Bring-up Cisco NCS 1002

After installing the hardware, boot the Cisco NCS 1002 system. You can connect to the XR console port and power on the system. NCS 1002 completes the boot process using the pre-installed operating system (OS) image. If no image is available, NCS 1002 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. From the XR console, access the System Admin console to configure system administration settings.

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 Sequence

The boot sequence in NCS 1002 that you need to follow is:

1. Boot using SSD (hard disk)
2. Boot using USB drive
3. Boot using iPXE

If there is no bootable image in all three boot options, reboot the system.

Boot NCS 1002

Use the console port to connect to NCS 1002. By default, the console port connects to the XR mode. If required, subsequent connections can be established 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, 8 data bits, 1 stop bit and no parity.

Step 3 Power on the NCS 1002.

To turn on the power shelves, press the power switch up. As NCS 1002 boots up, the boot process details are displayed 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 the NCS 1002 more time to complete the initial boot procedure; then press **Enter**.

Important If the boot process fails, it may be because the pre-installed image on the NCS 1002 is corrupt. In this case, the NCS 1002 can be booted using an external bootable USB drive.

Boot NCS 1002 Using USB Drive

The bootable USB drive is used to re-image the NCS 1002 for the purpose of system upgrade or to boot the NCS 1002 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.

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

Before you begin

- You need a USB drive with a storage capacity of at least 4 GB.
- NCS 1002 software image can be downloaded from this location.
- Copy the compressed boot file from the software download page at cisco.com to your local machine. The file name for the compressed boot file is in the format *ncs1k-usb-boot-<release_number>.zip*. For example, *ncs1k-usb-boot-6.3.2.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.

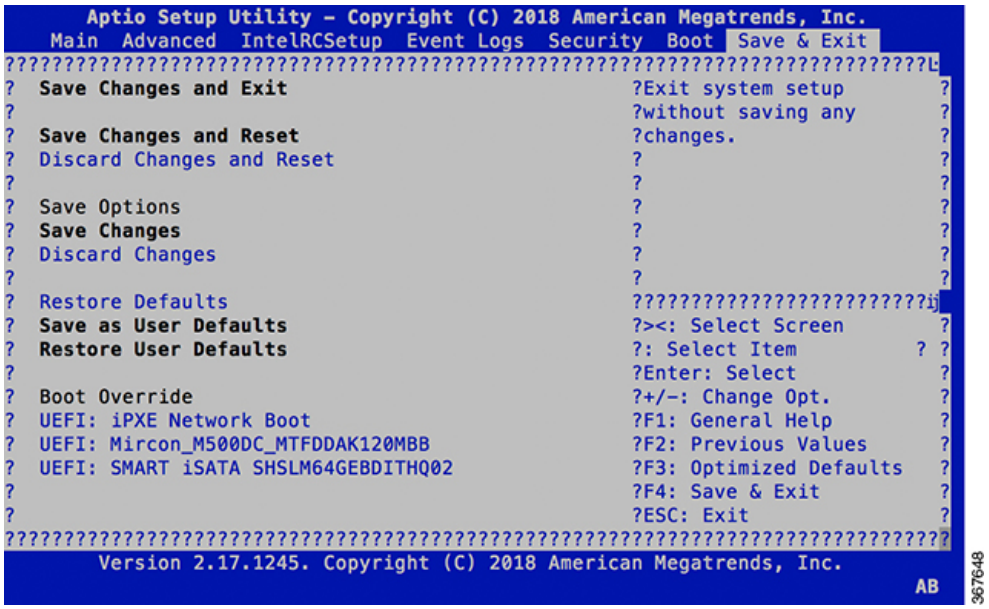
Note The content of the zipped file ("EFI" and "boot" directories) must be extracted directly in the root folder of the USB drive. If the unzipping application places the extracted files in a new folder, move the "EFI" and "boot" directories to the root folder of the USB drive.

Step 5 Insert the USB drive in one of the USB ports of NCS 1002.

Step 6 Reboot NCS 1002 using power cycle or console.

Step 7 Press Esc to enter BIOS.

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



Step 9 Choose **UEFI based USB device**.

