



## Bring-up Cisco NCS 1014

After installing the hardware, boot the Cisco NCS 1014 system. You can connect to the XR console port and power on the system. NCS 1014 completes the boot process using the pre-installed operating system (OS) image. If no image is available, NCS 1014 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.



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**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.

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## 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 Using ZTP

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

- ZTP helps you to remotely provision a router anywhere in the network. This eliminates the need for an expert to deploy network devices and reduces IT cost.
- Automated provisioning using ZTP removes delay, increases accuracy, provides better customer experience and is cost-effective.

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 on hand, you can reset a system to a 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:** 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. For more information, see [Fresh Boot Using DHCP, on page 2](#).

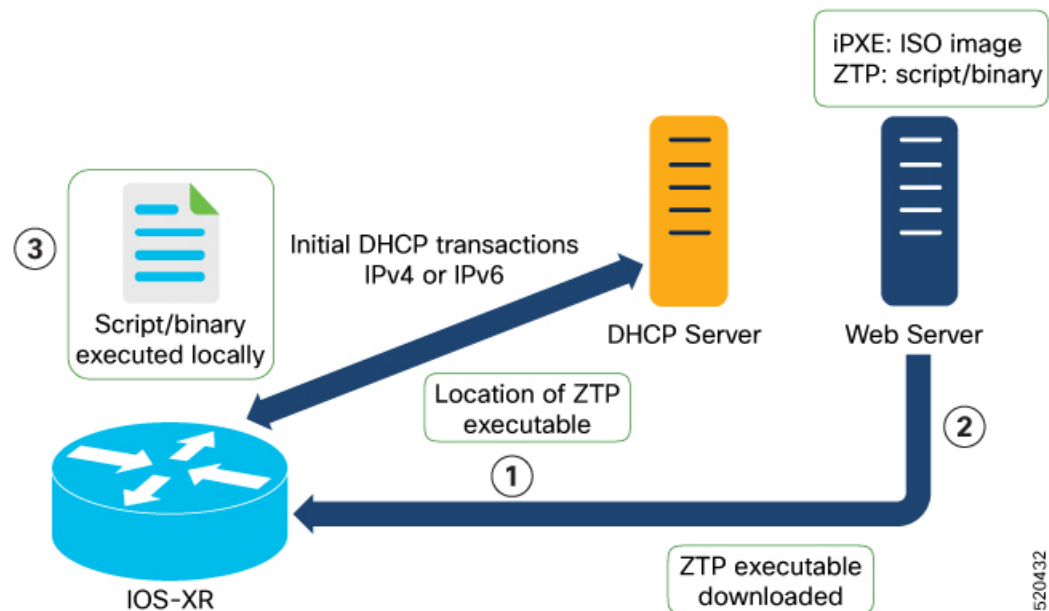
You must define the configuration file or the bootscript that is downloaded from the DHCP server.

- **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 4](#).
- **ZTP Bootscript:** Define the script to be executed on every boot. See [Configure ZTP BootScript, on page 8](#).
- **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 10](#).
- **Invocation using Reload Command:** Use this method when you want to forcefully initiate ZTP on a fully configured device using the **reload** command. See [Invoke ZTP Through Reload, on page 11](#).

## Fresh Boot Using DHCP

The ZTP process initiates when you boot the network device with an IOS XR image. The ZTP process starts only on a device without prior configuration.

This figure depicts the high-level workflow 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 defined in the configuration file. You can modify this sequence in the configuration file, if required.

