as chassis, card, CPU, and PSU.
FPD Description	Description of the FPD.
Req Reload	Determines whether reload is required to activate the FPD image.
SW Ver	Recommended FPD software version for the associated module running the current Cisco IOS XR Software.
Min Req SW Ver	Minimum required FPD software version to operate the module.
Min Req Board Ver	Minimum required hardware version for the associated FPD. A minimum hardware requirement of version 0.0 indicates that all the hardware can support this FPD version.

FPD can be upgraded using two methods:

- Upgrade FPDs Manually
- Upgrade FPDs Automatically

Upgrade FPDs Manually

Use the following procedure to upgrade the FPDs manually.

Note The Golden FPDs cannot be upgraded using the CLI.

Step 1 Use the **show hw-module fpd** command to display information about the current FPD version.

You can use this command to determine if you must upgrade the FPD.

Step 2 Use the **show alarms brief system active** command to display the active alarms.

You must upgrade the FPD when the **One Or More FPDs Need Upgrade Or Not In Current State** alarm is present.

Step 3 Use the **upgrade hw-module location** *[location-id]* **fpd** *[fpd name]* command to upgrade a specific FPD.

After upgrading the FPD, the user must wait for upgrade completion. The progress of the FPD upgrade can be monitored using the **show hw-module fpd** command.

Example:

```
RP/0/RP0/CPU0:ios#upgrade hw-module location 0/Rack fpd IoFpga
```

Note The FPDs of power modules belong to 0/PM0 and 0/PM1 locations. The FPDs belonging to both the PM locations cannot be simultaneously upgraded.

Step 4 Use the **reload location** *location-id* to reload the FPDs belonging to a specific location with the new version.

The **Reload Loc** field in the output of **show hw-module fpd** command indicates whether the reload is required or not.

Example:

```
RP/0/RP0/CPU0:ios#reload location 0/RP0/CPU0
```

Step 5 (Optional) Use the **upgrade hw-module location all fpd all** command to upgrade all the FPDs at once.

Step 6 (Optional) Use the **upgrade hw-module [location** [*location-id* | **all**]] **fpd** [*fpd name*] | **all**] command to upgrade a specific FPD, all the FPDs, or the FPDs belonging to a specific location.

Example:

```
RP/0/RP0/CPU0:ios#upgrade hw-module location all fpd all
```

Note The FPDs of power modules and SSDs cannot be forcefully upgraded.

Upgrade FPDs Automatically

The automatic FPD upgrade upgrades the FPD version of all the modules to the latest version. When automatic FPD upgrade is enabled, all the FPDs (except the Golden FPDs) that are in NEED UPGD status are upgraded to CURRENT status during the software upgrade.

In NCS 1010, automatic FPD upgrade is enabled by default.

Use the following commands to disable automatic FPD upgrade.

Example:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#fpd auto-upgrade disable
RP/0/RP0/CPU0:ios(config)#commit
RP/0/RP0/CPU0:ios(config)#end
```

Release 7.10.1 Caveats

The following upgrade caveats are applicable for the Cisco NCS 1010 platform for Release 7.10.1 and later:

Table 8: Upgrade Caveats for Cisco NCS 1010 Platform

From	To	Bridge SMUs Required	Caveats
7.7.1	7.10.1 and later	None	1*
7.9.1	7.10.1 and later	None	1*

1* : You can't roll back using the **install rollback** command.

The following downgrade caveats are applicable for the Cisco NCS 1010 platform for Release 7.10.1 and later:

Table 9: Downgrade Caveats for Cisco NCS 1010 Platform

From	To	Bridge SMUs Required	Caveats
7.10.1 and later	7.7.1	Yes	***, A*, B*, C*, D*
7.10.1 and later	7.9.1	Yes	***, C*, D*

***

- You don't need to run the **install commit** command after a downgrade operation because the operation is automatically committed.
- You can't roll back after a downgrade. To revert to the previous IOS XR previous version, replace or reimage to the relevant ISO.
- IOS XR configuration history is lost after a downgrade, but the NCS 1010 platform preserves the latest configuration.
- Install history from the last transaction is preserved after a downgrade operation.
- Downtime takes a longer time as the operation is performed through reimage.
- You can't downgrade using the **install package replace** command. Instead, use the **install replace** command to downgrade.
- Ensure that you reinstall third-party application once you complete the downgrade.
- PXE recovery is required if the image downgrading isn't bootable.
- You must re-install the *Type 6 masterkey* and reapply the configuration encrypted by it because they are lost after the downgrade.
- You must regenerate crypto keys and certificates after a downgrade.

A*: You can't downgrade to the base ISO. You can downgrade to a GISO containing the bridge SMU (CSCwd71524).

Note CSCwd71524:

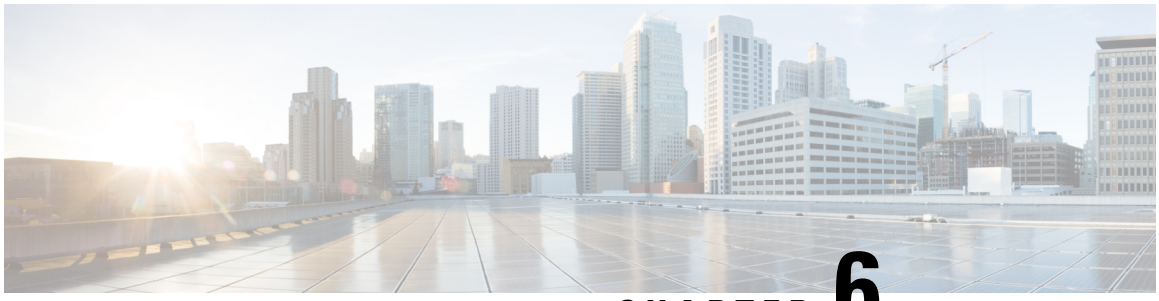
- When you upgrade from earlier than Release 7.10.1 to Release 7.10.1, system supports the installation process seemlessly.
- When you downgrade from Release 7.10.1, system preserves the present configuration and the install history from last transaction.

B*: You must recover the NCS 1010 platform through PXE if a power cycle occurs during the downgrade.

C*: FPD upgrade may cause your NCS 1010 platform to reload an extra time during boot-up.

D*: Traffic is impacted.

Use the **show install upgrade-matrix running** command to view the caveats.



CHAPTER 6

Understanding Remote Node Management Using OSC

The remote node management feature in NCS 1010 allows you to remotely manage an ILA node that is not connected to a management network through an OLT gateway node over Optical Supervisory Channel (OSC) interface. The OLT node is connected to a management network and manages ILA node remotely. If the OLT node link is down, the ILA node cannot be accessible.

- Prerequisites, on page 73
- DHCP Relay Configuration for OLT Node, on page 73
- Loopback IP address for OSC Interface, on page 75
- OSPF Neighbor Discovery, on page 75
- Configure ILA Node, on page 76
- Configure OLT Node, on page 76

Prerequisites

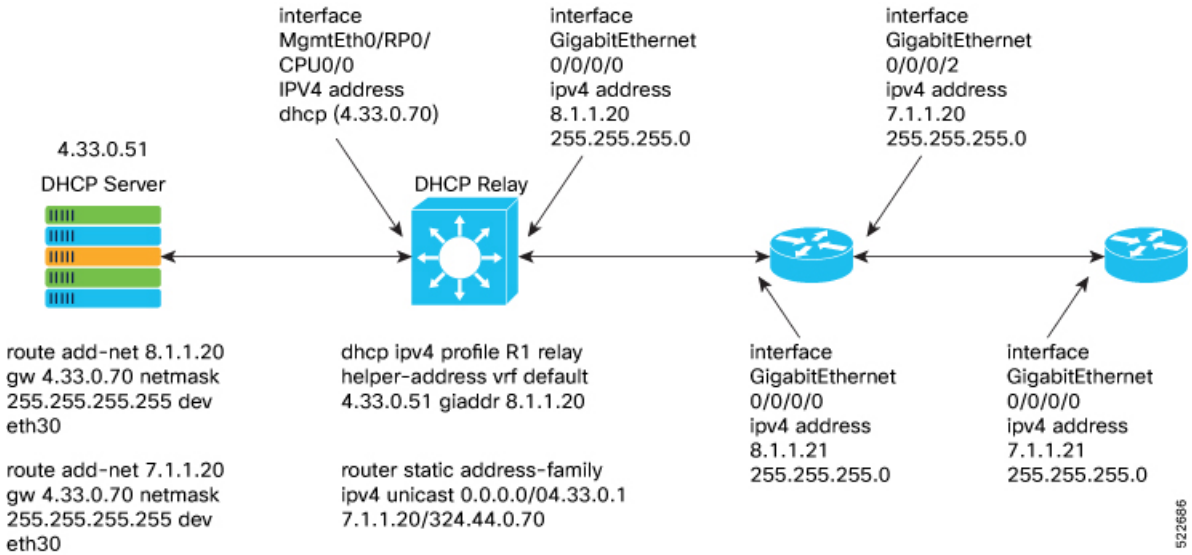
The remote node management for ILA node works only if the following conditions are met:

- The DSCP relay configuration for OLT node must be present. See DHCP Relay Configuration for OLT Node, on page 73
- The loopback address and IP address must be present for OSC interface. See Loopback IP address for OSC Interface, on page 75
- The OSPF neighbor discovery must be successful between OLT and ILA nodes. See OSPF Neighbor Discovery, on page 75

DHCP Relay Configuration for OLT Node

The OLT node must be configured with the DHCP management connection to manage the ILA node remotely over OSC interface.

Figure 6: DHCP Relay Configuration for OLT Node



Following is the sample DHCP relay configuration for the OLT gateway node:

