Basic NRP Configuration

This chapter describes how to perform a basic configuration for the node route processors (NRP-1 and NRP-2). The Cisco 6400 can contain multiple NRP modules, configured to operate independently or as 1+1 redundant pairs (NRP-1 only at this time). This chapter contains the following sections:

For information on differences between the NRP-1 and NRP-2, see the release notes for your specific software images. Also see Table 1-1 on page 1-4.

NRP-1 Configuration

This section describes configuration information specific to the NRP-1, including:

Methods Available for Configuring the NRP-1

The following methods are available for configuring the NRP-1:

- From a local console or workstation—Connect to the console port of the NRP-1.
- From a remote console or workstation—Initiate a Telnet connection to the NRP-1 over the NME interface.
- From the Cisco 6400 Service Connection Manager—See the Cisco 6400 SCM documentation.

For general information on basic Cisco IOS configuration, see the *Cisco IOS Configuration Fundamentals Configuration Guide*.

Note If your Telnet station or Simple Network Management Protocol (SNMP) network management workstation and the Cisco 6400 are on different networks, you must either use Dynamic Host Configuration Protocol (DHCP) to provide a default route, or add a static routing table entry to the routing table. To assign a static IP route, use the **ip route** global configuration command.

Initial NRP-1 Configuration

An NRP-1 running Cisco IOS Release 12.0(5)DC or later comes preinstalled with a default configuration and does not require initial configuration.

The following sections describe how to configure the NRP-1 for the first time:

- Using DHCP, page 3-2
- Checking the Software Release Version and Choosing the Configuration Method, page 3-2
- Configuring the NRP-1, page 3-3
- Verifying the Initial NRP-1 Configuration, page 3-4

Using DHCP

If you plan to configure a DHCP server to inform the NRP-1 of its IP address and mask, write down the Media Access Control (MAC) address of the server's Ethernet port.

Optionally, take note of a default gateway address and static routes to the DHCP server.

Note The Cisco 6400 performs a DHCP request *only* if the NME interface is configured with the **ip address negotiated** interface configuration command.

DHCP is the default IP assignment protocol for a new NRP-1, or for an NRP-1 that has had its configuration file cleared by means of the **erase nvram:startup-config** command. For DHCP, an Ethernet IP address, subnet mask, and the default route are retrieved from the DHCP server for any interface set with the **ip address negotiated** command. To configure DHCP, add an entry in the DHCP database using the instructions that came with your DHCP server.

Checking the Software Release Version and Choosing the Configuration Method

Complete the following steps to check the software release version and prepare for initial configuration:

Step 1 Connect a console terminal or a terminal server to the NRP-1 console port on the NRP-1 faceplate.

After the NRP-1 autoboots, the following information appears to verify that the router has booted successfully.

Take note of the software release version included in the display. For information on upgrading to a higher release version, see Appendix B, "Upgrading Software on the Cisco 6400."

```
                Restricted Rights Legend

Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
```

```
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

           cisco Systems, Inc.
           170 West Tasman Drive
           San Jose, California 95134-1706



Cisco Internetwork Operating System Software
IOS (tm) C6400R Software (C6400R-G4P5-M), Version 12.1(4.4)DC1, EARLY
DEPLOYMENT RELEASE SOFTWARE (fc1)
Copyright (c) 1986-2000 by cisco Systems, Inc.
Compiled Thu 14-Dec-00 2314 by leccese
Image text-base 0x60008960, data-base 0x60D2A000

cisco NRP (NRP1) processor with 94208K/36864K bytes of memory.
R5000 CPU at 200Mhz, Implementation 35, Rev 2.1, 1024KB L2 Cache
Last reset from BOOTFLASH
X.25 software, Version 3.0.0.
Bridging software.
2 Ethernet/IEEE 802.3 interface(s)
1 FastEthernet/IEEE 802.3 interface(s)
1 ATM network interface(s)
125K bytes of non-volatile configuration memory.

4096K bytes of Boot flash ROM (Sector size 256K).
8192K bytes of Flash SIMM (Sector size 256K).


Press RETURN to get started!
```

Step 2 Press **Return**. After a few seconds, the user EXEC prompt `Router>` appears. Use the **enable** EXEC command to enter privileged EXEC mode:

```
Router> enable
Router#
```

The prompt changes to the privileged EXEC prompt, from which you can manually configure the NRP-1. Proceed to the "Configuring the NRP-1" section on page 3-3.