- ZTP sends IPv4 DHCP request first on all the management ports. If the request fails, then ZTP sends IPv6 DHCP request on all the management ports.
  - ZTP sends IPv4 DHCP request first on all the data ports. If the request fails, then ZTP sends IPv6 DHCP request on all the data ports.
2. DHCP server identifies the device and responds with DHCP response.  
DHCP server should be configured to respond with DHCP response and supply script/config location with one of the following DHCP options:
    - DHCPv4 using BOOTP filename.
    - DHCPv4 using Option 67 (bootfile-name).
    - DHCPv6 using Option 59 (OPT\_BOOTFILE\_URL).
  3. The network device downloads the file from the web server using the URL location 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](#).

```
!! Building configuration
!! IOS XR Configuration 7.11.1.35I
!! Last configuration change at Fri Sep 15 17:18:53 2023 by cisco
!
hostname IOS_P2B_FLT
logging console debugging
username cisco
  group root-lr
  group cisco-support
  secret 10
$!$4gjnzvvdCz1z...$bovO.6uRYD9qsujiw6DNjTx6bngeDIVMvXxVbReal6bpd0SRo5qyfHk5S4D23r9hjtYtXnyQWNcrgbk0USB20
!
grpc
  port 57400
!
line template vty
  timestamp disable
  exec-timeout 0 0
!
line template test
  exec-timeout 0 0
!
line console
  timeout login response 30
  timestamp
  exec-timeout 0 0
  width 0
  length 0
!
line default
  timestamp disable
  exec-timeout 0 0
  length 0
  absolute-timeout 0
  session-timeout 0
!
vty-pool default 0 10 line-template default
fpd auto-upgrade enable
ntp
```

```
max-associations 99
!
call-home
service active
contact smart-licensing
profile CiscoTAC-1
active
destination transport-method email disable
destination transport-method http
!
!
netconf-yang agent
ssh
!
hw-module location 0/1/NXR0
mxponder-slice 0
trunk-rate 600G
client-rate 100GE
!
!
hw-module location 0/2/NXR0
mxponder-slice 0
trunk-rate 800G
client-port-rate 1 client-type 400GE
!
!
interface MgmtEth0/RP0/CPU0/0
description mgmt0
ipv4 address 10.105.57.64 255.255.255.0
!
interface MgmtEth0/RP0/CPU0/1
ipv4 address 10.127.60.44 255.255.255.0
ipv6 enable
!
controller Optics0/0/0/0
description optics0/0/0/0
pm 30-sec optics threshold opt min 2
fastpoll enable
perf-mon enable
!
controller Optics0/0/0/1
description optics0/0/0/1
fastpoll enable
!
controller Optics0/0/0/2
description optics0/0/0/2
perf-mon enable
!
controller Optics0/0/0/3
description optics0/0/0/3
!
controller Optics0/0/0/4
description optics0/0/0/4
!
controller Optics0/0/0/5
description optics0/0/0/5
!
controller Optics0/0/0/6
description optics0/0/0/6
!
controller Optics0/0/0/7
description optics0/0/0/7
!
controller Optics0/0/0/8
```

```

    description optics0/0/0/8
    !
  controller Optics0/0/0/9
    description optics0/0/0/9
    pm 15-min optics report opt max-tca enable
    pm 15-min optics threshold opt-dbm max -200
    pm 30-sec optics report opr min-tca enable
    pm 30-sec optics report opt max-tca enable
    pm 30-sec optics threshold opr-dbm min 500
    pm 30-sec optics threshold opt-dbm max -210
    !
  controller Optics0/0/0/10
    description optics0/0/0/10
    !
  controller Optics0/0/0/11
    description optics0/0/0/11
    !
  controller Optics0/0/0/12
    description optics0/0/0/12
    !
  controller Optics0/0/0/13
    description optics0/0/0/13
    !
  controller Optics0/1/0/0
    description optics0/1/0/0
    pm 15-min optics report opr min-tca enable
    pm 15-min optics threshold opr-dbm min 200
    pm 30-sec optics report opr min-tca enable
    pm 30-sec optics threshold opr-dbm min 200
    fastpoll enable
    !
  controller Optics0/1/0/1
    description optics0/1/0/1
    !
  controller Optics0/1/0/2
    description optics0/1/0/2
    !
  controller Optics0/1/0/3
    description optics0/1/0/3
    !
  controller Optics0/1/0/4
    description optics0/1/0/4
    !
  controller Optics0/1/0/5
    description optics0/1/0/5
    !
  controller Optics0/1/0/6
    description optics0/1/0/6
    !
  controller Optics0/1/0/7
    description optics0/1/0/7
    !
  controller Optics0/1/0/8
    description optics0/1/0/8
    !
  controller Optics0/1/0/9
    description optics0/1/0/9
    !
  controller Optics0/1/0/10
    description optics0/1/0/10
    !
  controller Optics0/1/0/11
    description optics0/1/0/11
    !