```
RP/0/RP0/CPU0:P2B_DT_02#sh running-config int mgmtEth 0/RP0/CPU0/2
Thu Jun  9 06:37:59.071 UTC
interface MgmtEth0/RP0/CPU0/2
 ipv4 address 192.168.1.1 255.255.255.252
!

RP/0/RP0/CPU0:P2B_DT_02#

RP/0/RP0/CPU0:P2C_DT_02#

RP/0/RP0/CPU0:P2B_DT_02#sh running-config dhcp ipv4
Thu Jun  9 06:28:51.879 UTC
dhcp ipv4
 profile R1 relay
  helper-address vrf default 10.4.33.51 giaddr 10.8.1.20
 !
 interface GigabitEthernet0/0/0/0 relay profile R1
!
```

In the above sample CLI,

- **10.4.33.51** is the DHCP server IP address
- **10.8.1.20** is the OSC interface IP address that going to ILA node from OLT node
- **0/0/0/0** is the interface number
- **R1** is the profile

Sample command for DHCP server:

```
3) Config on dhcp server:
route add -net <OLT-OSCip> gw <OLT-MGMTip> netmask 255.255.255.255 dev eth3

route add -net 10.8.1.20 gw 10.4.33.70 netmask 255.255.255.255 dev eth3
route add -net 10.7.1.20 gw 10.4.33.70 netmask 255.255.255.255 dev eth3
Config on OLT:
dhcp ipv4 profile R1 relay helper-address vrf default 10.4.33.51 giaddr 10.8.1.20
```

```
router static
address-family ipv4 unicast
  0.0.0.0/0 10.4.33.1
  10.7.1.20/32 10.4.44.70
interface MgmtEth0/RP0/CPU0/0
ipv4 address dhcp
interface GigabitEthernet0/0/0/0
ipv4 address 10.8.1.20 255.255.255.0
```

Loopback IP address for OSC Interface

The loopback IP address must be mapped for the OSC interface.

Note The loopback IP address is essential as it acts as a router ID for the OSPF configuration. Many communication protocols such as: SSH, GRPC and optical applications, and remote login need the router ID for OSPF configuration. .

Following is the sample of loopback and IP address for OSC interface:

```
RP/0/RP0/CPU0:P2B_DT_02#sh running-config interface loopback 0
Thu Jun  9 06:29:00.447 UTC
interface Loopback0
 ipv4 address 10.3.3.20 255.255.255.255
!
```

OSPF Neighbor Discovery

The OSPF neighbor discovery indicates the successful connection between OLT and ILA node.

Following is the sample CLI:

```
RP/0/RP0/CPU0:P2C_DT_02#sh ospf neighbor
Tue Jul 26 07:31:29.532 UTC
* Indicates MADJ interface
# Indicates Neighbor awaiting BFD session up
Neighbors for OSPF 1
Neighbor ID     Pri   State           Dead Time   Address         Interface
10.3.3.20         1     FULL/  -        00:00:35    10.8.1.20         GigabitEthernet0/0/0/0
Neighbor is up for 00:00:42

Total neighbor count: 1
RP/0/RP0/CPU0:P2C_DT_02#
```

In the above CLI,

- **198.51.100.1** is the neighbor IP address
- **10.8.1.21** is the OSC interface IP address

Configure ILA Node

The following is a sample command for ILA node configuration:

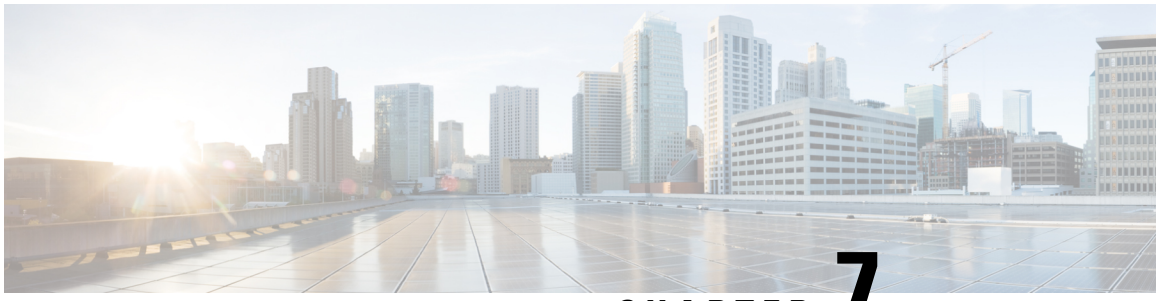
```
interface GigabitEthernet0/0/0/0
ipv4 address 10.8.1.21 255.255.255.0
!
interface GigabitEthernet0/0/0/2
ipv4 address 10.7.1.21 255.255.255.0

router ospf 1
distribute link-state
network point-to-point
redistribute connected
area 0
  interface Loopback0
  !
  interface GigabitEthernet0/0/0/0
  !
  interface GigabitEthernet0/0/0/2
```

Configure OLT Node

The following is a sample command to configure the OLT node with loopback ip:

