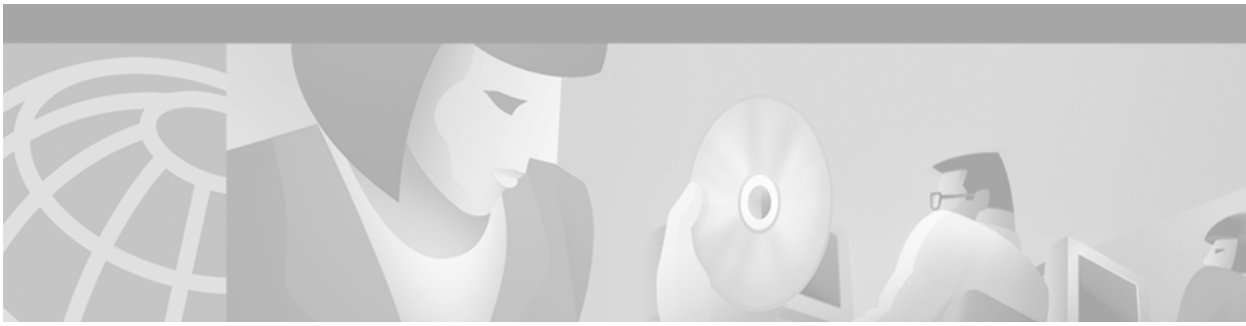

# NRP-2

This feature module describes the first release of Cisco 6400 NRP-2 and includes the following sections:



## NRP-2 Overview

The node route processor 2 (NRP-2) for the Cisco 6400 platform allows aggregation and termination of large numbers of broadband subscribers while supporting Layer 3 and integrated high-touch services such as authentication, policy routing, and Network Address Translation (NAT). The Cisco 6400 receives subscribers over OC-3, OC-12, or DS-3 interfaces on node line cards (NLCs). The node switch processor (NSP) switches incoming virtual circuits (VCs) or virtual paths (VPs) to the appropriate NRP-2. The NRP-2 aggregates and terminates the incoming virtual circuits (VCs), offering extended services based on user and service profiles through the Service Selection Gateway (SSG).

# Benefits

### Increased Session Scalability

The NRP-2 increases the session capacity of the Cisco 6400, providing a dramatic reduction in cost per subscriber. See the release notes for the number of sessions supported by your software release.

### Increased Bandwidth

The NRP-2 supports a 622-Mbps ATM interface to the backplane and a Gigabit Ethernet (GE) packet interface on the faceplate.

**Note** The GE interface is not supported in Cisco IOS Release 12.1(4)DC.

### Dual Processors

The NRP-2 hardware includes two processor subsystems. In Cisco IOS Release 12.1(4)DC, only one of the processors is used. In later software releases, the second processor will be used to provide increased session scalability.

### Integrated System Management

Configuration storage, console traffic, and network management traffic are now controlled by the existing NSP, providing a more manageable and integrated platform. You can use a single console port on the NSP to access the console lines of all NRP-2s in the Cisco 6400 chassis, and use a single management Ethernet interface on the NSP to monitor all NRP-2s in the system.

### Modular Design

The modular nature of the NRP-2 allows you to upgrade as your subscriber base grows. As the demand for services rises, you can add NRP-2 modules to the Cisco 6400 to provide increased session and bandwidth support.

### Backward Compatibility

The NRP-2 can be deployed in a Cisco 6400 chassis with existing modules, including the node route processor 1 (NRP-1). This enables you to increase your network capacity without replacing the chassis.

**Note** In redundant configurations, NRPs must be paired with NRPs of the same type (NRP-1 with NRP-1, NRP-2 with NRP-2).

**Note** As of Cisco IOS Release 12.1(4)DC, the NRP-2 does not support EHSA redundancy. For later software releases, check the release notes for possible redundancy support and related caveats.

# Differences Between the NRP-1 and NRP-2

Table 1 shows the major differences between the NRP-1 and NRP-2.

***Table 1 Differences Between NRP-1 and NRP-2***

| | NRP-1 | NRP-2 |
|---|---|---|
| Session scalability | Hardware supports as many as 2000 sessions per NRP-1. | Hardware supports as many as 16,000 sessions per NRP-2. |
| Physical interfaces | Faceplate interfaces:<br>• Console port<br>• Auxiliary port<br>• Ethernet port<br>• FastEthernet port<br>Backplane interfaces:<br>• 155 Mbps ATM interface<br>• Backplane Ethernet (BPE) | Faceplate interfaces:<br>• Gigabit Ethernet interface<br>Backplane interfaces:<br>• 622 Mbps ATM interface<br>• PAM mailbox serial interface[1] |
| Location of software images, configurations, and crash information | NRP-1 memory (built-in or internal Flash) | PCMCIA[2] disk on NSP. |
| Message logging | Messages are logged on the NRP-1 as a local message. | NRP-2 messages are logged on both the NSP and NRP-2. NRP-2 messages on the NSP include the NRP-2 slot number. |
| Console line access | Direct external connection to NRP-1 console port or auxiliary port | Indirect external connection via the NSP. NSP contains a virtual communication server to access the NRP-2 console. |
| ROMMON[3] | ROMMON not upgradable;<br>NRP-1 ROM state information stored locally on NRP-1 | ROMMON is upgradable;<br>NRP-2 ROM state information is stored on the NSP PCMCIA disk. |
| SNMP[4] | Standard SNMP services | Standard SNMP services, or can use the NSP as the proxy forwarder. |
| LED display[5] | None | On faceplate. |

1. The PAM mailbox serial interface is used for internal system communication. Do not attempt to configure serial interfaces on the Cisco 6400.
2. PCMCIA = Personal Computer Memory Card International Association
3. ROMMON = ROM Monitor
4. SNMP = Simple Network Management Protocol
5. The LED display on the NRP-2 does not provide any information in Cisco IOS Release 12.1(4)DC.

## NRP-2 Physical Interfaces

| NRP-2 Physical Interfaces | Appears in NRP-2 Configuration | Appears in NSP Configuration |
|---|---|---|
| 622-Mbps ATM interface to backplane | `interface ATM 0/0/0` | `interface ATM` *`slot`*`/0/0` |
| PAM mailbox serial interface[1] to backplane | `interface Serial 0/0/0` | `interface Serial` *`slot`*`/0/0` |
| Gigabit Ethernet interface on faceplate | `interface GigabitEthernet 0/0/0` | — |

1. The PAM mailbox serial interface is used for internal system communication. Do not attempt to configure any serial interfaces on the Cisco 6400.

**Note** The GE interface is not supported in Cisco IOS Release 12.1(4)DC.

## Management Through the NSP

The NRP-2 is designed for tighter integration with the node switch processor (NSP) of the Cisco 6400. The NSP provides the following functions for the NRP-2:

- Image and File Storage
- System Logging
- Console and Telnet Access
- SNMPv3 Proxy Forwarder

### Image and File Storage

The NRP-2 has no local image or file storage. The NSP stores the following NRP-2 files on the PCMCIA disk:

- NRP-2 images
- NRP-2 system configuration files
- NRP-2 ROM state information
- Crash information

**Note** The PCMCIA disk must be in NSP disk slot 0.

Whenever the NSP reloads, the NSP checks for the following directories on the PCMCIA disk. The NSP automatically creates any missing directories upon reload or PCMCIA disk insertion:

- images—one directory for storing NRP-2 images.
- slot1, slot2,..., slot8—eight directories for storing files for specific NRP-2 slots. Each slot directory contains:
  - Startup configuration file (nrp2-startup-config)
  - ROMMON variables (nrp2_rommon_nv.0)
  - Private network configuration (nrp2-private-config)
  - Crash information (crashinfo_*yyyymmdd-hhmmss*)

**Note** Do not remove the image and slot directories. Also, make sure that you understand the consequences before you delete any files in these directories.

You can create additional directories on the PCMCIA disk with the **mkdir** command. See "Cisco IOS File Management" in the *Cisco IOS Configuration Fundamentals Configuration Guide* for details.

### System Logging

By default, each system log message created by the NRP-2 appears on the NSP as a local message, and the message is labeled with the slot number of the NRP-2 that created the message. Each system log message also appears on the NRP-2 console.

For more information on using system logging, see the "Using Console and System Logging (Optional)" section on page 20.

### Console and Telnet Access

The NSP has been equipped with an internal communication server to access the NRP-2 console line. The NSP also has alias commands for telnetting to the NRP-2. For more information, see the "Methods Available for Accessing the NRP-2" section on page 9.

### SNMPv3 Proxy Forwarder

The NSP and NRP-2 support SNMPv1, SNMPv2c and SNMPv3. The NSP uses the SNMPv3 Proxy Forwarder feature to:

- Route the SNMPv3 messages destined for NRP-2
- Forward NRP-2 traps to the Network Element Manager

For general information on using SNMP, see "Configuring Simple Network Management Protocol (SNMP)" in the *Cisco IOS Configuration Fundamentals Configuration Guide*. For information on the Proxy Forwarder feature, see the "Using the NSP as the SNMPv3 Proxy Forwarder (Optional)" section on page 14.

# Restrictions and Limitations

For a complete list of restrictions and limitations, see the release notes for the software version running on your NRP-2. The release notes also include a list of hardware and software feature differences between the NRP-1 and NRP-2.

This section describes the following limitations:

- Maximum Transmission Unit
- VPI and VCI Limitations

## Maximum Transmission Unit

The maximum transmission unit (MTU) of the NRP-2 ATM interface to the backplane is 1900 bytes. Any incoming packet larger than 1900 bytes is dropped by the NRP-2. To make sure that no incoming packets are larger than the NRP-2 MTU, see the "Matching the MTU Size of the NRP-2 and Its Network Neighbors (Optional)" section on page 12.

### VPI and VCI Limitations

VPI and VCI values on the NRP-2 must share 14 bits. By default, VPI values are limited to 4 bits (0-15), and VCI values are limited to 10 bits (0-1023). You can change the VPI and VCI ranges, but together the VPI and VCI values cannot exceed 14 bits. To change the allowed VPI and VCI values, see the "Modifying VPI and VCI Ranges (Optional)" section on page 18.

## Related Documents

- *Cisco 6400 Software Configuration Guide and Command Reference*

# Supported Platforms

NRP-2 is supported on the Cisco 6400.

# Supported Standards, MIBs, and RFCs

#### Standards

None

#### MIBs

- CISCO-6400-CHASSIS-MIB
- CISCO-RHINO-MIB

For lists of MIBs supported by the Cisco 6400, see *MIBs Supported by the Cisco 6400*. To download MIB modules, go to the Cisco MIB web site on Cisco Connection Online (CCO) at http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

#### RFCs

None

# Prerequisites

- A PCMCIA disk must be in NSP disk slot 0. If using redundant NSPs, make sure that the secondary NSP also has a PCMCIA disk in disk slot 0.
- Use the same system image versions for the DC image on the NRP and the DB image on the NSP.
- Copy the NRP-2 image to the local network or to the PCMCIA disk in NSP disk slot 0.

# Configuration Tasks

See the following sections for NRP-2 configuration tasks. Each task in the list indicates if it is optional or required:



## Configuring the NSP to Support the NRP-2 (Required)

See the following sections for NSP configuration tasks for supporting NRP-2. Each task in the list indicates if the task is optional or required:

- Configuring NRP-2 Image Management on the NSP (Required)
- Changing the NRP-2 Configuration Register Setting (Optional)

### Configuring NRP-2 Image Management on the NSP (Required)

The NSP controls and manages the NRP-2 image download process. Cisco recommends that you store all NRP-2 images on the NSP PCMCIA disk, but you can also store NRP-2 images on a TFTP, FTP, or rcp server.

For each NRP-2 in your Cisco 6400 system, enter the following command on the NSP in global configuration mode:

| Command | Purpose |
|---|---|
| `Switch(config)# hw-module slot slot image image priority priority` | Assigns an image filename and path to the specified NRP-2 processor in the selected slot. Priority range is from 1 (highest) to 4 (lowest). |

Without the **hw-module (image)** command in the NSP configuration, the NRP-2 attempts to load the default image (c6400r2sp-g4p5-mz) from the disk0:/images/ directory.

**Timesaver** If you do not use all the priority values for NRP-2 images, leave priority 1 free for new or temporary images. Otherwise, you will have to adjust the priority levels of the other images for your NRP-2 to accommodate the new image.

### Example

In the following example, the NRP-2 in slot 2 of the Cisco 6400 chassis has three images assigned with different priorities, while the NRP-2 in slot 3 has only one image assigned:

```
hw-module slot 2 image c6400r2sp-g4p5-mz.DC priority 2
hw-module slot 2 image tftp://10.1.1.1/c6400r2sp-g4p5-mz.DC priority 3
hw-module slot 2 image disk0:MyDir/c6400r2sp-g4p5-mz.DC priority 4
hw-module slot 3 image c6400r2sp-g4p5-mz.DC priority 2
```

## Changing the NRP-2 Configuration Register Setting (Optional)

The configuration register defaults to the correct setting for normal operation. You should not change this setting unless you want to enable the break sequence or switch ROMMON devices.