```

```
controller Optics0/1/0/12
  description optics0/1/0/12
!
controller Optics0/1/0/13
  description optics0/1/0/13
!
controller Optics0/2/0/0
  description optics0/2/0/0
  transmit-power -25
  dwdm-carrier 100MHz-grid frequency 1923500
  rx-low-threshold -120
  rx-high-threshold 40
  tx-low-threshold -101
  tx-high-threshold 40
!
controller Optics0/2/0/1
  description optics0/2/0/1
!
controller Optics0/2/0/2
  description optics0/2/0/2
!
controller Optics0/2/0/3
  description optics0/2/0/3
!
controller Optics0/2/0/4
  description optics0/2/0/4
!
controller Optics0/2/0/5
  description optics0/2/0/5
!
controller Optics0/2/0/6
  description optics0/2/0/6
!
controller Optics0/2/0/7
  description optics0/2/0/7
!
controller Optics0/3/0/0
  description optics0/3/0/0
!
controller Optics0/3/0/1
  description optics0/3/0/1
!
controller Optics0/3/0/2
  description optics0/3/0/2
  pm 30-sec optics report opr min-tca enable
  pm 30-sec optics threshold opr-dbm min 200
!
controller Optics0/3/0/3
  description optics0/3/0/3
!
controller Optics0/3/0/4
  description optics0/3/0/4
!
controller Optics0/3/0/5
  description optics0/3/0/5
!
controller Optics0/3/0/6
  description optics0/3/0/6
!
controller Optics0/3/0/7
  description optics0/3/0/7
!
controller Optics0/3/0/8
  description optics0/3/0/8
```

```

!
controller Optics0/3/0/9
  description optics0/3/0/9
!
controller Optics0/3/0/10
  description optics0/3/0/10
!
controller Optics0/3/0/11
  description optics0/3/0/11
!
controller Optics0/3/0/12
  description optics0/3/0/12
!
controller Optics0/3/0/13
  description optics0/3/0/13
!
interface PTP0/RP0/CPU0/0
  shutdown
!
interface PTP0/RP0/CPU0/1
  shutdown
!
router static
  address-family ipv4 unicast
    0.0.0.0/0 10.105.57.1
    0.0.0.0/0 10.127.60.1
  !
!
snmp-server traps sensor
snmp-server traps fru-ctrl
netconf agent tty
!
lldp
!
ains-soak hours 47 minutes 59
ssh timeout 120
ssh server rate-limit 600
ssh server session-limit 100
ssh server v2
ssh server vrf default
ssh server netconf vrf default
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.

To manually execute a script during every boot, use the following configuration:

```

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

```

To ensure that we have connectivity in the third-party namespace for applications to use, the above configuration waits for the first data plane interface to be configured and wait an extra minute for the management interface to be configured with an IP address. 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
#
# NCS1014 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 7.11.1.35I
!! Last configuration change at Fri Sep 15 17:18:53 2023 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 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 ports), you need not bring up and configure the interface first. You can execute the **ztp initiate** command, even if the interface is down, so that the ZTP script brings it up and invoke *dhclient*. ZTP can run on all interfaces irrespective of whether the interfaces are up or not.

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

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

The log file *ztp.log* is saved in the `/var/log/ztp.log` folder, and a copy of log file is available in the `/disk0:/ztp/ztp.log` location using a soft link. However, executing **ztp clean** clears files saved on disk and not from the `/var/log/ztp.log` folder where current ZTP logs are saved. To get a log from current ZTP run, you must manually remove the ZTP log file from `/var/log/ztp.log`.

### SUMMARY STEPS

1. (optional) **ztp clean**
2. **ztp initiate**
3. (Optional) **ztp terminate**

### DETAILED STEPS

#### Step 1 (optional) **ztp clean**

##### Example:

```

RP/0/RP0/CPU0:ios#ztp clean
Fri Sep 15 17:12:33.477 IST
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.
RP/0/RP0/CPU0:ios#

```

Removes all the ZTP logs and saved settings.

#### Step 2 **ztp initiate**

##### Example:

```
RP/0/RP0/CPU0:ios#ztp initiate
Fri Sep 15 17:13:28.580 IST
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#
```

Reboots the Cisco NCS 1014 system.

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

### Step 3 (Optional) ztp terminate

#### Example:

```
RP/0/RP0/CPU0:ios#ztp terminate
Fri Sep 15 17:15:04.592 IST
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
RP/0/RP0/CPU0:ios#
```

Terminates the ZTP process.

## Invoke ZTP Through Reload

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

### SUMMARY STEPS

1. **configure**
2. **commit replace**
3. **ztp clean**
4. **reload**

### DETAILED STEPS

#### Step 1 configure

##### Example:

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

Enters the configuration mode.

#### Step 2 commit replace

##### Example:

```
RP/0/RP0/CPU0:ios(config)#commit replace
Fri Sep 15 11:47:31.746 UTC
```

This commit will replace or remove the entire running configuration. This operation can be service affecting.

## Invoke ZTP Through Reload

```
Do you wish to proceed? [no]: yes
RP/0/RP0/CPU0:ios(config)#
```

Removes the entire running configuration.

**Step 3** **ztp clean****Example:**

```
RP/0/RP0/CPU0:ios#ztp clean
Fri Sep 15 11:48:13.669 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.
RP/0/RP0/CPU0:ios#
```

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 see that the ZTP is initiated and the configuration has been restored successfully.