```
Configure

interface Loopback0
ipv4 address 10.3.3.21 255.255.255.255
!
interface GigabitEthernet0/0/0/0
ipv4 address 10.7.1.20 255.255.255.0
router ospf 1
distribute link-state
network point-to-point
area 0
  interface Loopback0
  !
  interface GigabitEthernet0/0/0/0
```

-



CHAPTER 7

Configuring BGP

- BGP Overview, on page 77
- Prerequisites for Implementing BGP, on page 78
- BGP Router Identifier, on page 78
- Configuring BGP, on page 79

BGP Overview

Table 10: Feature History

Feature Name	Release Information	Feature Description
Configuring BGP	Cisco IOS XR Release 7.11.1	BGP routers from a TCP connection between peer routers to exchange network reachability information to open and confirm the connection parameters. BGP on NCS 1010 is enabled only on management port enabling the customer to manage the Dynamic Circuit Network(DCN) connectivity.

BGP uses TCP as its transport protocol. Two BGP routers form a TCP connection between one another (peer routers) and exchange messages to open and confirm the connection parameters.

BGP routers exchange network reachability information. This information is mainly an indication of the full paths (BGP autonomous system numbers) that a route should take to reach the destination network. This information helps construct a graph that shows which autonomous systems are loop free and where routing policies can be applied to enforce restrictions on routing behavior.

Any two routers forming a TCP connection to exchange BGP routing information are called peers or neighbors. BGP peers initially exchange their full BGP routing tables. After this exchange, incremental updates are sent as the routing table changes. BGP keeps a version number of the BGP table, which is the same for all its BGP peers. The version number changes whenever BGP updates the table due to routing information changes. Keepalive packets are sent to ensure that the connection is alive between the BGP peers and notification packets are sent in response to error or special conditions.

Note ASN change for the BGP process is not currently supported via **commit replace**.

Prerequisites for Implementing BGP

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

BGP Router Identifier

For BGP sessions between neighbors to be established, BGP must be assigned a router ID. The router ID is sent to BGP peers in the OPEN message when a BGP session is established.

BGP attempts to obtain a router ID in the following ways (in order of preference):

- By means of the address configured using the **bgp router-id** command in router configuration mode.
- By using the highest IPv4 address on a loopback interface in the system if the router is booted with saved loopback address configuration.
- By using the primary IPv4 address of the first loopback address that gets configured if there are not any in the saved configuration.

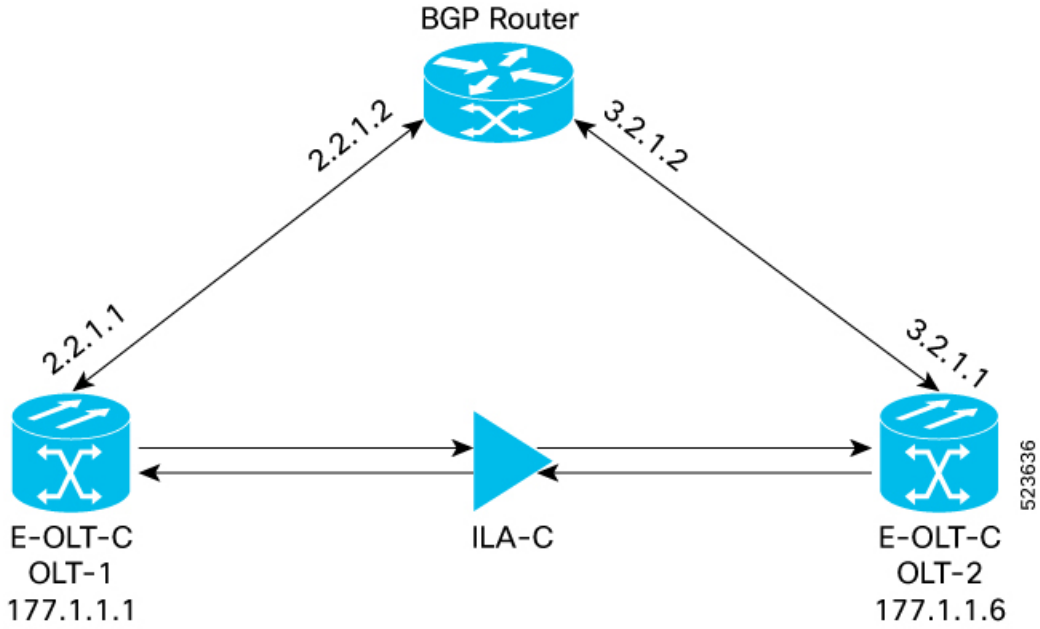
If none of these methods for obtaining a router ID succeeds, BGP does not have a router ID and cannot establish any peering sessions with BGP neighbors. In such an instance, an error message is entered in the system log, and the **show bgp summary** command displays a router ID of 0.0.0.0.

After BGP has obtained a router ID, it continues to use it even if a better router ID becomes available. This usage avoids unnecessary flapping for all BGP sessions. However, if the router ID currently in use becomes invalid (because the interface goes down or its configuration is changed), BGP selects a new router ID (using the rules described) and all established peering sessions are reset.

Note We strongly recommend that the **bgp router-id** command is configured to prevent unnecessary changes to the router ID (and consequent flapping of BGP sessions).

Configuring BGP

Figure 7: BGP Topology



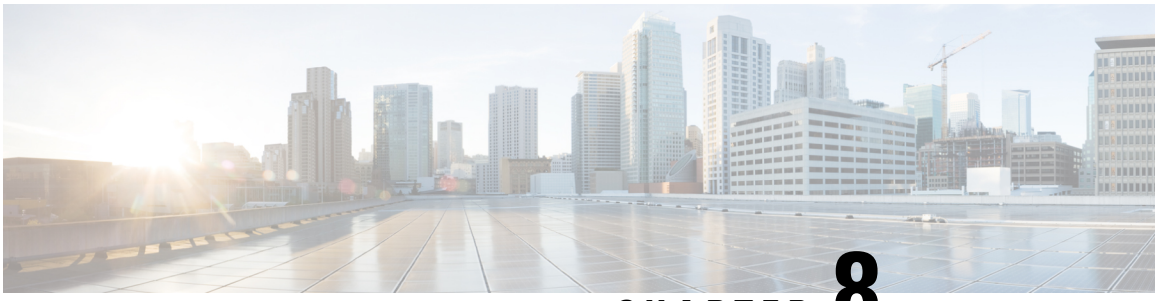

```
config
route-policy pass-all
end-policy
commit

RP/0/RP0/CPU0:OLT-1#conf
Fri Feb 23 09:32:29.216 IST
router bgp 1
bgp router-id 177.1.1.1
 address-family ipv4 unicast
  redistribute connected
  redistribute ospf 1 route-policy pass-all
 !
 address-family vpnv4 unicast
 !
 neighbor 2.2.1.2
  remote-as 100
  address-family ipv4 unicast
   route-policy pass-all in
   route-policy pass-all out
  !
 !
!
commit

show running-config router bgp
Thu Jan 11 15:54:43.439 IST
router bgp 1
 bgp router-id 177.1.1.1
 address-family ipv4 unicast
  redistribute connected
```

```
  redistribute ospf 1 route-policy pass-all
 !
 address-family vpnv4 unicast
 !
 neighbor 2.2.1.2
  remote-as 100
  address-family ipv4 unicast
   route-policy pass-all in
   route-policy pass-all out
  !
 !
!


RP/0/RP0/CPU0:OLT-2#conf
Fri Feb 23 09:32:29.216 IST
router bgp 1
 bgp router-id 177.1.1.6
 address-family ipv4 unicast
  redistribute connected
  redistribute ospf 1 route-policy pass-all
 !
 address-family vpnv4 unicast
 !
 neighbor 3.2.1.2
  remote-as 100
  address-family ipv4 unicast
   route-policy pass-all in
   route-policy pass-all out
  !
 !
!
commit

show running-config router bgp
Thu Jan 11 15:59:12.210 IST
router bgp 1
 bgp router-id 177.1.1.6
 address-family ipv4 unicast
  redistribute connected
  redistribute ospf 1 route-policy pass-all
 !
 address-family vpnv4 unicast
 !
 neighbor 3.2.1.2
  remote-as 100
  address-family ipv4 unicast
   route-policy pass-all in
   route-policy pass-all out
  !
 !
!

show route
route  router-id


RP/0/RP0/CPU0:BGP-ROUTER#config
Fri Feb 23 09:32:29.216 IST
router bgp 100
 bgp router-id 1.1.1.99
 address-family ipv4 unicast
  redistribute connected
 !
```

```
 neighbor 2.2.1.1
  remote-as 1
  address-family ipv4 unicast
   route-policy pass-all in
   route-policy pass-all out
  !
 !
 neighbor 3.2.1.1
  remote-as 1
  address-family ipv4 unicast
   route-policy pass-all in
   route-policy pass-all out
  !
 !
!
commit

show running-config router bgp
Thu Jan 11 15:59:58.059 IST
router bgp 100
 bgp router-id 1.1.1.99
 address-family ipv4 unicast
  redistribute connected
 !
 neighbor 2.2.1.1
  remote-as 1
  address-family ipv4 unicast
   route-policy pass-all in
   route-policy pass-all out
  !
 !
 neighbor 3.2.1.1
  remote-as 1
  address-family ipv4 unicast
   route-policy pass-all in
   route-policy pass-all out
  !
 !
!
```

Note Autonomous system numbers 2.0 standard supports 0 to 65535, and autonomous system numbers standard 4.0 supports 65536 onwards.

Configuring BGP



CHAPTER 8

Configure CDP

Table 11: Feature History

Feature Name	Release Information	Feature Description
CDP Support	Cisco IOS XR Release 7.10.1	Cisco Discovery Protocol (CDP) support is introduced on NCS 1010. CDP is a Layer 2 network discovery protocol for learning about directly connected Cisco devices. This protocol lets you easily view peer Cisco device information such as IP address, version number, platform type, connected ports, and so on for network planning and troubleshooting.

CDP is a Cisco proprietary layer 2 protocol used to obtain information about peer Cisco devices. It exchanges CDP packets with its neighbors to discover the platform type and capabilities of the peer device.

Each device configured for CDP sends periodic messages, known as advertisements, to a multicast address. Each device advertises at least one address at which it can receive messages. The advertisements also contain time-to-live or hold-time information which indicates the length of time a receiving device holds CDP information (180 seconds by default) before discarding it. Each device also listens to the periodic CDP messages sent by others (every 60 seconds by default) to learn about neighboring devices and determine when their interfaces go up or down.

Note CDP feature is available by installing the following RPMs:

- xr-cdp-7.10.1.19Iv1.0.0-1.x86_64.rpm
- xr-cdp-82eb6a4d2fa15d0e-7.10.1.19Iv1.0.0-1.x86_64.rpm
- xr-cdp-ncs1010-7.10.1.19Iv1.0.0-1.x86_64.rpm

- Enable CDP Globally, on page 84
- Disable CDP Globally, on page 84

• Enable CDP on Interfaces, on page 84
• Modify CDP Default Settings, on page 85
• Monitor CDP, on page 86

Enable CDP Globally

To enable CDP globally, use the following commands:

configure

cdp

commit

Disable CDP Globally

To disable CDP globally, use the following commands:

configure

no cdp

commit

Enable CDP on Interfaces

To enable CDP on the management interface, use the following commands:

configure

interface mgmtEth *rack/slot/instance/port*

cdp

commit

The following example enables CDP on the management interface.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/1
RP/0/RP0/CPU0:ios(config-if)#cdp
RP/0/RP0/CPU0:ios(config-if)#commit
```

To enable CDP on the Gigabit Ethernet (GE) interface, use the following commands:

configure

interface gigabitEthernet *rack/slot/instance/port*

cdp

commit

The following example enables CDP on the Gigabit Ethernet (GE) interface.

```
RP/0/RP0/CPU0:ios#configure
```

```
RP/0/RP0/CPU0:ios(config)#interface gigabitEthernet 0/0/0/0
RP/0/RP0/CPU0:ios(config-if)#cdp
RP/0/RP0/CPU0:ios(config-if)#commit
```

Modify CDP Default Settings

Use this task to modify CDP parameters such as the default version, holdtime, and timer.