Configuring the NRP-1

To perform an initial basic NRP-1 configuration, complete the following steps:

Step 1 Use the **configure terminal** privileged EXEC command to enter global configuration mode:

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

The prompt changes to the global configuration mode prompt.

Step 2 Enter the enable secret (which is a secure encrypted password) and the enable password (which is a nonencrypted password). The passwords should be different for maximum security. The following example sets the enable secret to "walnut" and the enable password to "pecan":

```
Router(config)# enable secret walnut
Router(config)# enable password pecan
```

An enable secret can contain from 1 to 25 uppercase and lowercase alphanumeric characters; an enable password or virtual terminal password can contain any number of uppercase and lowercase alphanumeric characters. In all cases, a number cannot be the first character. Spaces are also valid password characters. Leading spaces are ignored; trailing spaces are recognized.

Step 3 Enter a host name for the NRP-1. The default host name is `Router`. The host name appears in the CLI prompt.

```
Router(config)# hostname NRP-1
NRP-1(config)#
```

Step 4 If you are upgrading the NRP-1 from an earlier software version to Cisco IOS Release 12.0(5)DC or later, you can configure the NRP-1 to support network management Ethernet (NME) consolidation with the NSP. Complete the following steps to enable NME consolidation:

a. Enter interface configuration mode for Ethernet 0/0/0:

```
NRP-1(config)# interface ethernet 0/0/0
```

b. Remove any IP address and subnet mask associated with Ethernet 0/0/0:

```
NRP-1(config-if)# no ip address
```

c. Enter interface configuration mode for Ethernet 0/0/1:

```
NRP-1(config-if)# interface ethernet 0/0/1
```

d. Choose one of the following methods of assigning the IP address to Ethernet 0/0/1:

- Enable the DHCP server to obtain an IP address for Ethernet 0/0/1:

```
NRP-1(config-if)# ip address negotiated
```

or

- Assign a static IP address to Ethernet 0/0/1:

```
NRP-1(config-if)# ip address 172.26.94.158 255.255.255.0
```

e. Return to privileged EXEC mode:

```
NRP-1(config-if)# ^Z
```

Step 5 Store the running configuration in NVRAM as the startup configuration:

```
NRP-1# copy system:running-config nvram:startup-config
Destination filename [nrp-startup-config]? <cr>
847927 bytes copied in 280.48 secs (3028 bytes/sec)
NRP-1#
```

When the NRP-1 reloads, it runs the startup configuration. If you do not perform Step 5, your configuration changes will be lost the next time you reload the NRP-1.

Your NRP-1 is now minimally configured and will reload with the configuration you have entered. To see a list of the configuration commands available to you, enter **?** at the prompt or press the **help** key while you are in configuration mode.

Verifying the Initial NRP-1 Configuration

To check the running configuration, use the **more system:running-config** EXEC command.

To check the startup configuration in NVRAM, use the **more nvram:startup-config** EXEC command.

Segmentation and Reassembly Buffer Management

In Cisco IOS Release 12.1(1)DC, the following segmentation and reassembly (SAR) buffer management enhancements were introduced:

- Reduced Segmentation Buffer Size—Prior to this release, the default size of the PVC segmentation buffer was 256 packets. This meant that each PVC could queue up to 256 packets to be segmented and sent. Now the default size is 32 packets, and a new command allows you to manually change the segmentation buffer size.
- Increased Input/Output Memory Size—Prior to this release, the default input/output (I/O) memory size was 16 MB for NRP-1s with 64 MB or 128 MB DRAM. Now the default I/O memory size is 18 MB for an NRP-1 with 64 MB DRAM, and 36 MB for an NRP-1 with 128 MB DRAM. You can also manually set the I/O memory size with an environment variable under ROM monitor (ROMMON).
- Reserved Segmentation Buffer Slot for High-Priority Packets—For each PVC, a segmentation buffer slot is reserved for high-priority packets.

These SAR buffer management enhancements reduce the amount of memory resources that can be held by congested PVCs. This prevents a small group of congested PVCs from using all available memory resources and adversely affecting the performance of other PVCs. The enhancements also improve high-priority packet transmission. With a segmentation buffer slot reserved for high-priority packets, each PVC accommodates high-priority packets even when the segmentation buffer is full.