```
RP/0/RP0/CPU0:Sep 25 17:29:19.875 UTC: pyztp2[325]: %INFRA-ZTP-4-START : ZTP has started. Interfaces
  might be brought up if they are shutdown
RP/0/RP0/CPU0:Sep 25 17:30:33.286 UTC: pyztp2[325]: %INFRA-ZTP-6-DISCOVERY_COMPLETED : Discovery
  successful on MgmtDhcp4Fetcher. Will proceed with fetching.
RP/0/RP0/CPU0:Sep 25 17:30:47.362 UTC: pyztp2[325]: %INFRA-ZTP-6-FETCHING_COMPLETED : Provisioning
  file fetched successfully
RP/0/RP0/CPU0:Sep 25 17:31:30.889 UTC: pyztp2[325]: %INFRA-ZTP-4-CONFIG_INITIATED : ZTP has initiated
  config load and commit operations
RP/0/RP0/CPU0:Sep 25 17:32:36.100 UTC: pyztp2[325]: %INFRA-ZTP-4-CONFIG_FINISHED : ZTP has finished
  config load and commit operations
RP/0/RP0/CPU0:Sep 25 17:32:41.059 UTC: pyztp2[325]: %INFRA-ZTP-6-CFG_TAMP_SAVE_HASH : Config hash
  saved after ztp Config is: (643013d9a43a3d2576012a24eb9745a8f960480d0053d06ed81146cb3c3d54c5).
RP/0/RP0/CPU0:Sep 25 17:32:44.089 UTC: pyztp2[325]: %INFRA-ZTP-4-PROVISIONING_COMPLETED : ZTP has
  successfully completed the provisioning
RP/0/RP0/CPU0:Sep 25 17:32:52.909 UTC: pyztp2[325]: %INFRA-ZTP-4-EXITED : ZTP exited
User Access Verification
```

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

Reboots the Cisco NCS 1014 system.

## ZTP Logging

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

The following example displays the execution of a simple configuration script downloaded from a data interface using the command `ztp initiate interface MgmtEth 0/RP0/CPU0/0 verbose`. This script unshuts all the interfaces of the system and configures a load interval of 30 seconds on all of them.