Step 1 **configure**

Example:

```
RP/0/RP0/CPU0:ios#configure
```

Enters global configuration mode.

Step 2 **cdp advertise v1**

Example:

```
RP/0/RP0/CPU0:ios(config)#cdp advertise v1
```

Configures CDP to use only version 1 (CDPv1) in communicating with neighboring devices.

By default, when CDP is enabled, the device sends CDPv2 packets. CDP also sends and receives CDPv1 packets if the device with which CDP is interacting does not process CDPv2 packets.

In this example, the device is configured to send and receive only CDPv1 packets.

To disable CDP v1, use the **no cdp advertise v1** form of this command.

Step 3 **cdp holdtime** *seconds*

Example:

```
RP/0/RP0/CPU0:ios(config)#cdp holdtime 120
```

Specifies the amount of time that the receiving device holds a CDP packet sent from another device before discarding it.

By default, when CDP is enabled, the receiving device holds a CDP packet for 180 seconds before discarding it. The range of **holdtime** parameter is 10 to 255 seconds.

Note The CDP hold time must be set to a higher number of seconds than the time between CDP transmissions, which is set with the **cdp timer** command.

Step 4 **cdp timer** *seconds*

Example:

```
RP/0/RP0/CPU0:ios(config)#cdp timer 65
```

Specifies the frequency at which CDP update packets are sent.

By default, when CDP is enabled, CDP update packets are sent at a frequency of once every 60 seconds. The range of **timer** parameter is 5 to 254 seconds.

Note A lower timer setting causes CDP update packets to be sent more frequently.

Step 5 **commit**

Example:

```
RP/0/RP0/CPU0:ios(config)#commit
```

Saves the configuration changes and remains within the configuration session.

Monitor CDP

Use the **show cdp** command to display global CDP information.

```
RP/0/RP0/CPU0:ios#show cdp
Tue Feb 14 16:59:38.255 UTC
Global CDP information:
        Sending CDP packets every 60 seconds
        Sending a holdtime value of 180 seconds
        Sending CDPv2 advertisements is enabled
```

Use the **show cdp neighbors** command to display detailed information about neighboring devices discovered using CDP.

```
RP/0/RP0/CPU0:ios#show cdp neighbors mgmtEth 0/RP0/CPU0/1
Mon Apr 10 12:30:30.902 UTC
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater

Device ID       Local Intrfce    Holdtme Capability Platform  Port ID
R1              Mg0/RP0/CPU0/1   172     R          NCS1010   Mg0/RP0/CPU0/1
RP/0/RP0/CPU0:R2#show cdp neighbors
Mon Apr 10 12:30:39.251 UTC
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater

Device ID       Local Intrfce    Holdtme Capability Platform  Port ID
R1              Mg0/RP0/CPU0/1   164     R          NCS1010   Mg0/RP0/CPU0/1


RP/0/RP0/CPU0:ios#show cdp neighbors mgmtEth 0/RP0/CPU0/1 detail
Mon Apr 10 12:31:23.622 UTC

-------------------------
Device ID: R1
SysName : R1
Entry address(es):
  IPv4 address: 192.168.0.2
  IPv6 address: 2000:110::1
Platform: cisco NCS1010,  Capabilities: Router
Interface: MgmtEth0/RP0/CPU0/1
Port ID (outgoing port): MgmtEth0/RP0/CPU0/1
Holdtime : 120 sec

Version :
7.10.1.19I

advertisement version: 2
Duplex: full
```

Use the **show cdp entry** *entry-name* command to display information about a specific neighboring device or all the neighboring devices discovered using CDP.

```
RP/0/RP0/CPU0:ios#show cdp entry R1
Mon Apr 10 12:22:22.564 UTC

-------------------------
Device ID: R1
SysName : R1
Entry address(es):
  IPv4 address: 192.168.0.2
  IPv6 address: 2000:110::1
Platform: cisco NCS1010,  Capabilities: Router
Interface: MgmtEth0/RP0/CPU0/1
Port ID (outgoing port): MgmtEth0/RP0/CPU0/1
Holdtime : 121 sec

Version :
7.10.1.19I

advertisement version: 2
Duplex: full


RP/0/RP0/CPU0:ios#show cdp entry *
Mon Apr 10 12:24:59.927 UTC

-------------------------
Device ID: R1
SysName : R1
Entry address(es):
  IPv4 address: 192.168.0.2
  IPv6 address: 2000:110::1
Platform: cisco NCS1010,  Capabilities: Router
Interface: MgmtEth0/RP0/CPU0/1
Port ID (outgoing port): MgmtEth0/RP0/CPU0/1
Holdtime : 143 sec

Version :
7.10.1.19I

advertisement version: 2
Duplex: full
```

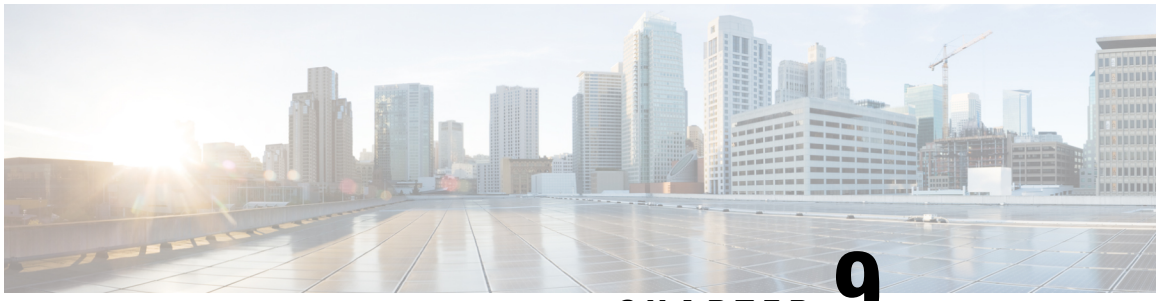
Use the **show cdp interface** [*interface-name*] command to display information about the interfaces on which CDP is enabled.

```
RP/0/RP0/CPU0:ios#show cdp interface Mg0/RP0/CPU0/1
Mon Apr 10 12:24:27.253 UTC
MgmtEth0/RP0/CPU0/1 is Up
  Encapsulation ether
  Sending CDP packets every 60 seconds
  Holdtime is 180 seconds
```

Use the **show cdp traffic** command to display information about the traffic gathered between devices using CDP.

```
RP/0/RP0/CPU0:ios#show cdp traffic
Mon Apr 10 12:32:09.247 UTC

CDP counters :
        Packets output: 11, Input: 5
```

```
Hdr syntax: 0, Chksum error: 0, Encaps failed: 0
No memory: 0, Invalid packet: 0, Truncated: 0
CDP version 1 advertisements output: 0, Input: 0
CDP version 2 advertisements output: 11, Input: 5
Unrecognize Hdr version: 0, File open failed: 0
```



CHAPTER 9

Daisy Chain

This chapter describes the Daisy Chain optical application for Cisco NCS 1010.

