# Bring-up Cisco NCS 1020

After installing the hardware, boot the Cisco NCS 1020 system. You can connect to the XR console port and power on the system. NCS 1020 completes the boot process using the pre-installed operating system (OS) image. If no image is available, NCS 1020 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.

There are two options for configuring a password: 'password' and 'secret'.

- Password: Uses type 7 encryption to store the password.
- Secret: Allows for type 5, 8, 9, or 10 hashing algorithms to store the password securely.

Starting from Release 24.4.x, Type 7 encryption and Type 5 hashing are considered less secure and are no longer available. We recommend using the 'secret' option with Type 10 hashing, which is now the default.

**During upgrade**:

- During the upgrade to Release 24.4.x, any configuration using the 'password' option will be automatically converted to use the 'secret' option with Type 10 hashing, ensuring the configuration remains functional postupgrade.

**Postupgrade**:

- You can still use the password and secret 5 option and commit the changes, but the password will be stored as 'secret' option with Type 10.
- Configurations for the first 100 usernames will retain the 'secret' configuration postupgrade.
- Configurations using 'secret' with Type 5 will remain unchanged and cannot be decrypted.
- You can verify the same using show running config command and in the syslog message. The syslog message will alert you that this is not secure, and it is advised to switch to 'secret' with Type 10.

**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 1020, on page 2
- Configure Management Interface, on page 22

• Configure Telnet, on page 27
• Configure SSH, on page 27

# Boot NCS 1020

Use the console port to connect to NCS 1020. 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.

### Procedure

**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 115200 bps, for NCS1010-CTR2-K9, 9600 bps for NCS1010-CTR2-B-K9, 8 data bits, 1 stop bit and no parity.

**Step 3** Power on NCS 1020.

To power on the shelves, install the AC or DC power supplies and cables. As NCS 1020 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 1020 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 1020 is corrupt. In this case, you can boot NCS 1020 using an external bootable USB drive.

# Boot NCS 1020 Using USB Drive

The bootable USB drive is used to reimage NCS 1020 for system upgrade or to boot the NCS 1020 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 1020 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 1020 software image can be downloaded from Software Download page on Cisco.com.

**Note** Since the NCS 1020 system uses the same XR image as NCS 1010, there are no changes in the USB bootable image name used. Hence the USB bootable image name is the same as NCS 1010.

- 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*.

### Procedure

**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.

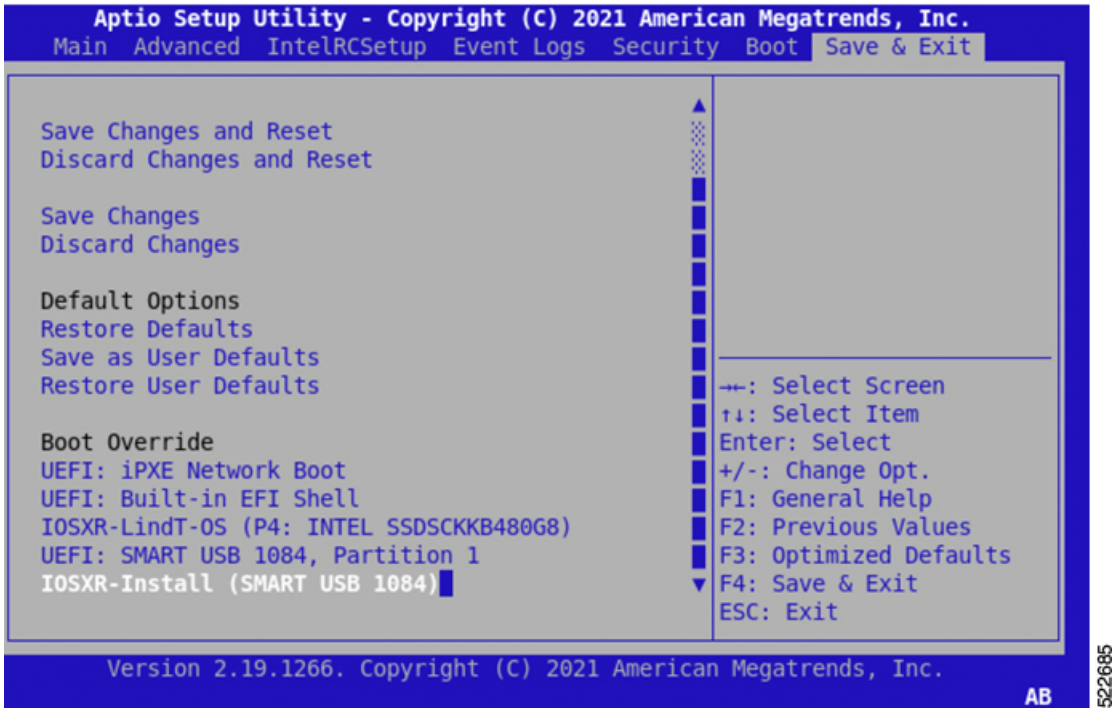
**Step 5** Insert the USB drive in one of the USB ports of NCS 1020 line card/controller card.