```

2023-09-25 17:37:31,693 28136 [Engine      ] DEB: ZAdmin, current state:active. Processing
work: Sending standby sync message. done = False
2023-09-25 17:37:31,716 28136 [Engine      ] DEB: ZAdmin, current state:active. Processing
work: [privileged] getting engine status. done = False
2023-09-25 17:37:31,717 28136 [Engine      ] DEB: ZAdmin, current state:active. Processing
work: Fetching provisioning data. done = False
2023-09-25 17:37:31,718 28136 [Engine      ] INF: ZAdmin, current state:active: state tag
changed to fetch
2023-09-25 17:37:31,721 28136 [Xr          ] INF: Downloading the file to /tmp/ztp.script
2023-09-25 17:37:31,948 28136 [ReportBootz ] INF: User script downloaded successfully.
Provisioning in progress.
2023-09-25 17:37:31,950 28136 [Engine      ] DEB: ZAdmin, current state:active. Processing
work: Config device work for ZAdmin. done = False
2023-09-25 17:37:31,951 28136 [ZtpHelpers  ] DEB: Executing: source /pkg/bin/ztp_helper.sh
&& echo -ne | xrcmd "show version"
2023-09-25 17:37:32,956 28136 [ZAdmin      ] DEB: Proceeding to provision the router
2023-09-25 17:37:32,958 28136 [Engine      ] DEB: ZAdmin, current state:active. Processing
work: ZAdmin: Apply configuration. done = False
2023-09-25 17:37:32,959 28136 [Engine      ] INF: ZAdmin, current state:active: state tag
changed to provision
2023-09-25 17:37:32,975 28136 [Env         ] DEB: No MTU configs detected
2023-09-25 17:37:32,977 28136 [Engine      ] DEB: ZAdmin, current state:active. Processing
work: ZAdmin: Apply configuration. done = False
2023-09-25 17:37:33,021 28136 [Xr          ] DEB: Will apply the following config:
/disk0:/ztp/customer/config.candidate
2023-09-25 17:37:33,022 28136 [Xr          ] INF: Applying user configurations
2023-09-25 17:37:33,023 28136 [Configuration] INF: Provisioning via config replace
2023-09-25 17:38:14,445 28136 [Configuration] INF: Configuration has been applied
2023-09-25 17:38:14,447 28136 [Env         ] DEB: cfg::createRefOnConfigCommit: called
2023-09-25 17:38:15,778 28136 [Env         ] DEB: cfg:: Generating hash for File name:
/disk0:/ztp/customer/config.inithash_tmp
2023-09-25 17:38:15,780 28136 [Env         ] DEB: cfg::_generateCfgAndSaveHash:: HASH :
643013d9a43a3d2576012a24eb9745a8f960480d0053d06ed81146cb3c3d54c5, type : 1
2023-09-25 17:38:17,743 28136 [Env         ] DEB: cfg::getRefOnConfigCommit: called
2023-09-25 17:38:17,818 28136 [Env         ] DEB: cfg::getRefOnConfigCommit :: ret : data
: 643013d9a43a3d2576012a24eb9745a8f960480d0053d06ed81146cb3c3d54c5, len: 64
2023-09-25 17:38:17,819 28136 [Env         ] INF: Env::getConfigRefHashOnCommit: get data
from tam : success:b'643013d9a43a3d2576012a24eb9745a8f960480d0053d06ed81146cb3c3d54c5'
2023-09-25 17:38:17,821 28136 [Engine      ] DEB: ZAdmin, current state:active. Processing
work: Sending standby sync message. done = False
2023-09-25 17:38:17,836 28136 [Engine      ] DEB: ZAdmin, current state:active. Processing
work: [privileged] getting engine status. done = False
2023-09-25 17:38:17,837 28136 [Engine      ] DEB: ZAdmin, current state:active. Processing
work: ZAdmin: Execute post-configuration script. done = False
2023-09-25 17:38:17,873 28136 [Env         ] INF: Env::cleanup, success:True, exiting:False
2023-09-25 17:38:17,876 28136 [ZtpHelpers  ] DEB: Executing: source /pkg/bin/ztp_helper.sh
&& echo -ne | xrcmd "show running-config"
2023-09-25 17:38:19,582 28136 [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
2023-09-25 17:38:20,695 28136 [Xr          ] INF: Removing linux route with ip 10.105.57.107
2023-09-25 17:38:20,731 28136 [Xr          ] INF: Failed to remove default route to to_xr
via 10.105.57.107 with error: Error: RTNETLINK answers: No such process encountered while

```

```

executing command: ip netns exec vrf-default ip route del default dev to_xr src 10.105.57.107
metric 512
2023-09-25 17:38:20,736 28136 [Engine      ] INF: ZAdmin, current state:active, exit
code:success
2023-09-25 17:38:20,737 28136 [Engine      ] INF: ZAdmin, current state:final, exit
code:success: state changed to final
2023-09-25 17:38:22,846 28136 [Engine      ] DEB: ZAdmin, current state:final, exit
code:success. Processing work: Sending standby sync message. done = False
2023-09-25 17:38:22,847 28136 [Engine      ] WAR: ZAdmin, current state:final, exit
code:success: work is ignored: work=<desc='Sending standby sync message' done=False
priv=False>
2023-09-25 17:38:22,848 28136 [Engine      ] DEB: ZAdmin, current state:final, exit
code:success. Processing work: [privileged] getting engine status. done = False
2023-09-25 17:38:27,853 28136 [__main__    ] DEB: Moved to final state
2023-09-25 17:38:27,854 28136 [__main__    ] DEB: ZTP completed successfully
2023-09-25 17:38:27,855 28136 [__main__    ] INF: Exiting SUCCESSFULLY

```

## Generate Tech Support Information for ZTP

When you have a problem that you cannot resolve in the ztp process, contact the 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 resolution, 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:ios#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:ios#

```

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.