- Daisy Chain Overview, on page 89
- Configure Daisy Chain on Management Ports, on page 90
- Verify Daisy Chain, on page 91
- Enable Storm Control on TOR Switch, on page 92
- Disable DAD on Management Port, on page 92

Daisy Chain Overview

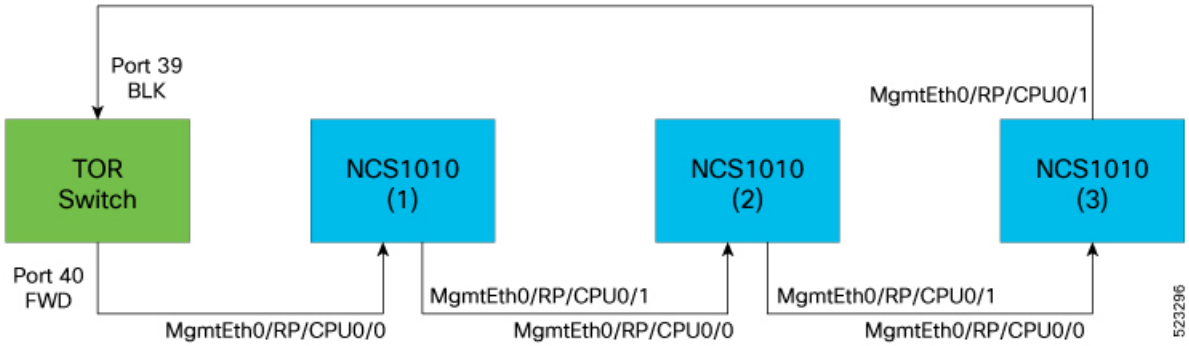
Table 12: Feature History

Feature Name	Release Information	Description
Daisy Chain on NCS 1010 Management Ports	Cisco IOS XR Release 7.10.1	You can now connect NCS 1010 devices in a Daisy Chain topology. Here multiple NCS 1010 devices are connected to form a ring-like topology, and only the first and last nodes are connected to a Top-of-Rack (TOR) switch, thereby reducing the number of connections. The Daisy Chain topology also provides more redundancy as data is transmitted in both directions. The first connection acts as a primary path and carries the traffic whereas the last connection acts as a secondary path. In case the primary path fails, the secondary path serves as its backup for data transmission and allows traffic to continue to transmit in the network.

The daisy chain arrangement allows multiple NCS 1010 nodes to be connected to each other in a ring, where only the first and the last nodes are connected to a TOR switch. The switch allows management of all the NCS 1010 devices in the network and also prevents traffic storm. The data transmitted over the network passes through each node in the ring until it reaches the destination node. This arrangement allows the switch to send data in both directions and prevents one node failure from cutting off certain network parts.

The following diagram shows the Daisy Chain topology where three NCS 1010 nodes are connected to each other over the management ports *0* and *1*.

Figure 8: NCS 1010 in a Daisy Chain Network



Configure Daisy Chain on Management Ports

Before you begin

The following prerequisites must be met before configuring Daisy Chain on NCS1010:

- Enable Storm Control on Switch.
- STP must be running on the TOR switch.
- Daisy chain must be enabled on all the NCS1010 devices in the topology.

Configuring Daisy Chain on managements ports of NCS 1010 devices involves the following tasks:

- Configure Daisy Chain on Management Ports
- Configure Daisy Chain

Example

The following example shows how to configure IP address on management port 0 of NCS1010 device:

```
RP/10/RP0:ios(config-if)#int mgmtEth 0/RP0/CPU0/0
RP/10/RP0:ios(config-if)#no shut
RP/10/RP0:ios(config-if)#ipv4 address 192.0.2.1 255.255.255.0
```

Configure Daisy Chain

configure

interface *type* **Rack/Slot/Instance/Port**

no ipv4 address

no ipv6 address

bridge-port routed-interface *type***Rack/Slot/Instance/Port**

Example 1

The following example shows how to configure daisy chain on management port 1 of NCS1010 device:

```
RP/0/RP0:ios(config)# configure
RP/0/RP0:switch(config)# interface mgmtEth0/RP0/CPU0/1
RP/10/RP0:ios(config-if)#no ipv4 address
RP/10/RP0:ios(config-if)#no ipv6 address
RP/10/RP0:ios(config-if)#bridge-port routed-interface mgmtEth 0/RP0/CPU0/0
RP/10/RP0:ios(config-if)#commit
```

Example 2

The following example shows how to configure daisy chain on management port 2 of NCS1010 device:

```
RP/0/RP0:switch(config)# configure
RP/0/RP0:switch(config)# interface mgmtEth0/RP0/CPU0/2
RP/10/RP0:ios(config-if)#no ipv4 address
RP/10/RP0:ios(config-if)#no ipv6 address
RP/10/RP0:ios(config-if)#bridge-port routed-interface mgmtEth 0/RP0/CPU0/0
RP/10/RP0:ios(config-if)#commit
```

Note Daisy chain can be extended to remote node using UDC port and OSC should be active with remote node.

Restriction LLDP and CDP is not supported on the management port if Daisy Chain is configured.

Verify Daisy Chain

To verify daisy chain configuration on management ports of NCS1010 device, use these commands:

show running-config interface*type*

Example

```
RP/0/RP0/CPU0:P2B_DT_02#show running-config interface mgmtEth
Wed Jun  7 12:44:43.673 IST
interface MgmtEth0/RP0/CPU0/0
 ipv4 address 192.0.2.1 255.255.0.0
!
```

```
interface MgmtEth0/RP0/CPU0/1
 bridge-port routed-interface MgmtEth0/RP0/CPU0/0
!
interface MgmtEth0/RP0/CPU0/2
 bridge-port routed-interface MgmtEth0/RP0/CPU0/0
!
```

Enable Storm Control on TOR Switch

When a large number of packets are broadcasted in a short time frame, it results in a traffic storm on a network. In a Daisy Chain network, excessive packet transmission by nodes and subsequent rebroadcasting by other nodes can lead to a traffic storm, overburdening the network.

In the Daisy Chain configuration, data can be transmitted in both directions. One of the Top of the Rack (TOR) switch ports is in the Forward state and carries the traffic whereas the other port is in the Blocked state. Three consecutive hello misses moves the port from Blocked to the Forwarding state.

When the NCS 1010 node reboots, the status of the port is changed from Blocked to Forwarding. Hence, a loop is created momentarily when both the TOR switch ports are in a forwarding state. This loop results in the duplication of packets on the network. To prevent this duplication, storm control must be enabled on the TOR switch.

To enable storm control on a TOR switch, use the following commands:

errdisable recovery interval *value*

errdisable recovery cause storm-control

Example

The following example shows how to enable storm control on a TOR switch:

```
RP/10/RP0:ios(config-if)#errdisable recovery interval 60
RP/10/RP0:ios(config-if)#errdisable recovery cause storm-control
```

Disable DAD on Management Port

By default, IPv6 Duplicate Address Detection (DAD) is enabled on the management ports. Similar to storm control scenario, when IPv6 is configured for a management port, DAD happens due to looping in the network. Since DAD was enabled, management port will be down. In order to avoid management port being down due to momentary looping, DAD must be disabled on the management port on which daisy chain is configured.

To disable DAD on the management port, use the following commands:

configure

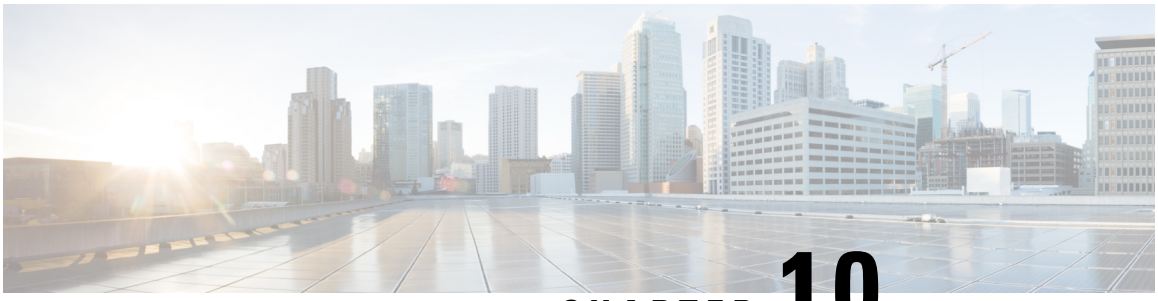
interface *type* **Rack/Slot/Instance/Port**

ipv6 nd dad attempts *value*

Example

The following is a sample configuration that disables DAD on management port 1:

```
RP/10/RP0:ios(config-if)#configure
RP/10/RP0:ios(config-if)#interface mgmtEth0/RP0/CPU0/1
RP/10/RP0:ios(config-if)#ipv6 nd dad attempts 1
```



CHAPTER 10

Configure ACL

This chapter describes the procedures to configure access control lists (ACL).