Note Because of process memory usage, setting the I/O memory size to a larger value might reduce the number of sessions that your NRP-1 can handle.

Setting the Segmentation Buffer Size

To manually set the size of all PVC segmentation buffers, complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# service internal`	Enables modification of PVC segmentation buffers.
Step 2	`Router(config)# interface atm 0/0/0`	Specifies the ATM interface.
Step 3	`Router(config-if-atm-vc)# atm vc tx number`	Sets the maximum number of packets in the PVC segmentation buffers.

Example

In the following example, the PVC segmentation buffer size is set to 64 packets.

```
!
service internal
interface atm 0/0/0
 atm vc tx 64
 !
```

Verifying the PVC Segmentation Buffer Size

To verify successful configuration of the segmentation buffer size, use the **show running-config** EXEC command.

Setting the I/O Memory Size

To manually set the size of I/O memory, enter the following command in ROMMON mode:

Command	Purpose
`Rommon> IOMEM=size`	Sets the size, in MB, of I/O memory. Allowed values depend on the amount of DRAM on your NRP, and they are listed in Table 3-1.

Table 3-1 Allowed Values of I/O Memory on the Cisco 6400 NRP-1

Main Memory on NRP-1	Allowed I/O Memory Range	Default IOMEM Setting
64 MB DRAM	18 MB to 24 MB	18 MB
128 MB DRAM	18 MB to 60 MB	36 MB

Note IOMEM entries must be an even number. If you enter an odd number, the NRP-1 will round it down to an even number. If you enter a number outside of the allowed I/O memory range, the NRP-1 will use the default IOMEM setting. You can also enter **unset IOMEM** in ROMMON to return to the default setting.

Example

In the following example, the I/O memory size is set to 20 MB.

```
Rommon> IOMEM=20
```

Verifying the I/O Memory Size

To verify that you successfully set the I/O memory size, use the **show memory** EXEC command. The following example shows an NRP-1 with an I/O memory size of 16 MB:

```
Router# show memory
                Head    Total(b)    Used(b)    Free(b)   Lowest(b)  Largest(b)
Processor   60E27540   35490496    5517076   29973420   14919296   29838876
    I/O      3000000   16777216    6006460   10770756    5385388   10770108
```

Using the NRP-1 File Systems and Memory Devices

File systems on the NRP-1 include read-only memory (system), read-write memory (NVRAM), Flash memory (boot flash), and remote file systems (such as TFTP, FTP, and rcp servers). Use the **show file systems** privileged EXEC command to display the valid file systems on your NRP-1:

```
Router# show file systems
File Systems:

     Size(b)     Free(b)      Type  Flags  Prefixes
           -           -     flash     rw   sec-flash:
           -           -     flash     rw   sec-bootflash:
           -           -     nvram     rw   sec-nvram:
*    3407872      249884     flash     rw   bootflash:
     7602176     3905620     flash     rw   flash:
           -           -    opaque     rw   null:
```

```
          -           -    opaque     rw   system:
          -           -   network     rw   tftp:
     129016      128049     nvram     rw   nvram:
          -           -    opaque     wo   lex:
          -           -   network     rw   rcp:
          -           -   network     rw   ftp:

Router#
```

Use the **dir** command to show the contents of a file system. Remember to include the trailing colon in the name of the file system:

```
Router# dir bootflash:
Directory of bootflash:/

  1  -rw-     3157860   Jul 15 2000 03:45:14  c6400r-boot-mz.120-5.DC

3407872 bytes total (249884 bytes free)
Router#
```

If your Cisco 6400 system is configured with redundant NRP-1s, use the **dir** command with file systems that begin with **sec-** to show file systems on the secondary (redundant) NRP-1. For example, **dir sec-nvram:** will show the contents of the NVRAM on the secondary NRP-1.

NRP-2 Configuration

This section describes information specific to the NRP-2, and includes the following subsections:

Restrictions

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

The maximum transmission unit (MTU) of the NRP-2 ATM interface to the backplane is 1900 bytes. Any incoming ATM 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" section on page 3-10.

VPI and VCI Limitations

Virtual path identifier (VPI) and virtual channel identifier (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 on the NRP-2" section on page 3-13.