### 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 12.25.0.1
```

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.

## Boot NCS 1014

Use the console port to connect to NCS 1014. 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 115200 bps for NCS1K14-CNTRLR-K9, 9600 bps for NCS1K14-CTLR-B-K9, 8 data bits, 1 stop bit and no parity.

**Step 3** Power on the NCS 1014.

To power on the shelves, install the AC or DC power supplies and cables. As NCS 1014 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 1014 more time to complete the initial boot procedure; then press **Enter**.

If the boot process fails, it may be because the preinstalled image on the NCS 1014 is corrupt. In this case, you can boot NCS 1014 using an external bootable USB drive.

---

## Boot NCS 1014 Using USB Drive

The bootable USB drive is used to reimage NCS 1014 for system upgrade or to boot the NCS 1014 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 1014 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.
  - 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-x64-usb-(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.

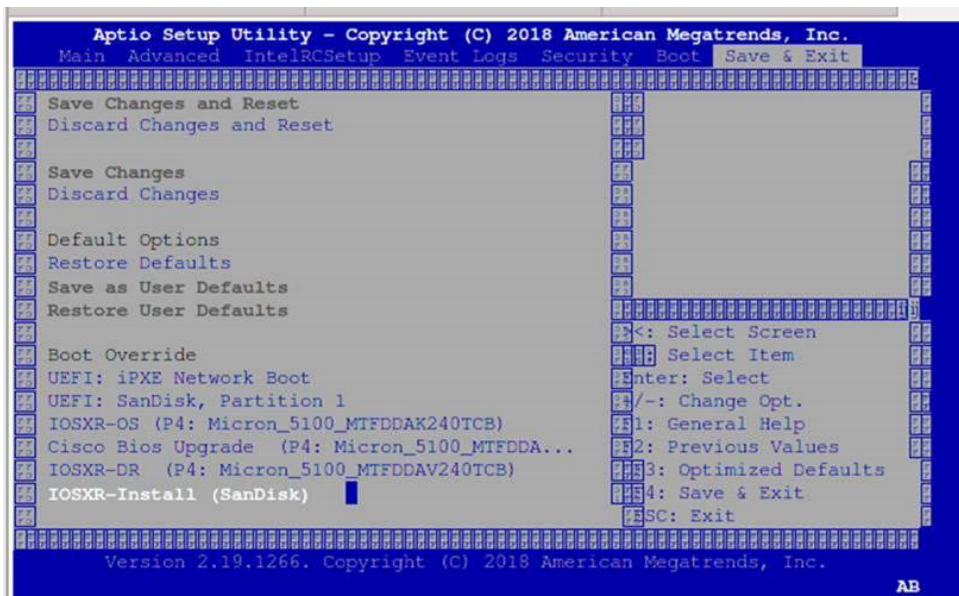
**Step 5** Insert the USB drive in one of the USB ports of NCS 1014.

**Step 6** Reboot NCS 1014 using power cycle or console.

**Note** Use the **reload bootmedia usb noprompt** command to boot the NCS1010 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** Select **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 1014 reboots automatically.

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

---

## 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.

```
RP/0/RP0/CPU0:ios#  
RP/0/RP0/CPU0:ios#reload bootmedia network location all  
Mon Dec 4 09:49:14.220 UTC  
Proceed with reload? [confirm]
```

- Power cycle the NCS 1014 chassis and start the iPXE boot process in the BIOS interface.



**Note** Software installation using iPXE boot with IPv6 is not supported.

---

## 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 when the DHCP server is running:

For example, for ipv4:

- a. Use MAC address of the chassis:

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:xx:xx:xx;
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 1014 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:

```
RP/0/RP0/CPU0:ios#reload bootmedia network location all
Mon Dec  4 09:49:14.220 UTC
Proceed with reload? [confirm]
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]

[ 3490.493853] systemd-shutdown[1]: Could not detach DM /dev/dm-9: Device or resource
busy
[ 3490.601094] systemd-shutdown[1]: Could not detach DM /dev/dm-8: Device or resource
busy
[ 3490.710401] systemd-shutdown[1]: Could not detach DM /dev/dm-7: Device or resource
busy
[ 3490.849417] systemd-shutdown[1]: Failed to finalize DM devices, ignoring
[ 3492.144874] Unsupported TPM Send Cmd! tpm_tag=8001,tpm_ordinal=0145
[ 3492.229149] tpm tpm0: tpm_try_transmit: send(): error -11
[ 3492.307885] reboot: Restarting system

Shelf Assembly Reset

NCS1014, Initializing Devices

Booting from Primary Flash
Aldrin: Programmed MI 4
Continue boot...
Version 2.19.1266. Copyright (C) 2023 American Megatrends, Inc.
BIOS Date: 10/06/2023 16:47:27 Ver: 0ACHI0480
Press <DEL> or <ESC> to enter setup.
TAM: Chip DB Verified