To change the NRP-2 configuration register setting, enter the following command in global configuration mode:

| Command | Purpose |
|---|---|
| `Switch(config)# hw-module slot` *slot* `config-register` *value*[1] | Changes the configuration register setting of the NRP-2 in the specified slot. |

1. For specific configuration register values, see the command reference for hw-module, page 39.

### Example

In the following example, an NRP-2 in slot 3 is set to boot to ROMMON, where ROMMON runs from the image found in BootFROM1. If you enter the **boot** ROMMON command, the NRP-2 loads the specified image from the disk0:/images/ directory.

```
hw-module slot 3 config-register 0x2100
hw-module slot 3 image c6400r2sp-g4p5-mz.DC priority 2
```

# Reloading the NRP-2 (Optional)

Use one of the following commands to reload the NRP-2:

| Command | Entered On | Purpose |
|---|---|---|
| `Switch# hw-module slot` *slot* `reset` | NSP | Simulates removal and insertion of the NRP-2 in the selected slot. The NRP-2 reloads. |
| `Router# reload` | NRP-2 | Reloads the NRP-2. |

**Note** While booting the NRP-2, do not attempt to remove or format the PCMCIA disk in Slot 0 of the NSP. Also, do not remove files or directories on the NSP PCMCIA disk while booting the NRP-2.

# Transferring an NRP-1 Configuration to an NRP-2 (Optional)

This section describes how to properly transfer an existing NRP-1 configuration to an NRP-2. Complete the following steps:

**Step 1** Copy the existing NRP-1 configuration to a location where you can edit the file:

```
Router# copy flash:my.cfg tftp://10.1.1.1/my.cfg
```

**Step 2** Edit the configuration file so that all VPI and VCI values are accepted by the NRP-2 default ranges (VPI range is 0-15, and VCI range is 0-1023).

**Step 3** Remove the NRP-1 from the Cisco 6400 chassis, and replace it with the NRP-2.

**Step 4** From the NSP, clear the alarm for the slot disturbed in Step 3:

```
Switch# clear facility-alarm cardtype 4
```

**Step 5** From the NSP, copy the configuration to the appropriate slot directory in the PCMCIA disk in NSP disk slot 0. Make sure that the filename is "nrp2-startup-config."

```
Switch# copy tftp://10.1.1.1/my.cfg disk0:/slot4/nrp2-startup-config
```

**Step 6** From the NSP, reload the NRP-2:

```
Switch# hw-module slot 4 reset
```

# Configuring the NRP-2 (Required)

Once you access the NRP-2 command line interface, you can configure the NRP-2 exactly as you would configure an NRP-1. See the following section, "Methods Available for Accessing the NRP-2," to access the NRP-2 command line interface.

**Note** For a complete list of hardware and software feature differences between the NRP-1 and NRP-2, see the release notes for the software version running on your NRP-2.

## Methods Available for Accessing the NRP-2

There are two methods available for accessing the NRP-2:

- Accessing the NRP-2 Console Through the NSP
- Telnetting to the NRP-2 from the NSP

### Accessing the NRP-2 Console Through the NSP

The NSP is equipped with an internal communication server for accessing the NRP-2 console line. To access the NRP-2 console line, telnet to the NSP as a communication server, using the port numbers shown in Table 2 to select the NRP-2.

*Table 2 Internal NSP Communication Server Port-Slot Associations*

| NSP Communication Server Port Numbers | Associated Cisco 6400 Chassis Slot |
|---|---|
| 2001, 4001, 6001 | Slot 1 |
| 2002, 4002, 6002 | Slot 2 |
| 2003, 4003, 6003 | Slot 3 |
| 2004, 4004, 6004 | Slot 4 |
| 2005, 4005, 6005 | Slot 5 |
| 2006, 4006, 6006 | Slot 6 |
| 2007, 4007, 6007 | Slot 7 |
| 2008, 4008, 6008 | Slot 8 |

To exit the NRP-2 console line without closing the console connection, use the escape sequence **Ctrl-Shift-6.** To close the NRP-2 console line connection, use the **exit** command.

### Example

Suppose the NSP in your Cisco 6400 system has the management IP address 10.1.5.4. To access the console line of the NRP-2 in Slot 6 of the same Cisco 6400 chassis, use the **telnet** command:

```
device# telnet 10.1.5.4 2006
Trying 10.1.5.4, 2006 ... Open

NRP-2#
```

To return to the device prompt without closing the NRP-2 console line connection, enter the escape sequence **Ctrl-Shift-6** at the NRP-2 prompt. Notice that the escape sequence does not appear as you enter it in the command-line interface (CLI):

```
NRP-2# Ctrl^
device#
```

To return to the connected NRP-2 console line, enter a blank line at the device prompt:

```
device#
[Resuming connection 1 to 10.1.5.4 ... ]

NRP-2#
```

To close the NRP-2 console line connection, use the escape sequence to return to the device prompt, and then use the **exit** command.

```
NRP-2# Ctrl^
device# exit
  (You have open connections) [confirm]
Closing:10.1.5.4 !



device con0 is now available




Press RETURN to get started.




device>
```

### Telnetting to the NRP-2 from the NSP

The NSP is equipped with command aliases for telnetting to the NRP-2s in the same Cisco 6400 chassis. To telnet to the NRP-2, use the following NSP command alias in EXEC mode:

| Command | Purpose |
|---|---|
| Switch# **nrps***slot* | Telnets to the NRP-2 in the specified slot. |

**Note** You need to set the VTY line password before you can telnet to the NRP-2.

To exit the NRP-2 VTY line without closing the Telnet session, use the escape sequence **Ctrl-Shift-6**. To close the NRP-2 Telnet session, use the **exit** command.

#### Example

Suppose you want to telnet to the NRP-2 from a device outside your Cisco 6400 system, and the NSP in the Cisco 6400 has the management IP address 10.1.5.4.

To telnet to the NRP-2, telnet first to the NSP, and then use the **nrps** command alias to telnet to the NRP-2:

```
device# telnet 10.1.5.4
Trying 10.1.5.4 ... Open


User Access Verification

Password:
NSP>
NSP> nrps6
Trying 10.6.0.2 ... Open

NRP-2>
```

To exit the NRP-2 prompt without closing the NRP-2 Telnet session, use escape sequence **Ctrl-Shift-6** at the NRP-2 prompt. Notice that the escape sequence does not appear as you enter it in the command-line interface (CLI):

```
NRP-2> Ctrl^
device#
```

The escape sequence returns the prompt to the original Telnet device, instead of the NSP. To return to the NRP-2 Telnet session, enter a blank line at the device prompt:

```
device#
[Resuming connection 1 to 10.1.5.4 ... ]

NRP-2>
```

To close the Telnet session to the NRP-2 and return to the NSP prompt, use the **exit** command.

```
NRP-2> exit

[Connection to 10.6.0.2 closed by foreign host]
NSP>
```

# Matching the MTU Size of the NRP-2 and Its Network Neighbors (Optional)

The NRP-2 ATM interface to the backplane supports a maximum packet size, or maximum transmission unit (MTU), of 1900 bytes. The ATM interface drops any incoming packet larger than 1900 bytes. To prevent packets from being dropped, make sure that the MTU sizes match for both ends of VCs.

## Displaying the MTU for the Main ATM Interface

To check the current MTU size on the NRP-2 ATM main interface, use the **show interface atm 0/0/0** EXEC command, which displays the following fields:

- "MTU"—largest MTU setting among all subinterfaces and the main ATM interface
- "sub MTU"—MTU setting on the main ATM interface

### Example—Main ATM Interface

```
NRP-2# show interface atm 0/0/0
...
→   MTU 1870 bytes, sub MTU 1850, BW 599040 Kbit, DLY 60 usec,
...
```

## Displaying the MTU for a Subinterface

To display the current MTU size on the NRP-2 ATM subinterface, use the **show interface atm 0/0/0.***subinterface* EXEC command. This command displays only one "MTU" field that represents the MTU setting for the subinterface.

### Example—ATM Subinterface

```
NRP-2# show interface atm 0/0/0.100
...
→   MTU 1870 bytes, BW 599040 Kbit, DLY 60 usec,
...
```

## Displaying the MTU for a Network Neighbor

To check the current MTU size on the network neighbor, use the **show interface atm** EXEC command for the interface used to terminate the VC from the NRP-2.

#### Example—Cisco 7200

```
7200# show interface atm 1/0
ATM1/0 is up, line protocol is up
  Hardware is ENHANCED ATM PA
➔   MTU 4470 bytes, sub MTU 4470, BW 149760 Kbit, DLY 80 usec,
...
```

#### Example—Cisco 6400 NRP-1

```
NRP-1# show interface atm 0/0/0
ATM0/0/0 is up, line protocol is up
  Hardware is ATM-SAR
➔   MTU 4470 bytes, sub MTU 4470, BW 156250 Kbit, DLY 80 usec,
...
```

## Changing the MTU on the NRP-2

To adjust the MTU size on the NRP-2, complete the following steps beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# interface atm 0/0/0` | Selects the ATM interface on the NRP-2. |
| **Step 2** | `Router(config-if)# mtu` *bytes* | Specifies the maximum packet size, in bytes, for the interface. Maximum value is 1900. |

## Changing the MTU on a Network Neighbor

To adjust the MTU size on the network neighbor, complete the following steps beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# interface atm` *slot*`/`*subslot*`/`*port* `[.`*subinterface* `[point-to-point \| multipoint]]` | Selects the interface used to terminate the VC from the NRP-2. |
| **Step 2** | `Router(config-if)# mtu` *bytes* | Specifies the maximum packet size, in bytes, for the interface. If the interface is used to terminate PVCs from the NRP-2, do not exceed 1900. |

#### Example

Suppose that the **show interface atm 0/0/0** EXEC command displayed the MTU size of 1900 bytes on the NRP-2, and the MTU size of 4470 bytes on a neighboring NRP-1.

```
NRP-2# show interface atm 0/0/0
ATM0/0/0 is up, line protocol is up
  Hardware is NRP2 ATM SAR
➔   MTU 1900 bytes, sub MTU 1900, BW 599040 Kbit, DLY 60 usec,
...
```

```
NRP-1-neighbor# show interface atm 0/0/0
ATM0/0/0 is up, line protocol is up
  Hardware is ATM-SAR
→   MTU 4470 bytes, sub MTU 4470, BW 156250 Kbit, DLY 80 usec,
...
```

In the following example, the network neighbor MTU size is reduced to 1900 to match the MTU size of the NRP-2.

```
!
interface ATM0/0/0
→ mtu 1900
 no ip address
 atm vc-per-vp 2048
 no atm ilmi-keepalive
!
```

## Verifying the MTU Size of the NRP-2 and Its Network Neighbors

To verify that the MTU size matches for the NRP-2 and its network neighbors, complete the following steps for each network neighbor:

**Step 1** Use the **show interface atm 0/0/0**[**.***subinterface*] EXEC command on the NRP-2 to view the NRP-2 MTU size.

**Step 2** Use the **show interface** EXEC command on the network neighbor to view the neighbor's MTU size.

**Step 3** Make sure that the MTU sizes for the NRP-2 and the network neighbor are identical.

# Using the NSP as the SNMPv3 Proxy Forwarder (Optional)

The SNMPv3 Proxy Forwarder feature enables all NSP and NRP-2 components of the Cisco 6400 system to be managed as one functional entity. With the Proxy Forwarder feature enabled, the NSP:

- Forwards all SNMPv3 formatted messages (such as manager requests to get or set data) destined for the NRP-2s
- Routes the SNMPv3 formatted traps from NRP-2s to the NSP combined Network Management Ethernet (NME) interface

To configure the Proxy Forwarder feature, complete the following tasks:

- Task 1: Configuring the NSP as the Proxy Forwarder
- Task 2: Configuring the NRP-2 to Use the NSP as the Proxy Forwarder

## Task 1: Configuring the NSP as the Proxy Forwarder

To enable the NSP to act as the proxy forwarder for the NRP-2s in the Cisco 6400 chassis, enter the following NSP commands, beginning in global configuration mode:

| | Command (Entered on the NSP) | Purpose |
|---|---|---|
| **Step 1** | `Switch(config)# snmp-server group groupname v3 noauth` | Configures a new SNMPv3 group. |
| **Step 2** | `Switch(config)# snmp-server user username groupname v3` | Configures a new user to an SNMPv3 group. Make sure that you use the same *groupname* in Steps 1 and 2. |
| **Step 3** | `Switch(config)# snmp-server forwarder` | Enables the NSP SNMPv3 proxy forwarder. |
| **Step 4** | `Switch(config)# snmp-server host host-address vrf 6400-private version 3 noauth username` | Specifies the recipient of NRP-2 SNMPv3 trap messages. |

When you complete the previous steps, the NSP automatically generates **snmp-server user** and **snmp-server group** commands in the configuration.

Each time the NSP reloads or you insert an NRP-2 into the chassis, the NSP automatically generates **snmp-server engineID** commands in the configuration.

**Note** Do not modify or delete the automatically generated commands, because doing so may prevent SNMP from working properly.