**Step 6** Reboot NCS 1020 using power cycle or console.

**Note**
Use the **reload bootmedia usb noprompt** command to boot the NCS 1020 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 1020 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 1020 using ZTP and iPXE.

## Introduction to DHCP Relay

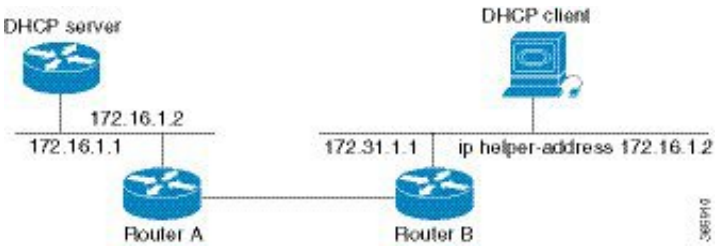
A DHCP relay agent is a host that forwards DHCP packets between clients and servers that do not reside on a shared physical subnet. Relay agent forwarding is distinct from the normal forwarding of an IP router where IP datagrams are switched between networks transparently.

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 1: Forwarding UDP Broadcasts to a DHCP Server Using a Helper Address***




## 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
!
```

## 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 1020 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 ncs1020
   {
   hardware ethernet ab:cd:ef:01:23:45;
   fixed-address <ip address>;
   filename "http://<httpserver-address>/<path-to-image>/ncs1020-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/ncs1020-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 1020 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 1020 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 13.

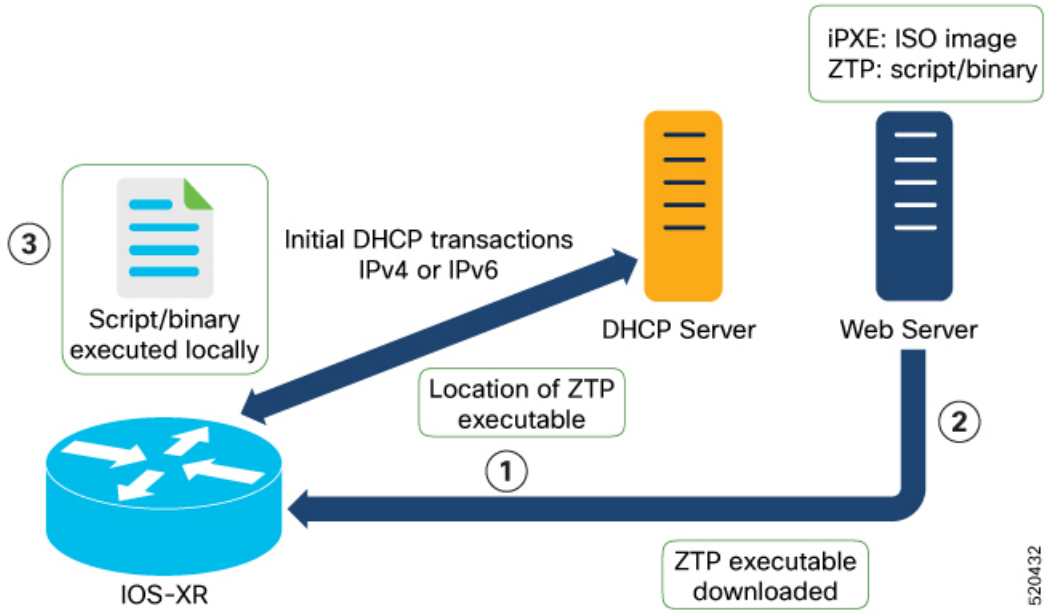
  You must define the configuration file or the bootscript that is downloaded from the DHCP server:

- **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 15.
- **ZTP Bootscript**: Define the script to be executed on every boot. See Configure ZTP BootScript, on page 16 .
- **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 17.

## 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 1020 System Setup and Software Installation Guide, IOS XR Release 7.7.x
19
Bring-up Cisco NCS 1020
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 ncs1020_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/ncs1020-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
#
# NCS1020 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.

**Procedure**

**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 1020 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.

**Procedure**

**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 1020 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 1020 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.

### Procedure

**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 SSH or 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. It advertises and learns the LLDP neighbor information through this system. This information about neighbors is then used to learn about the neighbors as well as the topology of the devices for Operations, Administration, and Maintenance (OAM) purposes.

**Note** Slot-0 and Slot-1 are provisioned for LLDP in NCS 1020.

### Advantages of LLDP

- Provides support on both Cisco and non-Cisco devices.