Software Boot OK, Validated

iPXE initialising devices...ok
```

```

iPXE 1.0.0+ (8b3e3) -- Open Source Network Boot Firmware -- http://ipxe.org
Features: DNS HTTP HTTPS TFTP VLAN EFI ISO9660 ISO9660_grub Menu
Trying net0-2051 and net0-2052...
net0-2051: 40:14:82:ba:d1:42 using NII on NII-0000:06:00.0 (open)
[Link:down, TX:0 TXE:0 RX:0 RXE:0]
[Link status: Unknown (http://ipxe.org/1a086194)]

```

- via BIOS interface:

1. Reboot NCS 1014 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:

```

RP/0/RP0/CPU0:ios#reload bootmedia network location all
Mon Dec  4 09:49:14.220 UTC
Proceed with reload? [confirm]
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]

[ 3490.493853] systemd-shutdown[1]: Could not detach DM /dev/dm-9: Device or resource
busy
[ 3490.601094] systemd-shutdown[1]: Could not detach DM /dev/dm-8: Device or resource
busy
[ 3490.710401] systemd-shutdown[1]: Could not detach DM /dev/dm-7: Device or resource
busy
[ 3490.849417] systemd-shutdown[1]: Failed to finalize DM devices, ignoring
[ 3492.144874] Unsupported TPM Send Cmd! tpm_tag=8001,tpm_ordinal=0145
[ 3492.229149] tpm tpm0: tpm_try_transmit: send(): error -11
[ 3492.307885] reboot: Restarting system

Shelf Assembly Reset

NCS1014, Initializing Devices

Booting from Primary Flash
Aldrin: Programmed MI 4
Continue boot...
Version 2.19.1266. Copyright (C) 2023 American Megatrends, Inc.
BIOS Date: 10/06/2023 16:47:27 Ver: 0ACHIO480
Press <DEL> or <ESC> to enter setup.
TAM: Chip DB Verified

Software Boot OK, Validated

iPXE initialising devices...ok

iPXE 1.0.0+ (8b3e3) -- Open Source Network Boot Firmware -- http://ipxe.org
Features: DNS HTTP HTTPS TFTP VLAN EFI ISO9660 ISO9660_grub Menu
Trying net0-2051 and net0-2052...
net0-2051: 40:14:82:ba:d2:6e using NII on NII-0000:06:00.0 (open)
[Link:down, TX:0 TXE:0 RX:0 RXE:0]
[Link status: Unknown (http://ipxe.org/1a086194)]
Configuring (net0-2051 40:14:82:ba:d2:6e)..... ok

```

```

net0: fe80::4214:82ff:feba:d26e/64
net1: fe80::4214:82ff:feba:d271/64 (inaccessible)
net2: fe80::4214:82ff:feba:d272/64 (inaccessible)
net3: fe80::4214:82ff:feba:d273/64 (inaccessible)
net0-2051: 10.105.57.37/255.255.255.128 gw 10.105.57.1
net0-2051: fe80::4214:82ff:feba:d26e/64
net0-2052: fe80::4214:82ff:feba:d26f/64
Filename:
http://10.105.57.29/ncs1010-golden-x86_64-7.11.1.51I-PROD_BUILD_7_11_1_51I_SIT_IMAGE.iso
http://10.105.57.29/ncs1010-golden-x86_64-7.11.1.51I-PROD_BUILD_7_11_1_51I_SIT_IMAGE.iso...
  ok
ncs1010-golden-x86_64-7.11.1.51I-PROD_BUILD_7_11_1_51I_SIT_IMAGE.iso: 1857357824
bytes
Booting /EFI/BOOT/bootx64.efi
Welcome to GRUB!

```

## Bring-Up Line Card

Use the following procedure to bring-up the NCS1014 line cards:

- Step 1** Insert the line card into the slot.
- Step 2** Wait until the line card LED turns Green.
- Step 3** Check the PID is in **OPERATIONAL** status using the **show platform** command.

### Example:

CCMD-16-C and CCM-16-L line cards

```

RP/0/RP0/CPU0:ios#show platform
Fri Sep 22 06:56:28.653 UTC
Node                Type                                State                Config state
-----
0/RP0/CPU0          NCS1K14-CNTRLR-K9 (Active)         IOS XR RUN           NSHUT, NMON
0/PM0               NCS1K4-AC-PSU                       OPERATIONAL          NSHUT, NMON
0/FT0               NCS1K14-FAN                          OPERATIONAL          NSHUT, NMON
0/FT1               NCS1K14-FAN                          OPERATIONAL          NSHUT, NMON
0/FT2               NCS1K14-FAN                          OPERATIONAL          NSHUT, NMON
0/0/NXR0            NCS1K14-CCMD-16-L                   OPERATIONAL          NSHUT, NMON
0/2/NXR0            NCS1K14-CCMD-16-C                   OPERATIONAL          NSHUT, NMON
0/3/NXR0            NCS1K14-CCMD-16-C                   OPERATIONAL          NSHUT, NMON

```

### Example:

2.4T line card