### Example

In the following example, the NSP is configured to act as the proxy forwarder:

```
snmp-server group usmgrp v3 noauth
snmp-server user usmusr usmgrp v3
snmp-server forwarder
snmp-server host 10.100.100.100 vrf 6400-private version 3 noauth trapusr
```

The previous commands cause the NSP to automatically generate the following commands:

```
snmp-server engineID remote 10.3.0.2 vrf 6400-private 80000009030000107BA9C7A0
snmp-server user trapusr trapusr v3
snmp-server user trapusr trapusr remote 10.3.0.2 vrf 6400-private v3
snmp-server user usmusr usmgrp remote 10.3.0.2 vrf 6400-private v3
snmp-server group trapusr v3 noauth notify *tv.FFFFFFFF.FFFFFFFF
```

## Task 2: Configuring the NRP-2 to Use the NSP as the Proxy Forwarder

To configure the NRP-2 to communicate with the NSP as the proxy forwarder, complete the following steps beginning in global configuration mode:

| | Command (Entered on the NRP-2) | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# snmp-server group` *groupname* `v3 noauth` | Configures a new SNMPv3 group. Make sure that the *groupname* argument entry matches that entered on the NSP in Task 1. |
| **Step 2** | `Router(config)# snmp-server user` *username groupname* `v3` | Configures a new user to an SNMPv3 group. Make sure that the *username* and *groupname* argument entries match those entered on the NSP in Task 1. |
| **Step 3** | `Router(config)# snmp-server enable traps [config \| syslog \| bgp \| ipmulticast \| rsvp \| frame-relay \| rtr \| snmp authentication linkdown linkup coldstart]` | Enables the NRP-2 to send traps. Optionally, you can select from specific types of traps. |
| **Step 4** | `Router(config)# snmp-server host 10.`*nrp2-slot*`.0.1 vrf 6400-private version 3 noauth` *username* | Specifies the NSP as the recipient of SNMPv3 trap messages. The **10.***nrp2-slot***.0.1** IP address is the private address for the internal NSP interface to the NRP-2 PAM mailbox serial interface. |

When you complete the previous steps, the NRP-2 automatically generates **snmp-server user** and **snmp-server group** commands in the configuration.

If you do not select any specific types of traps, the NRP-2 also automatically generates **snmp-server enable traps** commands to specify all available types of traps.

**Note** Do not modify or delete the automatically generated commands, because doing so may prevent SNMP from working properly.

### Example

In the following example, the NRP-2 is configured to allow the NSP to act as the proxy forwarder:

```
snmp-server group usmgrp v3 noauth
snmp-server user usmusr usmgrp v3
snmp-server enable traps
snmp-server host 10.3.0.1 vrf 6400-private version 3 noauth trapusr
```

The previous commands cause the NRP-2 to automatically generate the following commands:

```
snmp-server user trapusr trapusr v3
snmp-server group trapusr v3 noauth notify *tv.FFFFFFFF.FFFFFFFF
snmp-server enable traps snmp authentication linkdown linkup coldstart
snmp-server enable traps config
snmp-server enable traps syslog
snmp-server enable traps bgp
snmp-server enable traps ipmulticast
snmp-server enable traps rsvp
snmp-server enable traps frame-relay
snmp-server enable traps rtr
```

## Verifying the SNMPv3 Proxy Forwarder

To verify successful configuration of the SNMPv3 proxy forwarder feature, use the **more system:running-config** EXEC command. On both the NSP and NRP-2, check that you properly configured the commands described in the previous tasks.

Also check that the automatically generated commands correctly appear on both the NSP and NRP-2 running configurations. On the NSP, the three automatically generated commands that include an IP address are generated for every active NRP-2 in the chassis. The other automatically generated commands are created only once, regardless of the number of active NRP-2s installed in the chassis.

# Manual Disk Mirroring for Limited NSP Redundancy (Optional)

NSP Redundancy is limited in Cisco IOS Release 12.1(4)DB, because automatic disk mirroring of the PCMCIA disk in the NSP is not available in that release, and the NRP-2 relies on the NSP PCMCIA disk for file storage.

To perform manual disk mirroring, complete the following steps from the primary NSP:

**Step 1** To locate and identify all the directories and files on the PCMCIA disk in the primary NSP disk slot 0, use the **dir** EXEC command:

```
Switch# dir
Directory of disk0:/

3296  drw-           0   Aug 08 2000 21:20:40  images
3297  drw-           0   Aug 08 2000 21:20:42  slot1
3298  drw-           0   Aug 08 2000 21:20:42  slot2
3299  drw-           0   Aug 08 2000 21:20:42  slot3
3300  drw-           0   Aug 08 2000 21:20:42  slot4
3301  drw-           0   Aug 08 2000 21:20:42  slot5
3302  drw-           0   Aug 08 2000 21:20:42  slot6
3303  drw-           0   Aug 08 2000 21:20:42  slot7
3304  drw-           0   Aug 08 2000 21:20:42  slot8

20819968 bytes total (20434944 bytes free)
Switch#
```

**Step 2** To locate and identify all the directories and files on the PCMCIA disk in the secondary NSP disk slot 0, use the **dir** EXEC command:

```
Switch# dir sec-disk0:
Directory of sec-disk0:/

3296  drw-           0   Aug 08 2000 21:20:40  images
3297  drw-           0   Aug 08 2000 21:20:42  slot1
3298  drw-           0   Aug 08 2000 21:20:42  slot2
3299  drw-           0   Aug 08 2000 21:20:42  slot3
3300  drw-           0   Aug 08 2000 21:20:42  slot4
3301  drw-           0   Aug 08 2000 21:20:42  slot5
3302  drw-           0   Aug 08 2000 21:20:42  slot6
3303  drw-           0   Aug 08 2000 21:20:42  slot7
3304  drw-           0   Aug 08 2000 21:20:42  slot8

20819968 bytes total (20434944 bytes free)
Switch#
```

**Step 3** To mirror the nine images and slot directories, complete *one* of the following steps:

**a.** If the secondary NSP's PCMCIA disk 0 is empty or contains data that you can delete, use the **format** EXEC command to format the disk and automatically create the nine images and slot directories:

```
Switch# format sec-disk0:
```

**b.** If you do not want to delete all the data on the secondary NSP's PCMCIA disk 0, make sure that the number of bytes free displayed in Step 2 is large enough to accommodate the images and files from the primary NSP. Use the **mkdir** EXEC command to create the nine directories on the secondary NSP's PCMCIA disk 0:

```
Switch# mkdir sec-disk0/images/
Switch# mkdir sec-disk0/slot1/
Switch# mkdir sec-disk0/slot2/
...
Switch# mkdir sec-disk0/slot8/
```

**Step 4** To copy each file from the primary NSP PCMCIA disk to the secondary NSP PCMCIA disk, use the **copy** EXEC command:

```
Switch# copy disk0:/images/c6400r2sp-g4p5-mz.DC sec-disk0:/images/c6400r2sp-g4p5-mz.DC
Switch# copy disk0:/slot7/nrp2-startup-config sec-disk0:/slot7/nrp2-startup-config
Switch# copy disk0:/slot7/nrp2_rommon_nv.0 sec-disk0:/slot7/nrp2_rommon_nv.0
```

**Note** In Cisco IOS Release 12.1(4)DB, modifications to the data on the NSP PCMCIA disk that occur after performing manual disk mirroring are not copied automatically to the redundant NSP PCMCIA disk.

# Modifying VPI and VCI Ranges (Optional)

By default, VPI values are limited to 4 bits (0-15), and VCI values are limited to 10 bits (0-1023). You can change the VPI and VCI ranges, but the VPIs and VCIs must share 14 bits.

To change the VPI and VCI ranges, use the following commands beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# interface atm 0/0/0` | Selects the ATM interface on the NRP-2. |
| **Step 2** | `Router(config-if)# atm vc-per-vp` *number* | Sets the maximum number of allowed VCIs. The number of allowed VPIs is adjusted accordingly, such that the combination of VPIs and VCIs does not exceed 14 bits. See Table 3 for the allowed entries. The default *number* is 1023. |

**Note** Use of the **atm vc-per-vp** interface configuration command resets the ATM interface.

*Table 3 Allowed Entries for number Argument*

| *number*[1] | VCI Range | VCI Bits | VPI Range | VPI Bits |
|---|---|---|---|---|
| **64** | 0 - 63 | 6 | 0 - 255 | 8 |
| **128** | 0 - 127 | 7 | 0 - 127 | 7 |
| **256** | 0 - 255 | 8 | 0 - 63 | 6 |
| **512** | 0 - 511 | 9 | 0 - 31 | 5 |
| **1024** | 0 - 1023 | 10 | 0 - 15 | 4 |
| **2048** | 0 - 2047 | 11 | 0 - 7 | 3 |
| **4096** | 0 - 4095 | 12 | 0 - 3 | 2 |
| **8192** | 0 - 8191 | 13 | 0 - 1 | 1 |

1. Notice that the smallest allowed *number* entry is 64. The next possible value would be 32 (VCI range 0 - 31), but VCI values 0 through 31 are reserved by the ATM forum for particular functions (such as ILMI).

### Example

In the following example, the VCI range is set to 2048 values (0 - 2047), and the VPI range is set to 8 values (0 - 7):

```
!
interface ATM0/0/0
 no ip address
→ atm vc-per-vp 2048
 no atm ilmi-keepalive
!
```

## Verifying the VPI and VCI Ranges

To verify successful configuration of the VPI and VCI ranges, complete one or both of the following steps:

**Step 1** Use the **more system:running-config** EXEC command to check for successful configuration:

```
Router# more system:running-config
...
interface ATM0/0/0
 no ip address
→ atm vc-per-vp 2048
...
```

**Step 2** Use the **show controller atm 0/0/0** privileged EXEC command:

```
Router# show controller atm 0/0/0
...

*** SE64 General Data ***

  SE64_MAX_TX_PTYPE_HOLDER = 49152
  SE64_PARTICLE_POOL       = 32255
→ VPI bits                 = 3
→ VCI bits                 = 11

  SAR revision D
....
```

# Using Console and System Logging (Optional)

By default, each system log message created by the NRP-2 appears on the NSP as a local message, and the message is labeled with the slot number of the NRP-2 that created the message. Each system log message also appears on the NRP-2 console.

To control console and system logging, use the following commands:

| Command | Entered On | Purpose |
|---|---|---|
| `Router(config)# logging rate-limit` *rate* | NRP-2 | Limits the number of messages logged per second. Cisco recommends setting the rate limit to 25 messages per second. |
| `Router(config)# logging buffered` *size* | NRP-2 | Expands logging buffer size. |
| `Router# show logging` | NRP-2 | Shows the contents of logging buffers. |
| `Router# no logging` | NRP-2 | Stops NRP-2 system log messages from showing up on the NSP. |
| `Switch# no logging console` | NSP | Stops NRP-2 system log messages from showing up on the NSP. |

For more information on system and console logging, see the "Redirecting Debug and Error Message Output" section of the "Using Debug Commands" chapter of the *Cisco IOS Debug Command Reference, Release 12.1*.

## Troubleshooting Tips

Use the following debug commands to troubleshoot the NRP-2:

| NRP-2 Debug Command | Purpose |
|---|---|
| `Router# debug se64 {detail \| errors}` | Displays debug messages for the NRP-2 ATM SAR. |
| `Router# debug xconn` | Tracks the requests and responses for the cross-connect information protocol. |
| `Router# debug pmbox` | Displays debug messages for traffic flowing on the NRP-2 PAM mailbox serial interface. |

| NSP Debug Command | Purpose |
|---|---|
| `Switch# debug config-download` | Displays debug messages for the configuration download protocol. |
| `Switch# debug image-download [tftp]` | Displays debug messages for the image download protocol.<br>With optional **tftp** keyword, displays TFTP monitoring information as well |
| `Switch# debug pmbox` | Displays debug messages for traffic flowing on the NRP-2 PAM mailbox serial interface. |

# Monitoring and Maintaining the NRP-2

| Command | Purpose |
|---|---|
| `NRP-2> who`<br>`NSP> who` | Displays the console and telnet connections on either the NSP or NRP-2. |
| `NSP# clear line slot` | Clears NRP-2 console connections from the NSP. |
| `NSP> show line [line-type] number`<br>`NRP-2> show line [line-type] number` | Displays the parameters of a terminal line on either the NSP or NRP-2. |
| `NRP-2> show controller async` | Displays information specific to the NRP-2 PAM mailbox serial interface. |

### Examples

In the following example, the **who** EXEC command is used to identify the connection from the NSP to the NRP-2 console, and the **clear** privileged EXEC command is used to close the NRP-2 console session:

```
NSP# who
     Line       User       Host(s)              Idle       Location
*  0 con 0                idle                 00:00:00
→     6 tty 6               incoming             00:03:03 20.1.0.254
   18 vty 0               10.6.0.2             00:02:59 20.1.5.1

   Interface  User      Mode                      Idle Peer Address

NSP# clear line 6
[confirm]
  [OK]
NSP# who
     Line       User       Host(s)              Idle       Location
*  0 con 0                idle                 00:00:00
   18 vty 0               10.6.0.2             00:03:07 20.1.5.1

   Interface  User      Mode                      Idle Peer Address

NSP#
```