- Enables neighbor discovery between Cisco and 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 1020. But when you enable and disable LLDP in the global configuration mode, LLDP gets disabled on all the interfaces. To enable it again you must enable LLDP globally or reload NCS 1020.

*Table 1: Comparison of Cisco Discovery Protocol (CDP) and LLDP*

| CDP | 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.

### 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.

### Considerations for LLDP Configuration

- LLDP full stack functionality is supported on all the three management interfaces that are supported in NCS 1020.
- You can selectively enable or disable LLDP on any of the management interfaces.
- You can selectively enable or disable LLDP transmit or receive functionality at the management interface level.
- LLDP operational data is available on both the CLI and NETCONF-YANG interfaces.

## Global LLDP Attributes

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

*Table 2: Global LLDP Attributes*

| Attribute | Default | Range | Description |
|---|---|---|---|
| Holdtime | 120 seconds | 0–65535 seconds | Specifies the holdtime (in sec). Holdtime refers to the time or duration that an LLDP device maintains the neighbor information before discarding. |
| Reinit | 2 seconds | 2–5 seconds | Delay (in sec) for LLDP initialization on any interface |

| Attribute | Default | Range | Description |
|---|---|---|---|
| Timer | 30 seconds | 5–65534 seconds | Specifies the rate at which LLDP packets are sent (in sec) |

### Enabling LLDP Globally

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

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

**Note** Two additional GigabitEthernet based interfaces are enabled as part of the newly provisioned Slot-1 as given in the example below.

```
GigabitEthernet0/1/0/0 unassigned Down Down default
GigabitEthernet0/1/0/2 unassigned Down Down default
```

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.

**Note** If the RCOM interface is enabled, the output of **show lldp neighbors** command would include the entries for both LLDP neighbours and remote connect neighbours.

### Enable LLDP for Each 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 1020 chassis is not booted using ZTP.

### Before you begin

Ensure that two xr-telnet-* rpms are installed..

### Procedure

**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 1020 chassis is not booted using ZTP.

### Before you begin

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

### Procedure

**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.