The system detects USB and boots the image from USB.

```
Admin Console:
GNU GRUB version 2.00
Press F2 to goto grub Menu..
Booting from USB..
Loading Kernel..

Validating End Entity Certificate...

Validating SubCA Certificate...

Validating Root Certificate...
```

```
Loading initrd..

Validating End Entity Certificate...

Validating SubCA Certificate...

Validating Root Certificate...
CiscoSec: Image signature verification completed.
XR Console:
CiscoSec: Image signature verified.
[    9.957281] i8042: No controller found
Starting udev
udevd[972]: failed to execute '/etc/udev/scripts/network.sh' '/etc/udev/scripts/network.sh':
 No such file or directory
Populating dev cache
Running postinst /etc/rpm-postinsts/100-dnsmasq...
update-rc.d: /etc/init.d/run-postinsts exists during rc.d purge (continuing)
 Removing any system startup links for run-postinsts ...
  /etc/rcS.d/S99run-postinsts
Configuring network interfaces... done.
```

Step 10 Remove the USB drive. The NCS 1002 reboots automatically.

```
Setting maximal mount count to -1
Setting interval between checks to 0 seconds
Fri Dec 11 20:35:56 UTC 2015: Install EFI on /dev/mb_disk4
Fri Dec 11 20:35:57 UTC 2015: Install finished on mb_disk
Rebooting system after installation ...
[  116.973666] reboot: Restarting system

Version 2.17.1245. Copyright (C) 2015 American Megatrends, Inc.
BIOS Date: 11/29/2015 12:02:45 Ver: 0ACBZ1110
Press <DEL> or <ESC> to enter setup.
CiscoSec: Image signature verified.


GNU GRUB version 2.00
Press F2 to goto grub Menu..
Booting from Disk..
Loading Kernel..

Validating End Entity Certificate...

Validating SubCA Certificate...

Validating Root Certificate...
Loading initrd..

Validating End Entity Certificate...

Validating SubCA Certificate...

Validating Root Certificate...
CiscoSec: Image signature verification completed.
Initrd, addr=0xff69a000, size=0x955cb0
[    1.745686] i8042: No controller found
```

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 re-image 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 boot loader 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. iPXE must be defined in the DHCP server configuration file.

Note For IPv6 configuration, see **Step 2** in Setup DHCP Server, on page 5.

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 ncs1001
   {
   hardware ethernet ab:cd:ef:01:23:45;
   fixed-address <ip address>;
   filename "http://<httpserver-address>/<path-to-image>/ncs1001-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;
             if exists user-class and option user-class = "iPXE" {
             filename "http://10.89.205.127/box1/ncs1001-mini-x-7.1.1.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.
- You have logged in to the System Admin console using the **admin** command.

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

```
hw-module location all bootmedia network reload
```

Example:

```
sysadmin-vm:0_RP0# hw-module location all bootmedia network reload
Wed Dec 23 15:29:57.376 UTC
Reload hardware module ? [no,yes]
```

The following example shows the output of the command:

```
iPXE 1.0.0+ (3e573) -- Open Source Network Boot Firmware -- http://ipxe.org
Features: DNS HTTP TFTP VLAN EFI ISO9660 NBI Menu
Trying net0...
net0: c4:72:95:a6:14:e1 using dh8900cc on PCI01:00.1 (open)
[Link:up, TX:0 TXE:0 RX:0 RXE:0]
```

```
Configuring (net0 c4:72:95:a6:14:e1)................... Ok << Talking to DHCP/PXE server to
 obtain network information
net0: 10.37.1.101/255.255.0.0 gw 10.37.1.0
net0: fe80::c672:95ff:fea6:14e1/64
net0: 2001:1800:5000:1:c672:95ff:fea6:14e1/64 gw fe80::20c:29ff:fefb:b9fe
net1: fe80::c672:95ff:fea6:14e3/64 (inaccessible)
Next server: 10.37.1.235
Filename: http://10.37.1.235/ncs1001/ncs1001-mini-x.iso
http://10.37.1.235/ ... 58% << Downloading file as indicated by DHCP/PXE server to boot
install image
```

Boot Using ZTP

Zero Touch Provisioning (ZTP) is used to deploy minimal configurations on several chassis. ZTP is used to boot, set up, and configure the system. Configurations such as configuring the management ethernet interface, installing SMUs, applications, and optional packages can be automated using ZTP. ZTP does not execute if a user name is already configured in the system.