In the following example, the **show line** EXEC command is entered on the NSP to look at the console connection to the NRP-2:

```
NSP# show line 6
    Tty Typ     Tx/Rx    A Modem  Roty AccO AccI   Uses   Noise  Overruns   Int
*     6 TTY     0/0      -    -      -    -    -      7       0     0/0       -

Line 6, Location:"", Type:"XTERM"
Length:24 lines, Width:80 columns
Status:Ready, Connected, Active
Capabilities:EXEC Suppressed, Software Flowcontrol In,
   Software Flowcontrol Out
Modem state:Ready
Modem hardware state:CTS DSR  DTR RTS
Special Chars:Escape  Hold  Stop  Start  Disconnect  Activation
                ^^x    none   ^S     ^Q      none
Timeouts:     Idle EXEC    Idle Session   Modem Answer  Session   Dispatch
                00:10:00        never                      none     not set
                             Idle Session Disconnect Warning
                               never
                             Login-sequence User Response
                              00:00:30
                             Autoselect Initial Wait
                               not set
Modem type is unknown.
Session limit is not set.
Time since activation:00:03:26
Editing is enabled.
History is enabled, history size is 10.
DNS resolution in show commands is enabled
Full user help is disabled
Allowed transports are telnet.  Preferred is telnet.
No output characters are padded
No special data dispatching characters
NSP#
```

In the following example, the **show line** EXEC command is used to view the NRP-2 console line parameters from the NRP-2:

```
NRP-2> show line con 0
    Tty Typ     Tx/Rx    A Modem  Roty AccO AccI   Uses   Noise  Overruns   Int
*     0 CTY              -    -      -    -    -      0       0     0/0       -

Line 0, Location:"", Type:""
Length:24 lines, Width:80 columns
Status:PSI Enabled, Ready, Active, Automore On
Capabilities:Software Flowcontrol In, Software Flowcontrol Out
Modem state:Ready
Special Chars:Escape  Hold  Stop  Start  Disconnect  Activation
                ^^x    none   ^S     ^Q      none
Timeouts:     Idle EXEC    Idle Session   Modem Answer  Session   Dispatch
                never         never                        none     not set
                             Idle Session Disconnect Warning
                               never
                             Login-sequence User Response
                              00:00:30
                             Autoselect Initial Wait
                               not set
Modem type is unknown.
Session limit is not set.
Time since activation:00:09:09
Editing is enabled.
History is enabled, history size is 10.
DNS resolution in show commands is enabled
Full user help is disabled
Allowed transports are pad telnet rlogin.  Preferred is telnet.
No output characters are padded
No special data dispatching characters
NRP-2>
```

In the following example, the **show controller async** EXEC command is used to look at the NRP-2 PAM mailbox serial interface:

```
NRP-2> show controller async
Pam bus async console controller
PAM bus data for mailbox at 0x1C00FFC0
   magic1 = 0xDEADBABE, magic2 = 0x21524541
   in_data = 0x0000000D, out_data = 0x0000000A
   in_status.received_break = 0
   out_status.received_break = 0
   tx_owned = TRUE, rx_owned = FALSE
Buffer information
   Rx ttycnt 0
   Tx ttycnt 16B
   Rx Buffs:inpk 0/0 inheadpk 0 dataq 0 0 0
            pakq 0 0 0
   Tx Buffs:outpk 0  txpkq 0 0 0
   Rx totalin 325 Tx totalout 7933
NRP-2>
```

In the following example, the **show controller async** EXEC command is entered on the NSP to view the PAM mailbox serial interface for the NRP-2 in slot 6:

```
NSP# show controller async
Async NRP2 Pam bus controller
TTY line 1 not available
TTY line 2 not available
TTY line 3 not available
TTY line 4 not available
TTY line 5 not available
TTY line 6
PAM bus data for mailbox at 0xA8A8FFC0
   magic1 = 0xDEADBABE, magic2 = 0x21524541
   in_data = 0x0000000D, out_data = 0x0000003E
   in_status.received_break = 0
   out_status.received_break = 0
   tx_owned = TRUE, rx_owned = FALSE
Buffer information
   Rx ttycnt 0
   Tx ttycnt 0
   Rx Buffs:inpk 0/0 inheadpk 0 dataq 0 0 0
             pakq 0 0 0
   Tx Buffs:outpk 0  txpkq 0 0 0
   Rx totalin 1302 Tx totalout 69
TTY line 7 not available
TTY line 8 not available
TTY line 9 not available
TTY line 10 not available
TTY line 11 not available
TTY line 12 not available
TTY line 13 not available
TTY line 14
PAM bus data for mailbox at 0xA8E8FFC0
   magic1 = 0xDEADBABE, magic2 = 0x21524541
   in_data = 0x00000000, out_data = 0x00000000
   in_status.received_break = 0
   out_status.received_break = 0
   tx_owned = TRUE, rx_owned = FALSE
Buffer information
   Rx ttycnt 0
   Tx ttycnt 0
   Rx Buffs:inpk 0/0 inheadpk 0 dataq 0 0 0
             pakq 0 0 0
   Tx Buffs:outpk 0  txpkq 0 0 0
   Rx totalin 0 Tx totalout 0
TTY line 15 not available
TTY line 16 not available
NSP#
```

# NRP-2 Command Reference

This section documents new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

- **show controllers atm 0/0/0**
- **show se64**
- **show chassis xconn**

# show controllers atm 0/0/0

To display information on the physical ATM interface of the Cisco 6400 NRP-2 or NRP-1, use the **show controllers atm 0/0/0** privileged EXEC command.

**Cisco 6400 NRP-2**

**show controllers atm 0/0/0**

**Cisco 6400 NRP-1**

**show controllers atm 0/0/0** [**detailed** | **scheduler** | **vc** *vpi*/*vci*]

## Syntax Description

| | |
|---|---|
| **0/0/0** | *slot/subslot/port* entry for the physical ATM interface of the Cisco 6400 NRP |
| **detailed** | Output shows all available information |
| **scheduler** | Output shows SAR scheduler information |
| **vc** | Output shows information for the specified virtual circuit (VC) |
| *vpi*/*vci* | Virtual path identifier (VPI) and virtual channel identifier (VCI) of the VC |

## Defaults

On the NRP-2, the default output shows all available information on the ATM interface.

On the NRP-1, the default output shows only segmentation and reassembly (SAR) controller information.

## Command Modes

Privileged EXEC

## Command History

| Release | Modification |
|---|---|
| 11.2 GS | This command was introduced. |
| 12.0(5)DA | This command was first supported on the Cisco 6260. |
| 12.0(5)XE | This command was first supported on the Cisco 7200 and 7500 series routers. |
| 12.0(5)T and 12.0(5)XK | This command was modified to support inverse multiplexing over ATM (IMA) groups on the Cisco 2600 and Cisco 3600 series routers. |
| 12.0(7)XE1 | This command was first supported on the Cisco 7100 series routers. |
| 12.1(3)DC | This command was modified from its original version, with no display options, for the Cisco 6400 NRP-1:<br>• To enable the output of cyclic redundancy check (CRC) error counts on a per-VC basis.<br>• To display only SAR controller information as the default output.<br>• With new options for controlling the output to include error counters on a per-VC basis. |
| 12.1(4)DC | This command syntax was returned to its simpler form for the Cisco 6400 NRP-2. |

## Examples

In the following NRP-2 example, the output displays all available SAR controller information:

```
NRP-2# show controllers atm 0/0/0

*** SE64 General Data ***

Resources:
                                    Thold   Thold   per-VC
  Pool     Total    Used    Free    Norm     Sys    Limit     VCs
  ------   -----   -----   -----   -----   -----   ------   -----
  TX-VBR    3273       1    3272    3241    3273     3273       1
  TX-UBR     409       8     401     377     409                2
  RX       32255       0   32255   21504   21568     3583       3
  MP-hld   49152       8   49144

Performance:
                         Throttled   Throttled   Throttled     Spin
  Path   Total   Queued       Total         Sys      Hi Pri  avg/max
  ----   -----   ------  ----------  ----------  ----------  -------
  TX      3682        8           0           0           0    0/128
  RX     32255        0           0                           1/128

Other:
  TX hw Links = 2   RX Free (tbl) = 32255
  VPI/VCI bits = 3/11  SAR Rev = D

*** SE64 Global Statistics ***

RX Path:
  rx_giant_discard     = 0             rx_misc_discard      = 0
  rx_pkt               = 4             rx_drop_vc_bad       = 0
  rx_drop_crc          = 0             rx_drop_runt         = 0
  rx_drop_vc_del       = 0             rx_drop_giant        = 0
  rx_drop_throttle     = 0

RX OAM Path:
  rx_oam_spin_int      = 0             rx_oam_spin_poll     = 0
  rx_oam               = 0             rx_oam_drop_buf      = 0
  rx_oam_drop_crc_10   = 0

RX General:
  rx_count             = 0             rx_pkt_spin_start    = 4
  rx_pkt_spin_total    = 4             rx_spin_int          = 4
  rx_spin_poll         = 0             rx_pkt_clp           = 0
  rx_pkt_ci            = 0
TX Path:
  tx_pkt_safe_start    = 8             tx_pkt_fast          = 0
  tx_drop_idb_down     = 0             tx_drop_vc_down      = 0
  tx_drop_vc_del       = 0             tx_drop_1par_clone   = 0
  tx_drop_2par_room    = 0             tx_drop_2par_coal    = 0
  tx_drop_gt2par       = 0             tx_drop_credit       = 0
  tx_drop_credit_sys   = 0             tx_drop_credit_pri   = 0
  tx_drop_oam_f4       = 0             tx_drop_pkt_len_0    = 0
  tx_drop_pkt_align    = 0             tx_drop_pkt_mp       = 0

TX General:
  tx_count_vbr         = 0             tx_count_ubr         = 8
  tx_tbl_count_vbr     = 1             tx_tbl_count_ubr     = 17
  tx_vc_limit_vbr      = 3273          tx_pkt_spin_start    = 0
  tx_pkt_spin_total    = 0             tx_spin_int          = 0
  tx_spin_poll         = 0             tx_combine           = 0
  tx_2par_coal         = 0
```

```
SE64 stats interrupts:
  tx_desc_wm           = 0             tx_tmp_cb_full       = 0
  tx_cb_full           = 0             abr_sched_drift      = 0

SE64 error interrupts:
  rx_stat_rpt_ring_ful = 0             tx_stat_rpt_ring_ful = 0
  rm_cell_ring_full    = 0             rx_buf_pool1_mt      = 0
  rx_buf_pool2_mt      = 0             rx_buf_pool3_mt      = 0
  tx_buf_pkt_desc_mt   = 0             rx_cb_full           = 0
  rx_tmp_cb_full       = 0             fail_sched_abr_vc    = 0
  crm                  = 0             biu_addr             = 0
  rx_cam_mult_hit      = 0             tx_cam_mult_hit      = 0
  rx_hec               = 0             data_parity          = 0
```

In the following NRP-1 example, the output consists only of the SAR controller information:

```
NRP-1# show controllers atm 0/0/0
Interface ATM0/0/0
Hardware is ATM-SAR
PCI registers:
  bus_no=0, device_no=4
  CFID=0xA102104C, CFCS=0x02000006, CFRV=0x02030002, CFLT=0x0000FF00
  CFBA=0x4A000000, CFIT=0x02010100


 *** TI1575 SAR at address 0x3A000000 ***
 Receive/Transmit Statistics
  rx_isrs:      0           rx_isr_pkts:   1           rx_isr_bufs:    0
  rx_cells_ovf: 0           tx_cells_ovf:  0           hec_errors_ovf: 0
  rx_unkn_prot: 314         rx_aal5_disc:  0           rx_pkt_ovf:     0
  unkn_prot_ovf:0           aal5_disc_ovf: 0           tx_count:       0
  rx_crc_error: 0           rx_no_buf:     0           rx_timeout:     0
  rx_abort:     0           rx_cong_cells: 0           rx_freeze:      0
  rx_no_valbuf: 0           rx_bad_vc:     0           fallback act:   0
  tx_abort:     0           tx_no_desc:    0           tx_align:       0
  tx_freeze:    0           disabled:      0           enabled:        0
  tx_clones:    0           tx_xmt_paks:   3           teardown_vc:    0
  tx_pend_count_negative: 0
  tx_forced: 0          (0)
  tx_max_queued:        6144        seg_ring_size:      32
  tx output drops:      0
   pkt_too_big:         0           tx_pak_failed:      0
   idb_down:            0           invalid_pkt_type:   0
   invalid_vcd:         0           vc_ring_full:       0
   over_max_queued:     0           slot_owned_by_chip: 0
   vc_not_in_use:       0
  invalid_addr_count:   0

 PCI Statistics
  detect_parity     0     system_error     0      master_abort      0
  rx_target_abort   0     sig_target_abort 0      data_parity       0

 Internal registers
  config:     0x6037      status:     0x2000040   imask:      0xC381
  ratcount:   0x800       globrat:    0x79        rxunkn:     0x10000010
  txcompsize: 0x7FF       rxcompsize: 0x1FF       txsegsize:  0x1F
  aal5discard:0x0         hecerrors:  0x0         unknprot:   0x14C
  rxcells:    0x1         txcells:    0x1B        schedsize:  0x1
  txqueue:    0x80002009(spinerr:0)  txpause:    0x0         chancount:  0x5
  txcompring: 0x311A00C   rxcompring: 0x3114020
```

```
 Structures common to all VCs
  receive free buffer ring
      address: 0x3110820   buf size: 10  ring size: 63  sar_indx: 1  drv_indx: 1
  receive completion ring
      addr: 0x3114000   indx: 1
  transmit completion ring
      addr: 0x311A000   indx: 3
```