- Understand Access Control Lists, on page 96
- How an ACL Works, on page 97
- Apply ACLs, on page 99
- Configure an Ingress IPv4 ACL on Management Ethernet Interface, on page 99
- Configure an Egress IPv4 ACL on the Management Ethernet Interface, on page 100
- Configure an Ingress IPv6 ACL on the Management Ethernet Interface, on page 102
- Configure an Egress IPv6 ACL on the Management Ethernet Interface, on page 103
- Configure Extended Access Lists, on page 104
- Modify ACLs, on page 105

Understand Access Control Lists

Table 13: Feature History

Feature Name	Release Information	Feature Description
ACL on Management Port	Cisco IOS XR Release 7.11.1	Access Control List (ACL) feature enables you to permit or deny specific devices to connect to the management port and access NCS 1010 devices. This control enhances network security. Both IPv4 and IPv6 ACLs are supported on the management port. Commands added: • **ipv4-access-list** • **ipv4-access-group** • **show access-lists-ipv4** • **ipv6-access-list** • **ipv6-access-group** • **show access-lists-ipv6**

Access Control Lists (ACLs) perform packet filtering to control the packets that move through the network. These controls allow to limit the network traffic and restrict the access of users and devices to the network. ACLs have many uses, and therefore many commands accept a reference to an access list in their command syntax. An ACL consists of one or more access control entries (ACE) that collectively define the network traffic profile. Access control entries (ACE) are entries in an ACL that describe the access rights related to a particular security identifier or user.

There are 2 types of ACLs:

- Standard ACLs-Verifies only the source IP address of the packets. Traffic is controlled by the comparison of the address or prefix configured in the ACL, with the source address found in the packet.
- Extended ACLs-Verifies more than just the source address of the packets. Attributes such as destination address, specific IP protocols, User Datagram Protocol (UDP) or Transmission Control Protocol (TCP) port numbers, Differentiated Services Code Point (DSCP), and so on are validated. Traffic is controlled by a comparison of the attributes stated in the ACL with those in the incoming or outgoing packets.

Purpose of ACLs

ACLs allow you to perform the following:

- Filter incoming or outgoing packets on an interface.
- Restrict the contents of routing updates.

- Limit debug output that is based on an address or protocol.
- Control vty access.

How an ACL Works

An ACL is a sequential list consisting of permit and deny statements that apply to IP addresses and upper-layer IP protocols. The ACL has a name by which it is referenced. Many software commands accept an ACL as part of their syntax.

An ACL can be configured and named; however, it does not take effect until the ACL is referenced by a command that accepts an ACL. Multiple commands can reference the same ACL. An ACL can control traffic arriving at the router or leaving the router, but not traffic originating at the router.

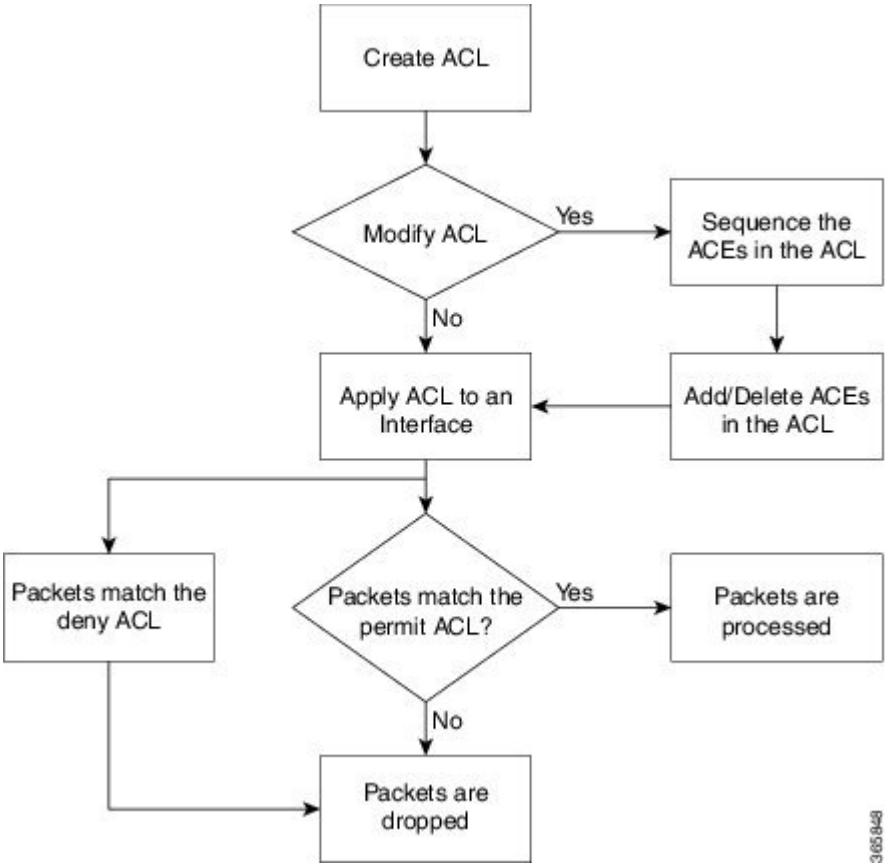
Source address and destination address are two of the most typical fields in an IP packet on which to base an ACL. Specify source addresses to control packets from certain networking devices or hosts. Specify destination addresses to control packets that are sent to certain networking devices or hosts.

You can also filter packets on the basis of transport layer information, such as whether the packet is a TCP, UDP, Internet Control Message Protocol (ICMP), or Internet Group Management Protocol (IGMP) packet.

ACL Workflow

The following image illustrates the workflow of an ACL.

Figure 9: ACL Workflow



Helpful Hints for Creating ACLs

Consider the following when creating ACLs:

- Create the access list before applying it to an interface.
- Organize your access list so that more specific references in a network or subnet appear before more general ones.
- To make the purpose of individual statements more easily understood at a glance, you can write a helpful remark before or after any statement.

Guidelines and Restrictions for Configuring ACLs

You must be aware of the following restrictions for configuring ACLs.

- Modifying an ACL when it is attached to the interface is supported.
- You can configure an ACL name with a maximum of 64 characters.
- You can configure an ACL name to comprise of only letters and numbers.

Apply ACLs

After you create an ACL, you must reference the ACL to make it work. ACL can be applied on *either* outbound or inbound interfaces. This section describes guidelines on how to accomplish this task for both terminal lines and network interfaces.

For inbound ACLs, after receiving a packet, Cisco IOS XR software checks the source address of the packet against the ACL. If the ACL permits the address, the software continues to process the packet. If the ACL rejects the address, the software discards the packet and returns an ICMP host unreachable message. The ICMP message is configurable.

For outbound ACLs, after receiving and routing a packet to a controlled interface, the software checks the source address of the packet against the ACL. If the ACL permits the address, the software sends the packet. If the ACL rejects the address, the software discards the packet and returns an ICMP host unreachable message.

When you apply an ACL that has not yet been defined to an interface, the software acts as if the ACL has not been applied to the interface and accepts all packets. Note this behavior if you use undefined ACLs as a means of security in your network.

Configure an Ingress IPv4 ACL on Management Ethernet Interface

Use the following configuration to configure an ingress IPv4 ACL on mgmtEth interface.

```
/* Configure mgmtEth interface with an IPv4 address */
RP/0/RP0/CPU0:ios#configure
Thu Oct 19 17:30:23.719 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/0
RP/0/RP0/CPU0:ios(config-if)#interface mgmtEth 0/RP0/CPU0/2
RP/0/RP0/CPU0:ios(config-if)#ipv4 address 4.33.0.57 255.255.255.0
RP/0/RP0/CPU0:ios(config-if)#no shutdown
RP/0/RP0/CPU0:ios(config-if)#commit
Thu Oct 19 17:31:25.127 UTC
RP/0/RP0/CPU0:ios(config-if)#exit


/* Verify if the interface is up */
RP/0/RP0/CPU0:ios(config)#do show ipv4 interface brief
Thu Oct 19 17:32:10.998 UTC

Interface                      IP-Address      Status          Protocol Vrf-Name
Loopback0                      3.3.3.16        Up              Up       default
GigabitEthernet0/0/0/0         7.1.11.5        Up              Up       default
GigabitEthernet0/0/0/2         9.1.11.5        Up              Up       default
MgmtEth0/RP0/CPU0/0            4.33.0.57       Up              Up       default
PTP0/RP0/CPU0/0                unassigned      Shutdown        Down     default
MgmtEth0/RP0/CPU0/1            8.1.1.1         Up              Up       default
PTP0/RP0/CPU0/1                unassigned      Shutdown        Down     default
MgmtEth0/RP0/CPU0/2            192.0.2.1       Down            Down     default


/* Configure an IPv4 ingress ACL */
RP/0/RP0/CPU0:ios(config)# ipv4 access-list V4-ACL-INGRESS
RP/0/RP0/CPU0:ios(config-ipv4-acl)# 10 permit tcp 192.0.2.2 255.255.255.0 any
```

```
RP/0/RP0/CPU0:ios(config-ipv4-acl)# 20 deny udp any any
RP/0/RP0/CPU0:ios(config-ipv4-acl)# 30 permit ipv4 192.0.2.64 255.255.255.0 any
RP/0/RP0/CPU0:ios(config-ipv4-acl)# commit
Thu Oct 19 18:31:25.127 UTC


/* Verify the ingress ACL creation */
RP/0/RP0/CPU0:ios(config)# do show access-lists ipv4
Thu Oct 19 18:32:25.127 UTC
...
ipv4 access-list V4-ACL-INGRESS
 10 permit tcp 192.0.2.2 255.255.255.0 any
 20 deny udp any any
 30 permit ipv4 192.0.2.64 255.255.255.0 any


/* Apply the ingress ACL to the mgmtEth interface */
RP/0/RP0/CPU0:ios(config)# interface mgmtEth 0/RP0/CPU0/0
RP/0/RP0/CPU0:ios(config-if)# ipv4 access-group V4-ACL-INGRESS ingress
RP/0/RP0/CPU0:ios(config-if)#commit
Thu Oct 19 18:34:25.127 UTC
RP/0/RP0/CPU0:ios(config-if)#exit


/* Verify if the ingress ACL has been successfully applied to the interface */

RP/0/RP0/CPU0:ios#show ipv4 interface mgmtEth 0/RP0/CPU0/0
Fri Oct 20 05:07:06.383 UTC
MgmtEth0/RP0/CPU0/0 is Up, ipv4 protocol is Up
  Vrf is default (vrfid 0x60000000)
  Internet address is 4.33.0.57/16
  MTU is 1514 (1500 is available to IP)
  Helper address is not set
  Directed broadcast forwarding is disabled
  Outgoing access list is not set
  Inbound  common access list is not set, access list is V4-ACL-INGRESS
  Proxy ARP is disabled
  ICMP redirects are never sent
  ICMP unreachables are always sent
  ICMP mask replies are never sent
  Table Id is 0xe0000000
```