```

RP/0/RP0/CPU0:ios#show platform
Fri Sep 22 06:56:28.653 UTC
Node                Type                                State                Config state
-----
0/RP0/CPU0          NCS1K14-CNTRLR-K9 (Active)         IOS XR RUN           NSHUT, NMON
0/PM0               NCS1K4-AC-PSU                       OPERATIONAL          NSHUT, NMON
0/FT0               NCS1K14-FAN                          OPERATIONAL          NSHUT, NMON
0/FT1               NCS1K14-FAN                          OPERATIONAL          NSHUT, NMON
0/FT2               NCS1K14-FAN                          OPERATIONAL          NSHUT, NMON
0/2/NXR0            NCS1K14-2.4T-K9                     OPERATIONAL          NSHUT, NMON
0/3/NXR0            NCS1K14-BLANK                        PRESENT              NSHUT, NMON

```

### Example:

## 2.4TX line card

RP/0/RP0/CPU0:ios#show platform

Node	Type	State	Config state
0/RP0/CPU0	NCS1K14-CNTLR-K9 (Active)	IOS XR RUN	NSHUT, NMON
0/PM0	NCS1K4-AC-PSU-2	OPERATIONAL	NSHUT, NMON
0/FT0	NCS1K14-FAN	OPERATIONAL	NSHUT, NMON
0/FT1	NCS1K14-FAN	OPERATIONAL	NSHUT, NMON
0/FT2	NCS1K14-FAN	OPERATIONAL	NSHUT, NMON
0/0/NXR0	NCS1K14-2.4T-X-K9	OPERATIONAL	NSHUT, NMON
0/1/NXR0	NCS1K14-2.4T-X-K9	OPERATIONAL	NSHUT, NMON
0/2/NXR0	NCS1K14-2.4T-X-K9	OPERATIONAL	NSHUT, NMON
0/3/NXR0	NCS1K14-2.4T-X-K9	OPERATIONAL	NSHUT, NMON

## Step 4

Check the line card environment parameters using the command **show environment [ power | voltage | current | temperature ] [ location | location ]**.

## Example:

RP/0/RP0/CPU0:ios#show environment power

CHASSIS LEVEL POWER INFO: 0

```

=====
Total output power capacity (Group 0 + Group 1) : 2500W + 0W
Total output power required                   : 1636W
Total power input                             : 637W
Total power output                            : 568W
=====

```

Power Group 0:

Power Module	Supply Type	-----Input----	-----Output---	Status		
		Volts	Amps	Volts	Amps	
0/PM1	NCS1K4-AC-PSU-2	227.5	2.8	12.1	47.0	OK
Total of Group 0:		637W/2.8A		568W/47.0A		

Location	Card Type	Power Allocated Watts	Power Used Watts	Status
0/RP0/CPU0	NCS1K14-CNTLR-K9	73	20	ON
0/FT0	NCS1K14-FAN	170	167	ON
0/FT1	NCS1K14-FAN	170	85	ON
0/FT2	NCS1K14-FAN	170	159	ON
0/0/NXR0	NCS1K14-2.4T-L-K9	460	38	ON
0/2/NXR0	NCS1K14-2.4T-X-K9	410	0	ON
0/3/NXR0	NCS1K14-CCMD-16-C	110	16	ON
0/Rack	NCS1014	73	14	ON

## Note

- When a slot is not in use, we recommend inserting a filler to allow proper airflow across the line cards to maintain an optimal system temperature.
- When a port is not in use, we recommend inserting a clip to maintain an optimal card temperature.
- Ensure to secure the line card in the chassis by tightening the top and bottom screws.

**Step 5** Upgrade the FPDs of the line card depending on the output of **show hw-module location 0/line-card-slot fpd** command.

## Configure NTP Server

### Understand NTP

*Table 1: Feature History*

Feature Name	Release Information	Feature Description
NTP Support	Cisco IOS XR Release 7.11.1	<p>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.</p> <p>Commands added:</p> <ul style="list-style-type: none"> <li>• <b>ntp server</b></li> <li>• <b>show ntp associations</b></li> <li>• <b>show ntp status</b></li> </ul>

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](#)

#### 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](#).