In the following NRP-1 example, the output consists of all available information:

```
NRP-1# show controllers atm 0/0/0 detailed
Interface ATM0/0/0
Hardware is ATM-SAR
PCI registers:
  bus_no=0, device_no=4
  CFID=0xA102104C, CFCS=0x02000006, CFRV=0x02030002, CFLT=0x0000FF00
  CFBA=0x4A000000, CFIT=0x02010100


 *** TI1575 SAR at address 0x3A000000 ***
 Receive/Transmit Statistics
  rx_isrs:      0           rx_isr_pkts:   1           rx_isr_bufs:    0
  rx_cells_ovf: 0           tx_cells_ovf:  0           hec_errors_ovf: 0
  rx_unkn_prot: 514         rx_aal5_disc:  0           rx_pkt_ovf:     0
  unkn_prot_ovf:0           aal5_disc_ovf: 0           tx_count:       0
  rx_crc_error: 0           rx_no_buf:     0           rx_timeout:     0
  rx_abort:     0           rx_cong_cells: 0           rx_freeze:      0
  rx_no_valbuf: 0           rx_bad_vc:     0           fallback act:   0
  tx_abort:     0           tx_no_desc:    0           tx_align:       0
  tx_freeze:    0           disabled:      0           enabled:        0
  tx_clones:    0           tx_xmt_paks:   3           teardown_vc:    0
  tx_pend_count_negative: 0
  tx_forced: 0          (0)
  tx_max_queued:        6144        seg_ring_size:      32
  tx output drops:      0
   pkt_too_big:         0           tx_pak_failed:      0
   idb_down:            0           invalid_pkt_type:   0
   invalid_vcd:         0           vc_ring_full:       0
   over_max_queued:     0           slot_owned_by_chip: 0
   vc_not_in_use:       0
  invalid_addr_count:   0

 PCI Statistics
  detect_parity     0     system_error     0      master_abort      0
  rx_target_abort   0     sig_target_abort 0      data_parity       0

 Internal registers
  config:     0x6037      status:     0x2000040   imask:      0xC381
  ratcount:   0x800       globrat:    0x79        rxunkn:     0x10000010
  txcompsize: 0x7FF       rxcompsize: 0x1FF       txsegsize:  0x1F
  aal5discard:0x0         hecerrors:  0x0         unknprot:   0x214
  rxcells:    0x1         txcells:    0x1B        schedsize:  0x1
  txqueue:    0x80002009(spinerr:0)  txpause:    0x0         chancount:  0x5
  txcompring: 0x311A00C   rxcompring: 0x3114020

 Structures common to all VCs
  receive free buffer ring
      address: 0x3110820   buf size: 10  ring size: 63  sar_indx: 1  drv_indx: 1
  receive completion ring
      addr: 0x3114000   indx: 1
  transmit completion ring
      addr: 0x311A000   indx: 3
```

```
*** VC information and associated 1575 structures ***
seg ring:  5     ringaddr: 0x311C400   ringindx:0     pendindx:0
 tx dma:   5     ctrlring: 0xC47100    pktcnt:     0
 rword10:   0x0         rword11: 0x0
 rword20:   0x0         rword21: 0x0        rword22: 0x0        rword23: 0x0
 pxmt      0     queued:   0
 VCs mapped to this ring
 vcd:      1     cellhdr:  0x1E00640   encap:      0            crcerror: 0
   rx dma: 5     config:   0x24000000  ctrlrxring: 0x80000200   timecnt:  0xC8000
   lookup: 2     channel:  5           vpivci:     0x1E0064
seg ring:  6     ringaddr: 0x311C480   ringindx:0     pendindx:0
 tx dma:   6     ctrlring: 0xC47120    pktcnt:     0
 rword10:   0x0         rword11: 0x0
 rword20:   0x0         rword21: 0x0        rword22: 0x0        rword23: 0x0
 pxmt      0     queued:   0
 VCs mapped to this ring
 vcd:      2     cellhdr:  0x2800C80   encap:      0            crcerror: 0
   rx dma: 6     config:   0x24000000  ctrlrxring: 0x80000400   timecnt:  0xC8000
   lookup: 3     channel:  6           vpivci:     0x2800C8
seg ring:  7     ringaddr: 0x311C500   ringindx:0     pendindx:0
 tx dma:   7     ctrlring: 0xC47140    pktcnt:     0
 rword10:   0x0         rword11: 0x0
 rword20:   0x0         rword21: 0x0        rword22: 0x0        rword23: 0x0
 pxmt      0     queued:   0
 VCs mapped to this ring
 vcd:      3     cellhdr:  0xA0        encap:      0            crcerror: 0
   rx dma: 7     config:   0x24000000  ctrlrxring: 0x80000600   timecnt:  0xC8000
   lookup: 0     channel:  7           vpivci:     0xA
seg ring:  8     ringaddr: 0x311C580   ringindx:0     pendindx:0
 tx dma:   8     ctrlring: 0xC47160    pktcnt:     0
 rword10:   0x0         rword11: 0x0
 rword20:   0x0         rword21: 0x0        rword22: 0x0        rword23: 0x0
 pxmt      0     queued:   0
 VCs mapped to this ring
 vcd:      4     cellhdr:  0x500       encap:      0            crcerror: 0
   rx dma: 8     config:   0x24000000  ctrlrxring: 0x80000800   timecnt:  0xC8000
   lookup: 1     channel:  8           vpivci:     0x50
seg ring:  9     ringaddr: 0x311C600   ringindx:3     pendindx:3
 tx dma:   9     ctrlring: 0xC47183    pktcnt:     0
 rword10:   0x663C0000  rword11: 0x33CE274
 rword20:   0x0         rword21: 0x33CDFC4  rword22: 0x0        rword23: 0x0
 pxmt      0     queued:   0
 VCs mapped to this ring
 vcd:      5     cellhdr:  0x3200640   encap:      0            crcerror: 0
   rx dma: 9     config:   0x24000000  ctrlrxring: 0x80000A00   timecnt:  0xC8000
   lookup: 4     channel:  9           vpivci:     0x320064

*** TI1585/1585 Scheduler at address 0x3A040000 ***
Configuration/Statistics
 line bw:    149760   min vc bw: 64    total slots: 2
 free slots: 2

1585 internal registers
 config:     0x227       status:     0x1E        imask:      0x0
 clkfreq:    0x18FCA1    revnum:     0x0         acrlow:     0x80000000
 acrok:      0x80000000

1585 connection config/status
 scheduler id 5
     type: VBR       pcr: 353207    scr: 353207    mbs: 91
rtv: 0x100
 scheduler id 6
     type: VBR       pcr: 353207    scr: 353207    mbs: 91
```

```
rtv: 0x100
 scheduler id 7
     type: VBR       pcr: 353207    scr: 353207    mbs: 91
rtv: 0x100
 scheduler id 8
     type: VBR       pcr: 353207    scr: 353207    mbs: 91
rtv: 0x100
 scheduler id 9
     type: VBR       pcr: 353207    scr: 353207    mbs: 91
rtv: 0x100
```

In the following NRP-1 example, the output consists of only the SAR scheduler information:

```
NRP-1# show controllers atm 0/0/0 scheduler
Interface ATM0/0/0
Hardware is ATM-SAR
PCI registers:
  bus_no=0, device_no=4
  CFID=0xA102104C, CFCS=0x02000006, CFRV=0x02030002, CFLT=0x0000FF00
  CFBA=0x4A000000, CFIT=0x02010100


 *** TI1585/1585 Scheduler at address 0x3A040000 ***
 Configuration/Statistics
  line bw:    149760   min vc bw: 64    total slots: 2
  free slots: 2

 1585 internal registers
  config:     0x227       status:     0x1E        imask:      0x0
  clkfreq:    0x18FCA1    revnum:     0x0         acrlow:     0x80000000
  acrok:      0x80000000

 1585 connection config/status
  scheduler id 5
      type: VBR       pcr: 353207    scr: 353207    mbs: 91
 rtv: 0x100
  scheduler id 6
      type: VBR       pcr: 353207    scr: 353207    mbs: 91
 rtv: 0x100
  scheduler id 7
      type: VBR       pcr: 353207    scr: 353207    mbs: 91
 rtv: 0x100
  scheduler id 8
      type: VBR       pcr: 353207    scr: 353207    mbs: 91
 rtv: 0x100
  scheduler id 9
      type: VBR       pcr: 353207    scr: 353207    mbs: 91
 rtv: 0x100
```

In the following NRP-1 example, the VC output consists only of information specific to VC 1/100:

```
NRP-1# show controllers atm 0/0/0 vc 50/100
Interface ATM0/0/0
Hardware is ATM-SAR
PCI registers:
  bus_no=0, device_no=4
  CFID=0xA102104C, CFCS=0x02000006, CFRV=0x02030002, CFLT=0x0000FF00
  CFBA=0x4A000000, CFIT=0x02010100


 *** VC information and associated 1575 structures ***
 seg ring:  9     ringaddr: 0x311C600   ringindx:3     pendindx:3
  tx dma:   9     ctrlring: 0xC47183    pktcnt:     0
  rword10:   0x663C0000  rword11: 0x33CE274
  rword20:   0x0         rword21: 0x33CDFC4  rword22: 0x0        rword23: 0x0
  pxmt      0     queued:   0
  VCs mapped to this ring
  vcd:      5     cellhdr:  0x3200640   encap:      0            crcerror: 0
    rx dma: 9     config:   0x24000000  ctrlrxring: 0x80000A00   timecnt:  0xC8000
    lookup: 4     channel:  9           vpivci:     0x320064
```

In the following NRP-1 example, the output displays cyclic redundancy check (CRC) error counters for each configured VC:

```
NRP-1# show controllers atm 0/0/0 detailed | include crc
  rx_crc_error: 0           rx_no_buf:     0           rx_timeout:     0
  vcd:      1     cellhdr:  0x1E00640   encap:      0            crcerror: 0
  vcd:      2     cellhdr:  0x2800C80   encap:      0            crcerror: 0
  vcd:      3     cellhdr:  0xA0        encap:      0            crcerror: 0
  vcd:      4     cellhdr:  0x500       encap:      0            crcerror: 0
  vcd:      5     cellhdr:  0x3200640   encap:      0            crcerror: 0
```

## Related Commands

| Command | Description |
|---|---|
| **show se64 vc-stats** | For the NRP-2, displays information for a specified VC. |
| **show atm interface** | Displays ATM-specific information about an ATM interface. |
| **show atm pvc** | Displays all ATM permanent virtual circuits (PVCs) and traffic information. |
| **show atm traffic** | Displays current global ATM traffic information to and from all ATM networks connected to the router. |
| **show atm vc** | Displays the ATM layer connection information about the virtual connections. |
| **debug se64 detail** | Enables the **show controllers atm 0/00** command output to display internal ATM SAR data and register values. |

# show se64

To display detailed NRP-2 ATM SAR information, use the **show se64** EXEC command.

**show se64** {**regs** | **mp_holder** | **vc-stats** *vpi vci* | **shaper** *shaper-number* | **vcd** *vcd*}

## Syntax Description

| | |
|---|---|
| **regs** | Displays the values of internal registers for the NRP-2 ATM SAR. |
| **mp_holder** | Displays VCs with counters of outstanding SAR driver data structures used to recover transmitted packets. These data structures are referred to as "holders" or "mp holders." |
| **vc-stats** | Displays counters and statistics for a specific VC. |
| *vpi vci* | Virtual path identifier and virtual channel identifier. |
| **shaper** | Displays details of SAR driver data structures used to enforce traffic shaping specified by a VBR-NRT VC. |
| *shaper-number* | Shaper number. Valid values are 0 to 7. |
| **vcd** | Displays details of SAR driver data structures for a specific VC descriptor (VCD). |
| *vcd* | VC descriptor number. Valid values are 0 to 16383. |

## Defaults

No default behavior or values.

## Command Modes

EXEC

## Command History

| Release | Modification |
|---|---|
| 12.1(4)DC | This command was introduced on the Cisco 6400 NRP-2. |

## Usage Guidelines

The **show se64** command is used for debugging and troubleshooting the NRP-2 ATM SAR.

The output of the **show se64 vc-stats** command is divided into five categories:

- General—Displays general statistics of the NRP-2 ATM SAR driver operation.
- RX Path—Displays statistics for the input and loss path of received packets through the NRP-2 ATM SAR driver, for the specified VC.
- RX General—Displays counters for the cells and packets received on the specified VC.
- TX Path—Displays statistics for the output and loss path of transmitted packets through the NRP-2 ATM SAR driver, for the specified VC.
- TX General—Displays counters for actions taken by the NRP-2 ATM SAR driver to successfully transmit certain packet types.