You have successfully configured an IPv4 ingress ACL on the mgmtEth interface.

Configure an Egress IPv4 ACL on the Management Ethernet Interface

Use the following configuration to configure an egress IPv4 ACL on the mgmtEth interface.

```
/* Configure mgmtEth interface with an IPv4 address */
RP/0/RP0/CPU0:ios#configure
Thu Oct 19 17:30:23.719 UTC
RP/0/RP0/CPU0:ios(config)#
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/0
RP/0/RP0/CPU0:ios(config-if)#ipv4 address 4.33.0.57 255.255.255.0
RP/0/RP0/CPU0:ios(config-if)#no shutdown
RP/0/RP0/CPU0:ios(config-if)#commit
Thu Oct 19 17:31:25.127 UTC
RP/0/RP0/CPU0:ios(config-if)#exit
```

```
/* Verify if the interface is up */
RP/0/RP0/CPU0:ios(config)#do show ipv4 interface brief
Thu Oct 19 17:32:10.998 UTC

Interface                      IP-Address      Status          Protocol Vrf-Name
Loopback0                      3.3.3.16        Up              Up       default
GigabitEthernet0/0/0/0         7.1.11.5        Up              Up       default
GigabitEthernet0/0/0/2         9.1.11.5        Up              Up       default
MgmtEth0/RP0/CPU0/0            4.33.0.57       Up              Up       default
PTP0/RP0/CPU0/0                unassigned      Shutdown        Down     default
MgmtEth0/RP0/CPU0/1            8.1.1.1         Up              Up       default
PTP0/RP0/CPU0/1                unassigned      Shutdown        Down     default
MgmtEth0/RP0/CPU0/2            192.0.2.1       Down            Down     default


/* Configure an IPv4 egress ACL */
RP/0/RP0/CPU0:ios(config)# ipv4 access-list V4-ACL-EGRESS
RP/0/RP0/CPU0:ios(config-ipv4-acl)# 10 permit ipv4 203.0.113.1 255.255.255.0 192.0.2.1
0.255.255.255
RP/0/RP0/CPU0:ios(config-ipv4-acl)# 20 deny udp any any
RP/0/RP0/CPU0:ios(config-ipv4-acl)# commit
Thu Oct 19 18:31:25.127 UTC


/* Verify the egress ACL creation */
RP/0/RP0/CPU0:ios(config)# do show access-lists ipv4
Thu Oct 19 18:32:25.127 UTC
ipv4 access-list V4-ACL-EGRESS
 10 permit ipv4 203.0.113.1 255.255.255.0 192.0.2.1 255.255.255.0
 20 deny ipv4 any any
...


/* Apply the egress ACL to the mgmtEth interface */
RP/0/RP0/CPU0:ios(config)# interface mgmtEth 0/RP0/CPU0/0
RP/0/RP0/CPU0:ios(config-if)# ipv4 access-group V4-ACL-EGRESS egress
RP/0/RP0/CPU0:ios(config-if)# commit
Thu Jul 11 09:19:49.569 UTC
RP/0/RP0/CPU0:ios(config-if)# exit


/* Verify if the egress ACL has been successfully applied to the interface */

RP/0/RP0/CPU0:ios#show ipv4 interface mgmtEth 0/RP0/CPU0/0
Fri Oct 20 05:07:06.383 UTC
MgmtEth0/RP0/CPU0/0 is Up, ipv4 protocol is Up
  Vrf is default (vrfid 0x60000000)
  Internet address is 4.33.0.57/16
  MTU is 1514 (1500 is available to IP)
  Helper address is not set
  Directed broadcast forwarding is disabled
  Outgoing access list is V4-ACL-EGRESS
  Inbound  common access list is not set, access list is not set
  Proxy ARP is disabled
  ICMP redirects are never sent
  ICMP unreachables are always sent
  ICMP mask replies are never sent
  Table Id is 0xe0000000
```

You have successfully configured an IPv4 egress ACL on the mgmtEth interface.

Configure an Ingress IPv6 ACL on the Management Ethernet Interface

Use the following configuration to configure an ingress IPv6 ACL on the mgmtEth interface.

```
/* Configure a mgmtEth interface with an IPv6 address */
RP/0/RP0/CPU0:ios#
RP/0/RP0/CPU0:ios#configure
Fri Oct 20 05:25:58.785 UTC
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/1
RP/0/RP0/CPU0:ios(config-if)#ipv6 address 2001::1/64
RP/0/RP0/CPU0:ios(config-if)#no shutdown
RP/0/RP0/CPU0:ios(config-if)#commit
Fri Oct 20 05:26:13.669 UTC
RP/0/RP0/CPU0:ios(config-if)#exit


/* Verify if the interface is up */
RP/0/RP0/CPU0:ios(config)#do show ipv6 interface mgmtEth 0/RP0/CPU0/1 brief
Fri Oct 20 05:26:52.612 UTC
MgmtEth0/RP0/CPU0/1    [Up/Up]
    fe80::3afd:f8ff:fe66:872
    2001::1


/* Configure an IPv6 ingress ACL */
RP/0/RP0/CPU0:ios(config)#ipv6 access-list V6-INGRESS-ACL
RP/0/RP0/CPU0:ios(config-ipv6-acl)#10 permit ipv6 any any
RP/0/RP0/CPU0:ios(config-ipv6-acl)#20 deny udp any any
RP/0/RP0/CPU0:ios(config-ipv6-acl)#commit
Fri Oct 20 05:28:46.664 UTC
RP/0/RP0/CPU0:ios(config-ipv6-acl)#exit


/* Verify the ingress ACL creation */
RP/0/RP0/CPU0:ios(config)#do show access-lists ipv6
Fri Oct 20 05:29:01.125 UTC
ipv6 access-list V6-INGRESS-ACL
 10 permit ipv6 any any
 20 deny udp any any


/* Apply the ingress ACL to the HundredGigE interface */
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/1
RP/0/RP0/CPU0:ios(config-if)#ipv6 access-group V6-INGRESS-ACL ingress
RP/0/RP0/CPU0:ios(config-if)#commit
Fri Oct 20 05:37:32.738 UTC
RP/0/RP0/CPU0:ios(config-if)#exit


/* Verify if the ingress ACL has been successfully applied to the interface */
RP/0/RP0/CPU0:ios(config)#do show ipv6 interface mgmtEth 0/RP0/CPU0/1
Fri Oct 20 05:38:00.753 UTC
MgmtEth0/RP0/CPU0/1 is Up, ipv6 protocol is Up, Vrfid is default (0x60000000)
  IPv6 is enabled, link-local address is fe80::3afd:f8ff:fe66:872
  Global unicast address(es):
    2001::1, subnet is 2001::/64
  Joined group address(es): ff02::1:ff00:1 ff02::1:ff66:872 ff02::2
      ff02::1
  MTU is 1514 (1500 is available to IPv6)
  ICMP redirects are disabled
```

```
ICMP unreachables are enabled
ND DAD is enabled, number of DAD attempts 1
ND reachable time is 0 milliseconds
ND cache entry limit is 1000000000
ND advertised retransmit interval is 0 milliseconds
ND router advertisements are sent every 160 to 240 seconds
ND router advertisements live for 1800 seconds
Hosts use stateless autoconfig for addresses.
Outgoing access list is not set
Inbound  common access list is not set, access list is V6-INGRESS-ACL
Table Id is 0xe0800000
Complete protocol adjacency: 0
Complete glean adjacency: 0
Incomplete protocol adjacency: 0
Incomplete glean adjacency: 0
Dropped protocol request: 0
Dropped glean request: 0
RA DNS Server Address Count: 0
RA DNS Search list Count: 0
```

You have successfully configured an IPv6 ingress ACL on the mgmtEth interface.