ZTP auto provisioning involves:

- **Configuration:** Downloads and executes the configuration files. The first line of the file must contain `!! IOS XR` for ZTP to process the file as a configuration.
- **Script:** 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 a script.

The user can either use the ZTP bash script or the ZTP configuration file.

```
host n1k {
  #hardware ethernet 00:a0:c9:00:00:00;
  option dhcp-client-identifier "<chassis-serial-number>";
     filename "http://<IP-address>/<folder>/ncs1k-ztp.script";
     #filename "http://<IP-address>/<folder>/ncs1k-ztp.cfg";
  }
```

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

```
#! /bin/bash
#
# NCS1K 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. The user can automate all the configurations such as configuring the management ethernet interface, slice provisioning, and so on.

```
!! IOS XR Configuration version = 6.3.2
!
telnet vrf default ipv4 server max-servers 20
!
```

```
vty-pool default 0 20 line-template default
!
interface MgmtEth0/RP0/CPU0/0
 ipv4 address dhcp
 no shutdown
!
router static
 address-family ipv4 unicast
  0.0.0.0/0 10.77.132.1
!
end
```

Boot NCS 1002 Using Golden ISO

Golden ISO is a feature provided to user for building customized ISO using mini ISO, required SMUs and IOS-XR configuration.

Before the introduction of Golden ISO feature, the user must perform the following three steps, to install a new image.

Step 1 : Boot the system with mini ISO. This can be done using iPXE or USB boot.

Step 2 : Install, add, and activate all the relevant SMUs/optional packages on to NCS 1002. NCS 1002 reloads on reload of any SMUs.

Step 3 : Apply IOS-XR configuration.

Benefits of Golden ISO

- Saves installation effort and time.
- System gets ready in a single command and single boot.

Golden ISO is built using ‘gisobuild.py’script, which is available at /pkg/bin/gisobuild.py location.

Limitations

- install operation over IPv6 is not supported.

Build Golden ISO

The following command is used to build Golden ISO:

```
/pkg/bin/gisobuild.py -i./ncs1k-mini-x.iso -r ./rpm_directory -c ./xr_config -1 V1
```

ncs1k-mini-x.iso - mini ISO of NCS 1002.

rpm_directory - Directory where SMUs (xr, calvados and host) are copied.

xr_config - IOS-XR configuration to be applied to system after booting.

V1 - Label of Golden ISO.

Note Golden ISO needs 6 GB free space to work. If 6 GB free space is not available, user gets the following error message.

```
"[xr-vm_node0_RP0_CPU0:/pkg/bin]$gisobuild.py -i/harddisk:/ncs1k-mini-x-6.5.2.26I.iso
-r/misc/disk1/ -1v2
Minimum 6 GB of free disk space is required for building Golden ISO.
Error: 2.35736465454 GB free disk space available in /pkg/bin"
```

The user must run the script under XR run prompt as follows:

[xr-vm_node0_RP0_CPU0:~]$

[xr-vm_node0_RP0_CPU0:~]$cd /run/

[xr-vm_node0_RP0_CPU0:/run]$gisobuild.py -i /harddisk:/ncs1k-mini-x-6.5.2.26I.iso -r /misc/disk1/ -l v2

System requirements check [PASS]

Golden ISO build process starting...

Platform: ncs1k Version: 6.5.2.26I

Scanning repository [/misc/disk1]...

Building RPM Database...

Total 1 RPM(s) present in the repository path provided in CLI

[1] ncs1k-k9sec-4.1.0.0-r65226I.x86_64.rpm

Following XR x86_64 rpm(s) will be used for building Golden ISO:

(+) ncs1k-k9sec-4.1.0.0-r65226I.x86_64.rpm

...RPM compatibility check [PASS]

Building Golden ISO...

Summary .....

XR rpms:

ncs1k-k9sec-4.1.0.0-r65226I.x86_64.rpm

...Golden ISO creation SUCCESS.

Golden ISO file is created in the following format:

platform-name-golden-x.iso-*version.label* (does not contain security(*k9sec*.rpm) rpm)

Example: ncs1k-golden-x-7.0.1.14I-V1.iso

platform-name-goldenk9-x.iso-*version.label* (contains security(*k9sec*.rpm) rpm)

Example: ncs1k-goldenk9-x-7.0.1.14I-V1.iso

Note Once the GISO file is created, please move the GISO file from the \run folder to the harddisk folder.

Boot NCS 1002 using the following procedure:

Step 1 : Install add source /harddisk:/ <space> ncs1k-goldenk9-x-7.0.1.126I-V2.iso

Install operation 1 started by root:

Install operation 1 finished successfully.

Here ID is 1.

Step 2 : Install activate id 1.

Step 3 : Install commit.

Verify Boot Operation

Procedure

Step 1 After the boot operation, reload the NCS 1002.

Step 2 **show version**

Example:

```
RP/0/RP0/CPU0:ios# show version
Wed Aug  8 16:10:20.694 IST
Cisco IOS XR Software, Version 6.5.1
Copyright (c) 2013-2018 by Cisco Systems, Inc.

Build Information:
Built By     : ahoang
Built On     : Mon Aug  6 14:00:31 PDT 2018
Built Host   : iox-ucs-023
Workspace    : /auto/srcarchive17/prod/6.5.1/ncs1k/ws
Version      : 6.5.1
Location     : /opt/cisco/XR/packages/

cisco NCS-1002 () processor
System uptime is 1 day 5 hours 15 minutes
```

Compare the displayed version with the boot image version. The versions need to be the same.

Access the System Admin Console

All system administration and hardware management setups are performed from the System Admin console.

Procedure

Step 1 Login to the XR console as the root user.

Step 2 **admin**

Example:

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

```
Wed Jul 29 18:05:14.280 UTC

root connected from 127.0.0.1 using console on xr-vm_node0_RP1_CPU0
sysadmin-vm:0_RP0#
```

After you enter the System Admin console, the prompt changes to:

```
sysadmin-vm:0_RP0#
```

Step 3 (Optional) **exit**

Example:

```
sysadmin-vm:0_RP0# exit


Wed Jul  29 18:05:15.994 UTC
RP/0/RP0/CPU0:ios#
```

Return to the XR CLI from the System Admin CLI.

Configure Management Interface

To use the management interface for system management and remote communication, you must configure an IP address and subnet mask for the management ethernet interface. To communicate with devices on other networks (such as remote management stations or TFTP servers), you need to configure a default (static) route for the NCS 1002.

The range of supported MTU of management plane is 64 to 1514 bytes.

Before you begin

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

Procedure

Step 1 **configure**

Example:

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

Enters 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 interface.

Step 4 **no shutdown**

Example:

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

Places the 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** *0.0.0.0/0default-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 is to be used for communications 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

Configure Telnet, on page 12 and Configure SSH, on page 13.

Configure Telnet

With a terminal emulation program, establish a telnet session to the management interface port using its IP address.

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 Telnet servers are allowed. By default, no Telnet servers are 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.

What to do next

Configure SSH, on page 13

Configure SSH

With a terminal emulation program, establish a SSH connection to the management interface port using its IP address.

Before you begin

- Install the ncs1k-k9sec package on the NCS 1002. For details about package installation, see Install Packages.
- 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 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.

Step 4 **show ssh session details**

Example:

```
RP/0/RP0/CPU0:ios# show ssh session details
```

Displays a detailed report of the SSHv2 connections to and from NCS 1002.

What to do next

Perform Clock Synchronization with NTP Server, on page 14

Perform Clock Synchronization with NTP Server

There are independent system clocks for the XR and the System Admin. To ensure that these clocks do not deviate from true time, they need to be synchronized with the clock of a NTP server. In this task you will configure a NTP server for the XR. After the XR clock is synchronized, the System Admin clock automatically synchronizes with the XR clock.

Before you begin

Configure and connect to the management port.

Procedure

Step 1 **configure**

Example:

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

Enters XR Configuration mode.

Step 2 **ntp server** *server_address*

Example:

```
RP/0/RP0/CPU0:ios# ntp server 64.90.182.55
```

The XR clock is configured to be synchronized with the specified sever.