**Note** The RX Path and TX Path output do not account for packets lost by the Cisco IOS.

Each shaper number can be mapped to one or more VCDs. The VCDs mapped to the selected shaper appears at the end of the **show se64 shaper** command output:

```
NRP-2# show se64 shaper 0
Shaper Number 0
pcr_kb 1000, pcr_cr 2271, pcr_count 24218
scr_kb 50, scr_cr 113, scr_count 4843600
mbs 10, mbs count 10
skip count 190, scr_inc 1023
➔ VC on the shaper:
➔ 00002
```

To determine the VCD number to use in the **show se64 vcd** command, use the **show atm pvc** privileged EXEC command:

```
NRP-2# show atm pvc
            VCD /                                          Peak  Avg/Min Burst
Interface   Name        VPI   VCI  Type   Encaps   SC    Kbps   Kbps   Cells  Sts
0/0/0.100   1            0   300   PVC    SNAP     UBR   10000                UP
0/0/0.200   2            0   400   PVC    SNAP     VBR    1000     50   10    UP
0/0/0.300   foobe        0   500   PVC    SNAP     UBR  599040                UP
...
```

If the VCD is displayed as a name instead of a number for the PVC of interest, use the **show atm pvc** *name* privileged EXEC command to determine the VCD number:

```
NRP-2# show atm pvc foobe
ATM0/0/0.300:VCD:3, VPI:0, VCI:500, Connection Name:foobe
UBR, PeakRate:599040
AAL5-LLC/SNAP, etype:0x0, Flags:0xC20, VCmode:0x0
...
```

## Examples

```
Router# show se64 regs
*** SE64 Internal Regs ***

SAR revision D


VPI bits 3, VCI bits 11

Number of free mp holders:49152
Number of particle in the sar 32255

rx buffer base:virtual 0C000000, physical AC000000
rx buffer size (byte):66058240, number of rx buffers:32255

OAM cell ring base:virtual 0B050000, physical AB050000
OAM shadow write pointer:0, OAM read pointer:10
OAM cell ring size (byte):65536, number of entries:1024

RM cell ring base:virtual 0AFC4000, physical AAFC4000
RM cell ring size (byte):16384, number of entries:256

Rx status ring base:virtual 0B020000, physical AB020000
Rx shadow write pointer:0, Rx read pointer:1284
Rx status ring size (byte):131072, number of entries:16384

Tx status ring base:virtual 0AFE0000, physical AAFE0000
Tx shadow write pointer:0, Tx read pointer:707
Tx status ring size (byte):131072, number of entries:16384
```

```
SE64 internal memory and registers base:virtual 24000000, physical 84000000
SE64 registers base:virtual 2401F000, physical 8401F000
SE64 local memory base:virtual 20000000, physical 80000000

Rx VC descriptor table base:virtual 20000000, physical 80000000
Rx VC descriptor table size(byte):1048576

Tx VC descriptor table base:virtual 20100000, physical 80100000
Tx VC descriptor table size(byte):1048576

Tx link pool base:virtual 20200000, physical 80200000
Tx link pool size(byte):794624
SE64 register value:
Addr 2401F000, high 84000037, low 84000037, Rc Lg Buffer Pool Config Register 1
Addr 2401F010, high FC000009, low FC000009, Rc Lg Buffer Pool Config Register 2
Addr 2401F020, high 7FF0000C, low 7FF0000C, Rc Sm Buffer Pool Config Register
Addr 2401F040, high 00000000, low 00000000, Rc Lg Buffer Pool Depth Register
Addr 2401F060, high 00000000, low 00000000, Rc Sm Buffer Pool Depth Register
Addr 2401F100, high 00000000, low 00000000, Rc Buffer Pool Return Register
Addr 2401F180, high 00000000, low 00000000, Rc Lg Buffer Pool Region Flag Regr
Addr 2401F190, high FFFFFFFF, low FFFFFFFF, Rc Sm Buffer Pool Row Map Regr 1
Addr 2401F1A0, high FFFFFFFF, low FFFFFFFF, Rc Sm Buffer Pool Row Map Regr 2
Addr 2401F400, high 00000090, low 00000090, Receive Processor Control Register
Addr 2401F410, high 00000000, low 00000000, Rc Ext. Descriptor Table Base Regr
Addr 2401F420, high 82FC4000, low 82FC4000, Rc RM Cell Ring Register
Addr 2401F430, high 83050285, low 83050285, Rc OAM Cell Ring Register
Addr 2401F440, high 80000000, low 80000000, Rc RM Cell Ring Stop Register
Addr 2401F450, high 8006800B, low 8006800B, Rc OAM Cell Ring Stop Register
Addr 2401F800, high 001C4FA7, low 00508002, Transmit Packet-Add Register 1
Addr 2401F808, high 00000000, low 82FC9038, Transmit Packet-Add Register 2
Addr 2401F810, high 11C28F06, low 11C28F06, Transmit Buffer-Add Register
Addr 2401F900, high 0000FEFE, low 0000FEFE, Tx Buf Link Pool Region FlagRegr
Addr 2401F908, high C0000001, low C0000001, Tx Buffer Link Pool Depth Register
Addr 2401FA00, high 00000000, low 00000000, Protocol Header Register 0H
Addr 2401FA08, high 00000000, low 00000000, Protocol Header Register 0L
Addr 2401FA10, high 00000000, low 00000000, Protocol Header Register 1H
Addr 2401FA18, high 00000000, low 00000000, Protocol Header Register 1L
Addr 2401FA20, high 00000000, low 00000000, Protocol Header Register 2H
Addr 2401FA28, high 00000000, low 00000000, Protocol Header Register 2L
Addr 2401FA30, high 00000000, low 00000000, Protocol Header Register 3H
Addr 2401FA38, high 00000000, low 00000000, Protocol Header Register 3L
Addr 2401FA40, high 00000000, low 00000000, Protocol Header Register 4H
Addr 2401FA48, high 00000000, low 00000000, Protocol Header Register 4L
Addr 2401FA50, high 00000000, low 00000000, Protocol Header Register 5H
Addr 2401FA58, high 00000000, low 00000000, Protocol Header Register 5L
Addr 2401FA60, high 00000000, low 00000000, Protocol Header Register 6H
Addr 2401FA68, high 00000000, low 00000000, Protocol Header Register 6L
Addr 2401FA70, high 00000000, low 00000000, Protocol Header Register 7H
Addr 2401FA78, high 00000000, low 00000000, Protocol Header Register 7L
Addr 2401FA80, high 00000000, low 00000000, Protocol Header Register 8H
Addr 2401FA88, high 00000000, low 00000000, Protocol Header Register 8L
Addr 2401FA90, high 00000000, low 00000000, Protocol Header Register 9H
Addr 2401FA98, high 00000000, low 00000000, Protocol Header Register 9L
Addr 2401FAA0, high 00000000, low 00000000, Protocol Header Register AH
Addr 2401FAA8, high 00000000, low 00000000, Protocol Header Register AL
Addr 2401FAB0, high 00000000, low 00000000, Protocol Header Register BH
Addr 2401FAB8, high 00000000, low 00000000, Protocol Header Register BL
Addr 2401FB00, high 00000000, low 00000000, VC Base Address Register
Addr 2401FB08, high 00FFFFFF, low 00FFFFFF, FRM Cell Time Interval Register
Addr 2401FB10, high 00000000, low 00000000, CRM Interrupt Register
...
(additional register settings deleted)
...
```

```
NRP-2# show se64 mp_holder
Number of free mp holders:49146

vcd 1, number of holders 6

Number of mp holders in the closed VC queue:0
```

```
NRP-2# show se64 vc-stats 4 33
*** SE64 Statistics for VPI/VCI = 4/33 ***

General:
  rx_count             = 0             rx_limit             = 7064
  tx_count             = 0             tx_limit             = 40

RX Path:
  rx_pkt               = 209           rx_drop_giant        = 0
  rx_drop_crc          = 7             rx_drop_runt         = 0
  rx_drop_vc_del       = 0             rx_drop_throttle     = 0

RX general:
  rx_pkt_clp           = 0             rx_pkt_ci            = 0
  rx_cell_count        = 319

TX Path:
  tx_pkt_safe_start    = 224           tx_pkt_fast          = 27
  tx_drop_idb_down     = 0             tx_drop_vc_down      = 0
  tx_drop_vc_del       = 0             tx_drop_1par_clone   = 0
  tx_drop_2par_room    = 0             tx_drop_2par_coal    = 0
  tx_drop_gt2par       = 0             tx_drop_credit       = 0
  tx_drop_oam_f4       = 0             tx_drop_pkt_len_0    = 0
  tx_drop_pkt_align    = 0             tx_drop_pkt_mp       = 0

TX General:
  tx_combine           = 0             tx_2par_coal         = 0
```

```
NRP-2# show se64 shaper 0
Shaper Number 0
pcr_kb 1000, pcr_cr 2271, pcr_count 24218
scr_kb 50, scr_cr 113, scr_count 4843600
mbs 10, mbs count 10
skip count 190, scr_inc 1023
VC on the shaper:
00002
```

If the shaper has no PVCs assigned to it, the **show se64 shaper** command displays an invalid status:

```
NRP-2# show se64 shaper 3
Shaper Number 3
Status:Invalid
```

```
NRP-2# show se64 vcd 1
TX
Addr 20100000, high 9BD294BF low 00000001
Addr 20100008, high 0000001C low 98000000
Addr 20100010, high 00000000 low 0006000D
Addr 20100018, high 40000000 low 00000000
Addr 20100020, high 80000000 low 000012C0
Addr 20100028, high 00000000 low 00000000
Addr 20100030, high 00000000 low 00000000
Addr 20100038, high 00000000 low 00000000

RX
Addr 20004B00, high C704DD7B low 21000000
Addr 20004B08, high 00000002 low BC0010B0
Addr 20004B10, high 00000000 low 00000000
Addr 20004B18, high 00000000 low 00000000
Addr 20004B20, high 80001010 low 00000000
Addr 20004B28, high 00000000 low 00000000
Addr 20004B30, high 00000000 low 00000000
Addr 20004B38, high 00000000 low 00000000
```

## Related Commands

| Command | Description |
|---|---|
| **show controllers atm 0/0/0** | Displays global (as opposed to VC-specific) information on the physical ATM interface. |

# show chassis xconn

To display the current state of the cross connect information requests from the NRP-1 or NRP-2 to the NSP, use the **show chassis xconn** EXEC mode command.

**show chassis xconn**

## Syntax Description

This command has no keywords or arguments.

## Defaults

No default behavior or values.

## Command Modes

EXEC

## Command History

| Release | Modification |
|---|---|
| 12.1(4)DC | This command was introduced on the Cisco 6400 NRP-2. |

## Examples

In the following example, there are no outstanding cross-connect requests from the NRP-2 to the NSP:

```
NRP-2> show chassis xconn
Xconn List len = 2048
 Req outstanding = 0, Req Pending = 0
 VC status
 ---------
 Outstanding_cnt = 0, Pending_cnt = 0
```

In the following example, there is one request that is outstanding. The request is for PVC 40/50 on the NRP-2 ATM 0/0/0 interface. The request has nine more retries with a current timeout of 8000 milliseconds.

```
NRP-2# show chassis xconn
Xconn List len = 2048
 Req outstanding = 1, Req Pending = 0
 VC status
 ---------
 Outstanding VC (1002) 40/50, retry cnt = 9, timeout_period = 8000
 Outstanding_cnt = 1, Pending_cnt = 0
```

## Related Commands

| Command | Description |
|---|---|
| **debug xconn** | Displays debug NSP and NRP process cross-connect messages |

# NSP Command Reference

This section documents new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

- **hw-module**
- **nrps**
- **show controllers async**
- **snmp-server forwarder**

# hw-module

### hw-module (image)

To identify the image to download to a specific NRP-2 processor, use the **hw-module (image)** global configuration command. To remove an NRP-2 image specification, use the **no** form of this command.

**hw-module slot** *slot* **image** *image* **priority** *priority*

**no hw-module slot** *slot* **image** *image* **priority** *priority*

### hw-module (config-register)

To change the configuration register settings for the NRP-2, use the **hw-module (config-register)** global configuration command.

**hw-module slot** *slot* **config-register** *value*

### hw-module (reset)

To simulate removal and insertion of a device installed in the Cisco 6400 chassis, use the **hw-module (reset)** EXEC command.

**hw-module** {**slot** *slot* | **subslot** *slot*/*subslot* | **main-cpu** | **sec-cpu** | **nsp** {**A** | **B**}} **reset**

### hw-module (shutdown)

To simulate removal or shutdown of a device installed in the Cisco 6400 chassis, use the **hw-module (shutdown)** global configuration command. The device remains in removed state even through system reloads. To return the device to inserted state in the chassis, use the **no** form of this command.