Configure an Egress IPv6 ACL on the Management Ethernet Interface

Use the following configuration steps to configure an egress IPv6 ACL on the mgmtEth interface.

```
/* Configure a mgmtEth interface with an IPv6 address */
RP/0/RP0/CPU0:ios(config)#interface mgmtEth 0/RP0/CPU0/1
RP/0/RP0/CPU0:ios(config-if)#ipv6 address 2001::1/64
RP/0/RP0/CPU0:ios(config-if)#no shutdown
RP/0/RP0/CPU0:ios(config-if)#commit
Thu Jan 25 11:41:25.778 IST
Router(config-if)# exit


/* Verify if the interface is up */
Router(config)# do show ipv6 interface brief
Thu Jul 11 09:47:50.812 UTC
HundredGigE 0/0/0/0 [Up/Up]
    fe80::bd:b9ff:fea9:5606
    1001::1
HundredGigE 0/0/0/1 [Up/Up]
    fe80::23:e9ff:fea8:a44e
    2001::1


/* Configure an IPv6 egress ACL */
Router(config)# ipv6 access-list V6-EGRESS-ACL
Router(config-ipv6-acl)# 10 permit ipv6 any any
Router(config-ipv6-acl)# 20 deny udp any any
Router(config-ipv6-acl)# commit
Thu Jul 11 09:50:40.566 UTC
Router(config-ipv6-acl)# exit


/* Verify the egress ACL creation */
RP/0/RP0/CPU0:ios(config)#do show ipv6 interface mgmtEth 0/RP0/CPU0/1 brief
Fri Oct 20 05:26:52.612 UTC
MgmtEth0/RP0/CPU0/1    [Up/Up]
```

```
    fe80::3afd:f8ff:fe66:872
    2001::1
…

/* Apply the egress ACL to the mgmtEth interface */
Router(config)# interface mgmtEth 0/RP0/CPU0/1
Router(config-if)# ipv6 access-group V6-EGRESS-ACL egress
Router(config-if)# commit
Thu Jul 11 09:52:57.751 UTC
Router(config-if)# exit


/* Verify if the egress ACL has been successfully applied to the interface */
RP/0/RP0/CPU0:ios(config)#do show ipv6 interface mgmtEth 0/RP0/CPU0/1
Fri Oct 20 05:38:00.753 UTC
MgmtEth0/RP0/CPU0/1 is Up, ipv6 protocol is Up, Vrfid is default (0x60000000)
  IPv6 is enabled, link-local address is fe80::3afd:f8ff:fe66:872
  Global unicast address(es):
    2001::1, subnet is 2001::/64
  Joined group address(es): ff02::1:ff00:1 ff02::1:ff66:872 ff02::2
      ff02::1
  MTU is 1514 (1500 is available to IPv6)
  ICMP redirects are disabled
  ICMP unreachables are enabled
  ND DAD is enabled, number of DAD attempts 1
  ND reachable time is 0 milliseconds
  ND cache entry limit is 1000000000
  ND advertised retransmit interval is 0 milliseconds
  ND router advertisements are sent every 160 to 240 seconds
  ND router advertisements live for 1800 seconds
  Hosts use stateless autoconfig for addresses.
  Outgoing access list is V6-EGRESS-ACL
  Inbound  common access list is not set, access list is not set
  Table Id is 0xe0800000
  Complete protocol adjacency: 0
  Complete glean adjacency: 0
  Incomplete protocol adjacency: 0
  Incomplete glean adjacency: 0
  Dropped protocol request: 0
  Dropped glean request: 0
  RA DNS Server Address Count: 0
  RA DNS Search list Count: 0
...
```

You have successfully configured an IPv6 egress ACL on the mgmtEth interface.

Configure Extended Access Lists

Use Extended Access Lists to verify more than just the source address of the packets. Attributes such as destination address, specific IP protocols, UDP or TCP port numbers, DSCP, and so on are validated. Traffic is controlled by a comparison of the attributes stated in the ACL with those in the incoming or outgoing packets.

To configure Extended Access Lists, you must create an access list and specify the condition to allow or deny the network traffic.

```
/* Enter the global configuration mode and create the access list*/
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#ipv4 access-list acl_1
RP/0/RP0/CPU0:ios(config-ipv4-acl)#10 remark Do not allow user1 to telnet out
```

```
/*Specify the condition to allow or deny the network traffic.*/
RP/0/RP0/CPU0:ios(config-ipv4-acl)#10 permit 172.16.0.0 0.0.255.255
RP/0/RP0/CPU0:ios(config-ipv4-acl)#20 deny 192.168.34.0 0.0.0.255
RP/0/RP0/CPU0:ios(config-ipv4-acl)#commit
```

Running Configuration

```
RP/0/RP0/CPU0:ios#show running-config
Fri Oct 20 06:21:11.024 UTC
!! Building configuration...
!! IOS XR Configuration 24.1.1.23I
!! Last configuration change at Fri Oct 20 06:19:08 2023 by cisco

!
ipv4 access-list acl_1
 10 permit ipv4 172.16.0.0 0.0.255.255 any
 20 deny ipv4 192.168.34.0 0.0.0.255 any
!
```

Verification

```
RP/0/RP0/CPU0:ios#show access-lists ipv4 acl_1
Fri Oct 20 06:22:17.223 UTC
ipv4 access-list acl_1
 10 permit ipv4 172.16.0.0 0.0.255.255 any
 20 deny ipv4 192.168.34.0 0.0.0.255 any
```

Modify ACLs

This section describes a sample configuration to modify ACLs.

```
*/ Create an Access List*/
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#ipv4 access-list acl_1

*/Add entries (ACEs) to the ACL*/
RP/0/RP0/CPU0:ios(config-ipv4-acl)#10 permit ip host 10.3.3.3 host 172.16.5.34
RP/0/RP0/CPU0:ios(config-ipv4-acl)#20 permit icmp any any
RP/0/RP0/CPU0:ios(config-ipv4-acl)#30 permit tcp any host 10.3.3.3
RP/0/RP0/CPU0:ios(config-ipv4-acl)#end


*/Verify the entries of the ACL*/:
Router#show access-lists ipv4 acl_1
ipv4 access-list acl_1
10 permit ip host 10.3.3.3 host 172.16.5.34
20 permit icmp any any
30 permit tcp any host 10.3.3.3


*/Add new entries, one with a sequence number "15" and another without a sequence number
to the ACL. Delete an entry with the sequence number "30":*/
RP/0/RP0/CPU0:ios(config)#ipv4 access-list acl_1
RP/0/RP0/CPU0:ios(config-ipv4-acl)# 15 permit 10.5.5.5 0.0.0.255
RP/0/RP0/CPU0:ios(config-ipv4-acl)# no 30
RP/0/RP0/CPU0:ios(config-ipv4-acl)# permit 10.4.4.4 0.0.0.255
RP/0/RP0/CPU0:ios(config-ipv4-acl)# commit
```

/When an entry is added without a sequence number, it is automatically given a sequence number that puts it at the end of the access list. Because the default increment is 10, the entry will have a sequence number 10 higher than the last entry in the existing access list/

```
*/Verify the entries of the ACL:*/
RP/0/RP0/CPU0:ios#show access-lists ipv4 acl_1
ipv4 access-list acl_1
 10 permit ipv4 host 10.3.3.3 host 172.16.5.34

15 permit 10.5.5.5 0.0.0.255---*/newly added ACL (with the sequence number)*/
20 permit icmp any any
30 permit ipv4 10.4.4.0 0.0.0.255 any ---*/newly added ACL (without the sequence number)*/

*/The entry with the sequence number 30, that is, "30 permit tcp any host 10.3.3.3" is
deleted from the ACL*/
```

You have successfully modified ACLs in operation.