**hw-module** {**slot** *slot* | **subslot** *slot*/*subslot* | **main-cpu** | **sec-cpu** | **nsp** {**A** | **B**}} **shutdown**

**no hw-module** {**slot** *slot* | **subslot** *slot*/*subslot* | **main-cpu** | **sec-cpu** | **nsp** {**A** | **B**}} **shutdown**

## Syntax Description

| | |
|---|---|
| **config-register** | Specifies a change in the configuration register settings. |
| **image** | Specifies an image to assign to selected slot. |
| *image* | Any valid integrated file system (IFS), including:<br>• *filename*—Specifies an image in the "images" directory of the NSP PCMCIA disk.<br>• **disk0:***directory/path/filename*—Specifies an image on the NSP PCMCIA disk but not in the "images" directory.<br>• **tftp:***.../filename*—Specifies an image on a TFTP server. |
| **main-cpu** | Specifies that the main CPU should be reset. Allows you to reset the main CPU regardless of the CPU you are currently logged in to. |
| **nsp** {**A** \| **B**} | Specifies the slot (0A or 0B) of the NSP to be reset. |
| **priority** | Specifies the priority of the selected image for the slot. |
| *priority* | Priority value. The priority range is from 1 (highest) to 4 (lowest). |
| **reset** | Simulates card removal and insertion of the specified device. |
| **sec-cpu** | Specifies that the secondary CPU should be reset. Allows you to reset the secondary CPU regardless of the CPU you are currently logged into. |

| | |
|---|---|
| **shutdown** | Simulates shutdown or removal of the designated card from the system. Holds card in shutdown or removed state, even through system reloads. |
| *slot*<br>*slot/subslot* | Specifies the slot or subslot of the device. Slot range is 1-8, subslot range is 0-1. |
| *value* | Hexadecimal or decimal value that represents the 16-bit configuration register value that you want to use the next time the router is restarted. The value range is from 0x0000 to 0xFFFF (0 to 65,535 in decimal).<br>Specific bit values:<br>• 0x2101—Default configuration register setting. Combines the behaviors of the 0x2000, 0x0100, and 0x0001 bit values.<br>• 0x2000—If set (as it is by default), ROMMON runs from the image found in BootFROM1, if valid. If clear, ROMMON always runs the ROMMOM image in BootFROM0.<br>• 0x0100—Break or abort has no effect.<br>• 0x0001—NRP-2 boots the image specified with the **hw-module (image)** command.<br>• 0x0000—NRP-2 boots to ROMMON. |

## Defaults

**hw-module (image)**

No image identified

**hw-module (config-register)**

Configuration register value is 0x2101

**hw-module (reset)**

No default behavior or values

**hw-module (shutdown)**

Shutdown disabled

## Command Modes

Global configuration

The **reset** version of this command can be used in EXEC mode.

## Command History

| Release | Modification |
|---|---|
| 11.2 GS | This command was introduced. |
| 11.3(6)AA | This command was first supported on the Cisco AS5800. |
| 12.0(1)DB | This command was first supported on the Cisco 6400 NSP. |
| 12.0(9)SL | This command was first supported on the Cisco 10000 Edge Services Router (ESR). |

| Release | Modification |
|---|---|
| 12.0(1a)W5(5b) | This command was first supported on the Catalyst 8540 Multiservice ATM Switch Router (MSR), Catalyst 8510 MSR, and LightStream 1010 ATM switch router. |
| 12.1(4)DB | The **image** and **config-register** versions of this command were introduced on the Cisco 6400 NSP to support the NRP-2. |

## Usage Guidelines

### hw-module (image)

Enter at least one instance of this command for each NRP-2 in the Cisco 6400 system. Without the command in the NSP configuration, the NRP-2 attempts to load the default image (c6400r2sp-g4p5-mz) from the NSP disk0:/images/ directory. If the image cannot be located, the NRP-2 is not able to boot.

Cisco recommends that you store all NRP-2 images on the NSP PCMCIA "disk0:/images" directory, but you can also store NRP-2 images on any integrated file system (IFS) device, including disk1 and TFTP, FTP, or rcp servers.

For images in the disk0:/images directory, you can use a shortened **no** version of the command to remove an NRP-2 image specification: **no hw-module** *filename*.

The **hw-module (image)** command performs the same function for the NRP-2 as the **boot system** global configuration command does for the NRP-1. Because NRP-2 boot information is stored on the NSP, the **hw-module (image)** command is entered on the NSP.

**Note** The **boot system** global configuration command is not supported on the NRP-2.

### hw-module (config-register)

This command enables you to change the NRP-2 configuration register settings.

The **hw-module (config-register)** command performs the same function for the NRP-2 as the **config register** global configuration and **confreg** ROMMON mode commands do for the NRP-1. Because the NRP-2 ROM state information is stored on the NSP, the **hw-module (config-register)** command is entered on the NSP.

**Note** The **config register** global configuration and **confreg** ROMMON mode commands are not supported on the NRP-2.

### hw-module (reset)

This is the only version of the **hw-module** command that can be entered in EXEC mode. It can be used to reload the specified device from the NSP.

### hw-module (shutdown)

This command keeps the selected card offline, even through system reloads.

## Examples

### hw-module (image)

In the following example, the NRP-2 in slot 2 of the Cisco 6400 chassis has three images assigned with different priorities, while the NRP-2 in slot 3 has only one image assigned:

```
Switch(config)# hw-module slot 2 image c6400r2sp-g4p5-mz.DC priority 2
Switch(config)# hw-module slot 2 image tftp://10.1.1.1/c6400r2sp-g4p5-mz.DC priority 3
Switch(config)# hw-module slot 2 image disk0:MyDir/c6400r2sp-g4p5-mz.DC priority 4
Switch(config)# hw-module slot 3 image c6400r2sp-g4p5-mz.DC priority 2
```

**Timesaver** If you don't use all the priority values for NRP-2 images, consider leaving priority 1 free for new or temporary images.

### hw-module (config-register)

In the following example, the configuration register setting causes the NRP-2 in slot 4 to boot only to ROMMON mode:

```
Switch(config)# hw-module slot 4 config-register 0x0
```

In the following example, the configuration register setting causes the NRP-2 in slot 2 to boot the image specified with the **hw-module (image)** command:

```
Switch(config)# hw-module slot 2 config-register 0x1
```

### hw-module (reset)

In the following example, the device in slot 5 is reset:

```
Switch# hw-module slot 5 reset
*Sep 28 22:30:56.590:%NSP_OIR-6-FULL_CREM:Card NRP2 removed from slot:5
*Sep 28 22:30:58.510:%NSP_OIR-6-FULL_CINS:Card NRP2 inserted into slot:5
*Sep 28 22:30:58.510:%NSP_OIR-6-FULL_ONLINE:Card NRP2, slot:5, being brought online
```

In the following example, the NSP in slot 0A is reset:

```
Switch# hw-module nsp A reset
```

### hw-module (shutdown)

In the following example, the device in slot 4 is shutdown:

```
Switch(config)# hw-module slot 4 shutdown
```

# nrps

To telnet from the NSP to the NRP-2, use the **nrps** EXEC command alias.

**nrps***slot*

| Syntax Description | | |
|---|---|---|
| | *slot* | Slot number of the NRP-2 to which you want to telnet. Valid values are 1 to 8. |

**Defaults**

No default behavior or values.

**Command Modes**

EXEC (alias)

**Command History**

Not applicable for command aliases

**Usage Guidelines**

This is a command alias that telnets to the NRP-2.

You need to set the VTY line password before you can telnet to the NRP-2.

**Examples**

In the following example, the user telnets from the NSP to the NRP-2 in slot 4 of the Cisco 6400 chassis, enters privileged EXEC mode, and then exits the Telnet session.

```
NSP# nrps4
Trying 10.4.0.2 ... Open

Router> enable
Router# exit

[Connection to 10.4.0.2 closed by foreign host]
NSP#
```

# show controllers async

To display information on the NRP-2 PAM mailbox serial interface from the NSP, use the **show controllers async** EXEC command.

**show controllers async**

## Syntax Description

This command has no arguments or keywords.

## Defaults

No default behavior or values.

## Command Modes

EXEC

## Command History

| Release | Modification |
|---|---|
| 11.2 | This command was introduced on the Cisco 1005 router. |
| 11.3(2)T | This command was introduced on Cisco 3600 series routers. |
| 12.1(4)DB | This command was introduced on the Cisco 6400 NSP, to support the NRP-2. |

## Usage Guidelines

On the Cisco 6400, the **show controllers async** command can be used on the NSP or NRP-2 to view information for the NRP-2 PAM mailbox serial interface.

## Examples

In the following example, the **show controllers async** command is used to view the NRP-2 PAM mailbox serial interface from the NSP:

```
NSP# show controllers async
Async NRP2 Pam bus controller
TTY line 1 not available
TTY line 2 not available
TTY line 3 not available
TTY line 4 not available
TTY line 5 not available
TTY line 6
PAM bus data for mailbox at 0xA8A8FFC0
   magic1 = 0xDEADBABE, magic2 = 0x21524541
   in_data = 0x0000000D, out_data = 0x0000003E
   in_status.received_break = 0
   out_status.received_break = 0
   tx_owned = TRUE, rx_owned = FALSE
Buffer information
   Rx ttycnt 0
   Tx ttycnt 0
   Rx Buffs:inpk 0/0 inheadpk 0 dataq 0 0 0
            pakq 0 0 0
   Tx Buffs:outpk 0  txpkq 0 0 0
   Rx totalin 1302 Tx totalout 69
```

```
TTY line 7 not available
TTY line 8 not available
TTY line 9 not available
TTY line 10 not available
TTY line 11 not available
TTY line 12 not available
TTY line 13 not available
TTY line 14
PAM bus data for mailbox at 0xA8E8FFC0
   magic1 = 0xDEADBABE, magic2 = 0x21524541
   in_data = 0x00000000, out_data = 0x00000000
   in_status.received_break = 0
   out_status.received_break = 0
   tx_owned = TRUE, rx_owned = FALSE
Buffer information
   Rx ttycnt 0
   Tx ttycnt 0
   Rx Buffs:inpk 0/0 inheadpk 0 dataq 0 0 0
            pakq 0 0 0
   Tx Buffs:outpk 0  txpkq 0 0 0
   Rx totalin 0 Tx totalout 0
TTY line 15 not available
TTY line 16 not available
NSP#
```

# snmp-server forwarder

To enable the SNMPv3 proxy forwarder, use the **snmp-server forwarder** global configuration command. To disable the proxy forwarder, use the **no** form of this command.

**snmp-server forwarder**

**no snmp-server forwarder**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Disabled

## Command Modes

Global configuration

## Command History

| Release | Modification |
|---|---|
| 12.1(4)DB | This command was introduced on the Cisco 6400 NSP to support the NRP-2. |

## Usage Guidelines

The SNMPv3 Proxy Forwarder feature enables all NSP and NRP-2 components of the Cisco 6400 system to be managed as one functional entity. With the Proxy Forwarder feature enabled, the NSP:

- Forwards all SNMPv3 formatted messages (such as manager requests to get or set data) destined for the NRP-2s
- Routes the SNMPv3 formatted traps from NRP-2s to the NSP combined Network Management Ethernet (NME) interface

When the NSP and NRP-2 are properly configured for SNMPv3 and the Proxy Forwarder feature, both the NSP and NRP-2 automatically generate a series of SNMP commands. Do not modify or delete the automatically generated commands, because doing so may prevent SNMP from working properly.

## Examples

In the following example, the NSP is configured to act as the proxy forwarder:

```
snmp-server group usmgrp v3 noauth
snmp-server user usmusr usmgrp v3
→ snmp-server forwarder
snmp-server host 10.100.100.100 vrf 6400-private version 3 noauth trapusr
```

The previous commands cause the NSP to automatically generate the following commands:

```
snmp-server engineID remote 10.3.0.2 vrf 6400-private 80000009030000107BA9C7A0
snmp-server user trapusr trapusr v3
snmp-server user trapusr trapusr remote 10.3.0.2 vrf 6400-private v3
snmp-server user usmusr usmgrp remote 10.3.0.2 vrf 6400-private v3
snmp-server group trapusr v3 noauth notify *tv.FFFFFFFF.FFFFFFFF
```

In the following example, the NRP-2 is configured to allow the NSP to act as the proxy forwarder:

```
snmp-server group usmgrp v3 noauth
snmp-server user usmusr usmgrp v3
snmp-server enable traps
snmp-server host 10.3.0.1 vrf 6400-private version 3 noauth trapusr
```

The previous commands cause the NRP-2 to automatically generate the following commands:

```
snmp-server user trapusr trapusr v3
snmp-server group trapusr v3 noauth notify *tv.FFFFFFFF.FFFFFFFF
snmp-server enable traps snmp authentication linkdown linkup coldstart
snmp-server enable traps config
snmp-server enable traps syslog
snmp-server enable traps bgp
snmp-server enable traps ipmulticast
snmp-server enable traps rsvp
snmp-server enable traps frame-relay
snmp-server enable traps rtr
```

## Related Commands

The SNMPv3 Proxy Forwarder feature requires the NSP and NRP-2 to be configured using specific options in the **snmp-server** global configuration commands:

| NSP Command | Description |
|---|---|
| **snmp-server group** *groupname* **v3 noauth** | Configures a new SNMPv3 group. |
| **snmp-server user** *username groupname* **v3** | Configures a new user to the SNMPv3 group. |
| **snmp-server host** *host-address* **vrf 6400-private version 3 noauth** *username* | Specifies the recipient of NRP-2 SNMPv3 trap messages. |

| NRP-2 Command | Description |
|---|---|
| **snmp-server group** *groupname* **v3 noauth** | Configures a new SNMPv3 group. Make sure that the *groupname* matches that entered on the NSP. |
| **snmp-server user** *username groupname* **v3** | Configures a new user to an SNMPv3 group. Make sure that the *username* and *groupname* match those entered on the NSP. |
| **snmp-server enable traps** [**config** \| **syslog** \| **bgp** \| **ipmulticast** \| **rsvp** \| **frame-relay** \| **rtr** \| **snmp authentication linkdown linkup coldstart**] | Enables the NRP-2 to send traps. Optionally, you can select from specific types of traps. |
| **snmp-server host 10.***nrp2-slot***.0.1 vrf 6400-private version 3 noauth** *username* | Specifies the NSP as the recipient of SNMPv3 trap messages. The **10.***nrp2-slot***.0.1** IP address is the private address for the internal NSP interface to the NRP-2 PAM mailbox serial interface. |

# NRP-2 Debug Commands

This section documents new or modified **debug** commands. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

- **debug pmbox**
- **debug se64**
- **debug xconn**

# debug pmbox

To display debug messages for traffic flowing on the NRP-2 PAM mailbox serial interface, use the **debug pmbox** EXEC command. The **no** form of this command disables debugging output.

**debug pmbox** {**events** | {**rx-path** | **tx-path**} {**all** | **config-download** | **config-update** | **diag** | **driver** | **ehsa** | **force-fail** | **image-download** | **info-request** | **nrp** | **ping** | **status-update** | **syslog** | **test1** | **test2** | **xc-request** | **xc-response**}}

**no debug pmbox** {**events** | {**rx-path** | **tx-path**} {**all** | **config-download** | **config-update** | **diag** | **driver** | **ehsa** | **force-fail** | **image-download** | **info-request** | **nrp** | **ping** | **status-update** | **syslog** | **test1** | **test2** | **xc-request** | **xc-response**}}

## Syntax Description

| | |
|---|---|
| **events** | Displays PAM mailbox messaging events. Traces routine execution as message are moved from one CPU to another. |
| **rx-path** | Selects messages received by the PAM mailbox serial interface from the NSP. |
| **tx-path** | Selects messages transmitted by the PAM mailbox serial interface to the NSP. |
| **all** | Displays all messages. |
| **config-download** | Displays configuration download messages. |
| **config-update** | Displays configuration update messages. |
| **diag** | Displays diagnostic messages. |
| **driver** | Displays driver messages. |
| **ehsa** | Displays enhanced high system availability (EHSA) messages. |
| **force-fail** | Displays force failover messages. |
| **image-download** | Displays image download messages. |
| **info-request** | Displays information request messages. |
| **nrp** | Displays NRP messages. |
| **ping** | Displays ping messages. |
| **status-update** | Displays status update messages. |
| **syslog** | Displays PAM mailbox system log messages. |
| **test1** | Displays test1 messages. |
| **test2** | Displays test2 messages. |
| **xc-request** | Displays cross connect request messages. |
| **xc-response** | Displays cross connect response messages. |

## Defaults

No default behavior or values.

## Command History

| Release | Modification |
|---|---|
| 12.1(4)DC | This command was introduced on the Cisco 6400 NRP-2. |

## Examples

In the following example, image download messages are received and transmitted by the PAM mailbox serial interface of the NRP-2 in slot 5. Notice that the request messages are 24 bytes long and the response messages are 12288 bytes long.

```
Switch# debug pmbox rx-path tx-path image-download

Switch#
RX(5/0) type:IMAGE DNLD, len = 24
TX(5/0) type:IMAGE DNLD, len = 12288
RX(5/0) type:IMAGE DNLD, len = 24
TX(5/0) type:IMAGE DNLD, len = 12288
RX(5/0) type:IMAGE DNLD, len = 24
TX(5/0) type:IMAGE DNLD, len = 12288
```

# debug se64

To display debug messages for the NRP-2 ATM SAR, use the **debug se64** EXEC command. The **no** form of this command disables debugging output.

**debug se64** {**detail** | **errors**}

**no debug se64** {**detail** | **errors**}

## Syntax Description

| | |
|---|---|
| **detail** | Enables the **show controllers atm 0/0/0** privileged EXEC command to display internal ATM SAR data and register values. |
| **errors** | Displays run time SAR driver error information. |

## Defaults

No default behavior or values.

## Command History

| Release | Modification |
|---|---|
| 12.1(4)DC | This command was introduced on the Cisco 6400 NRP-2. |

## Examples

In the following example, the debug output shows that the SAR was not ready to transmit packets:

```
NRP-2# debug se64 errors

NRP-2#
01:39:05:%SYS-5-CONFIG_I:Configured from console by console
01:39:15:%NRP2_SE64-3-LLD_SNDPAK_SARNOTREADY:SAR not ready during packet TX:
vcd 2644
-Traceback= 60124A88 601CFF28 6012D878 602EFBCC 802C7EAC
01:39:45:%NRP2_SE64-3-LLD_SNDPAK_SARNOTREADY:SAR not ready during packet TX:
vcd 2249
-Traceback= 60124A88 601CFF28 6012D878 602EFBCC 802C7EAC
01:40:15:%NRP2_SE64-3-LLD_SNDPAK_SARNOTREADY:SAR not ready during packet TX:
vcd 3810
```

## Related Commands

| Command | Description |
|---|---|
| **show controllers atm 0/0/0** | Displays information on the physical ATM interface. |

# debug xconn

To track the requests and responses for the cross-connect information protocol, use the **debug xconn** EXEC command. The **no** form of this command disables debugging output.

**debug xconn**

**no debug xconn**

## Syntax Description

This command has no keywords or arguments.

## Defaults

No default behavior or values.

## Command History

| Release | Modification |
|---|---|
| 12.1(4)DC | This command was introduced on the Cisco 6400 NRP-2. |

## Examples

The debug output contains the following information:

- Message type
  - O—Outstanding message
  - A—Resent message
  - R—Received message
  - P—Postponed message to be deferred until correct responses are received
- Total number of outstanding messages
- Total number of pending messages
- VC

In the following example, the debug output tracks the requests and responses for the cross-connect information protocol on VC 42/52. One request message is sent and identified as outstanding, then is resent three times. Finally, a response message is received, reducing the total number of outstanding messages to 0. This example includes no pending messages:

```
1w3d:O (1-0) 42/52
1w3d:A (1-0) 42/52
1w3d:A (1-0) 42/52
1w3d:A (1-0) 42/52
1w3d:R (0-0) 42/52
```

## Related Commands

| Command | Description |
|---|---|
| **show chassis xconn** | Displays the current state of the cross-connect information requests from the NRP-1 or NRP-2 to the NSP. |

# NSP Debug Commands

This section documents new or modified **debug** commands. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

- **debug config-download**
- **debug image-download**

# debug config-download

The Cisco 6400 uses a download protocol to download the NRP-2 startup configuration from the NSP. The download protocol and data pass through the NRP-2 PAM mailbox serial interface. To view the configuration download protocol message header types as they are received on the PAM mailbox serial interface, use the **debug config-download** EXEC command. The **no** form of this command disables debugging output.

**debug config-download**

**no debug config-download**

## Syntax Description

This command has no keywords or arguments.

## Defaults

Disabled

## Command History

| Release | Modification |
|---|---|
| 12.1(4)DC | This command was introduced on the Cisco 6400 NSP to support the NRP-2. |

## Examples

In the following example, the **debug config-download** command is used to display configuration download protocol monitoring information:

```
switch# debug config-download
CDNLD debugging is on
Switch#
00:01:39:CDNLD(6/0):WRR
00:01:39:CDNLD(6/0):DR
00:01:39: do_chksum num_bytes = 610
00:01:39: calc cksum = 0xC405
00:01:39:CDNLD(6/0):DR
```

## Related Commands

| Command (Entered on the NRP-2) | Description |
|---|---|
| `NRP-2# debug pmbox rx-path config-download` | Displays configuration download messages received by the NRP-2 PAM mailbox serial interface. |
| `NRP-2# debug pmbox tx-path config-download` | Displays configuration download messages transmitted by the NRP-2 PAM mailbox serial interface. |

# debug image-download

The Cisco 6400 uses a download protocol to download the NRP-2 image from the NSP or integrated file system (IFS). The download protocol and data pass through the NRP-2 PAM mailbox serial interface. To view the image download protocol message header types as they are received on the PAM mailbox serial interface, use the **debug image-download** EXEC command. The **no** form of this command disables debugging output.

**debug image-download** [**tftp**]

**no debug image-download**

## Syntax Description

| | |
|---|---|
| **tftp** | Also displays TFTP download messages. |

## Defaults

Disabled

## Command History

| Release | Modification |
|---|---|
| 12.1(4)DC | This command was introduced on the Cisco 6400 NSP to support the NRP-2. |

## Related Commands

| Command (Entered on the NRP-2) | Description |
|---|---|
| `NRP-2# debug pmbox rx-path image-download` | Displays image download messages received by the NRP-2 PAM mailbox serial interface. |
| `NRP-2# debug pmbox tx-path image-download` | Displays image download messages transmitted by the NRP-2 PAM mailbox serial interface. |

# Glossary

**ABR**—available bit rate. QoS class defined by the ATM Forum for ATM networks. ABR is used for connections that do not require timing relationships between source and destination. ABR provides no guarantees in terms of cell loss or delay, providing only best-effort service. Traffic sources adjust their transmission rate in response to information they receive describing the status of the network and its capability to successfully deliver data. Compare with CBR, UBR, and VBR.

**BPE**—Backplane Ethernet.

**CBR**—constant bit rate. QoS class defined by the ATM Forum for ATM networks. CBR is used for connections that depend on precise clocking to ensure undistorted delivery. Compare with ABR, UBR, and VBR.

**CRC**—cyclic redundancy check. Error-checking technique in which the frame recipient calculates a remainder by dividing frame contents by a prime binary divisor and compares the calculated remainder to a value stored in the frame by the sending node.

**FTP**—File Transfer Protocol. Application protocol, part of the TCP/IP protocol stack, used for transferring files between network nodes. FTP is defined in RFC 959.

**GBIC**—gigabit interface converter.

**GCRA**—generic cell rate algorithm. In ATM, an algorithm that defines conformance with respect to the traffic contract of the connection. For each cell arrival, the GCRA determines whether the cell conforms to the traffic contract.

**GE**—gigabit Ethernet.

**IFS**—integrated file system, such as TFTP, FTP, or rcp servers.

**MBS**—maximum burst size. In an ATM signaling message, burst tolerance is conveyed through the MBS, which is coded as a number of cells. The burst tolerance together with the SCR and the GCRA determine the MBS that can be transmitted at the peak rate and still be in conformance with the GCRA. See also SCP and GCRA.

**MTU**—maximum transmission unit. Maximum packet size, in bytes, that a particular interface can handle.

**NME**—network management Ethernet. The local area network used to control and manage equipment in a Central Office and branch locations. The NME connection on the Cisco 6400 is an RJ-45 connector for a 10BaseT port on the NSP module.

**NRP**—node route processor. One of the component modules used in the Cisco 6400. This module is the Layer 3 element for the Cisco 6400 responsible for implementing the routing function.

**NRP-1**—Node route processor that incorporates a 100-Mbps Fast Ethernet interface for connecting into an IP network and has processing capability for OC-3 rate of user traffic. Compare with NRP-2.

**NRP-2**—Node route processor that provides a Gigabit Ethernet interface and sufficient processing capability for handling OC-12 rate of user traffic. Compare with NRP-1.

**NSP**—node switch processor. Node switch processor. One of the component modules used in the Cisco 6400. This module is responsible for all ATM switching and control functions within the Cisco 6400.

**OC**—Optical carrier. A series of physical protocols (OC-3, OC-12, and so on), defined for SONET optical signal transmissions.

**PAM mailbox serial interface**—Backplane interface that connects the NSP and the NRP-2. Used for internal communication only, the PAM mailbox serial interface is not intended to carry user data.

**PCMCIA**—Personal Computer Memory Card International Association. Refers to a standard used for credit-card sized computer peripherals. Type I devices are very thin memory cards: Type 2 devices include most modems and interfaces; and Type 3 devices are used for disk drives and thicker components.

**PCR**—peak cell rate. Parameter defined by the ATM Forum for ATM traffic management. In CBR transmissions, PCR determines how often data samples are sent. In ABR transmissions, PCR determines the maximum value of the ACR.

**QoS**—quality of service. Measure of performance for a transmission system that reflects its transmission quality and service availability.

**rcp**—remote copy protocol. Protocol that allows users to copy files to and from a file system residing on a remote host or server on the network. The rcp protocol uses TCP to ensure the reliable delivery of data.

**ROMMON**—ROM Monitor.

**SAR**—segmentation and reassembly.

**SCR**—Parameter defined by the ATM Forum for ATM traffic management. For VBR connections, SCR determines the long-term average cell rate that can be transmitted. See also VBR.

**SNMP**—Simple Network Management Protocol. Network management protocol used almost exclusively in TCP/IP networks. SNMP provides a means to monitor and control network devices, and to manage configurations, statistics collection, performance, and security.

**TFTP**—Trivial File Transfer Protocol. Simplified version of FTP that allows files to be transferred from one computer to another over a network.

**UBR**—unspecified bit rate. QoS class defined by the ATM Forum for ATM networks. UBR allows any amount of data up to a specified maximum to be sent across the network, but there are no guarantees in terms of cell loss rate and delay. Compare with ABR, CBR, and VBR.

**VBR**—variable bit rate. QoS class defined by the ATM Forum for ATM networks. VBR is subdivided into a real time (RT) class and non-real time (NRT) class. VBR-RT is used for connections in which there is a fixed timing relationship between samples. VBR-NRT is used for connections in which there is no fixed timing relationship between samples, but that still need a guaranteed QoS. Compare with ABR, CBR, and UBR.

**VCD**—virtual circuit descriptor. When you create a PVC, you create a VCD and attach it to the VPI and VCI. A VCD identifies which VPI/VCI to use for a particular packet. The number chosen for the VCD is independent of the VPI/VCI used.