Prerequisites

- A Personal Computer Memory Card International Association (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 release versions for the system images on the NRP-2 and the NSP.
- Copy the NRP-2 image to a TFTP server on the local management network or to the PCMCIA disk in NSP disk slot 0.
- Complete the NSP configuration tasks in the "NRP-2 Support" section on page 2-19.

Methods Available for Configuring the NRP-2

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

- Accessing the NRP-2 Console Through the NSP
- Using Telnet to Connect to the NRP-2 from the NSP

You can also configure the NRP-2 with the Cisco 6400 Service Connection Manager, Release 2.2(1) and later. For more information, see the Cisco 6400 SCM documentation.

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, use Telnet to connect to the NSP as a communication server, using the port numbers shown in Table 3-2 to select the NRP-2.

Table 3-2 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

Table 3-2 Internal NSP Communication Server Port-Slot Associations (continued)

NSP Communication Server Port Numbers	Associated Cisco 6400 Chassis Slot
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 x**. 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 from another router:

```
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 full escape sequence does not appear as you enter it in the command-line interface (CLI):

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

Using Telnet to Connect to the NRP-2 from the NSP

The NSP is equipped with command aliases for using Telnet to connect to an NRP-2 in the same Cisco 6400 chassis. To use Telnet to connect to the NRP-2, use the following NSP command alias in EXEC mode:

Command	Purpose
`Switch# nrps`*slot*	Uses Telnet to connect to the NRP-2 in the specified slot.

Note Set the enable password for the NSP before you use Telnet to connect 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 use Telnet to connect 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 use Telnet to connect to the NRP-2, first connect to the NSP, and then use the **nrps** command alias to connect 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 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

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 virtual connections.

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 virtual connection 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. The 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.

Modifying VPI and VCI Ranges on the NRP-2

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 3-3 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 3-3 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
....
```

Saving the NRP-2 Startup Configuration

To save the NRP-2 running configuration to NVRAM as the startup configuration, use the **copy** EXEC command:

```
NRP-2# copy system:running-config nvram:startup-config
Destination filename [nrp-startup-config]? <cr>
847927 bytes copied in 280.48 secs (3028 bytes/sec)
NRP-2#
```

Note Although the prompt displays the destination filename of `nrp-startup-config`, the NRP-2 uses the filename `nrp2-startup-config` and saves it in the NSP PCMCIA disk0:/slot*n*/ directory, where *n* is the slot in which the NRP-2 is installed.

When the NRP-2 reloads, it runs the startup configuration. If you do not save to the startup configuration, your configuration changes will be lost the next time you reload the NRP-1.

Using NRP-2 Console and 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.

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(config)# no logging console`	NRP-2	Stops NRP-2 system log messages from appearing on the NSP and NRP-2 consoles. Messages are still logged on the NSP.
`Switch(config)# no logging console`	NSP	Stops NRP-2 system log messages from appearing 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*.

Troubleshooting and Monitoring the NRP-2

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

Debug Command (Entered on the NRP-2)	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.

Debug Command (Entered on the NSP)	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. 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.

Use the following commands to monitor and maintain the NRP-2:

Command	Purpose
NRP-2> **who** 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* 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.

Example—Using the who and clear Commands on the NSP

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#
```

Example—Using the show line Command on the 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#
```

Example—Using the show line Command on the NRP-2

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>
```

Example—Using the show controller async Command on the NRP-2

In the following example, the **show controller async** EXEC command is used to monitor 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>
```

Example—Using the show controller async Command on the NSP

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#
```

Transferring an NRP-1 Configuration to an NRP-2

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:

a. All VPI and VCI values are accepted by the NRP-2 default ranges (VPI range is 0–15, and VCI range is 0–1023).

b. The ATM MTU settings are less than 1900 bytes and match the MTU settings on the network neighbors.

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 source cardtype slot 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
```

Permanent Virtual Circuits

Permanent virtual circuits (PVCs) are used to connect the NRP to the ATM interfaces of the NSP and node line cards (NLCs) in the Cisco 6400 chassis. Typically, each subscriber is bound to a specific NRP and should be configured as a separate PVC.

The following sections describe common methods of configuring PVCs:

- Configuring PVCs on the ATM Interface, page 3-20
- Configuring PVCs on ATM Subinterfaces, page 3-21
- Configuring VC Classes, page 3-23
- Configuring PVC Discovery, page 3-25
- Configuring PVC Traffic Shaping, page 3-26

For more general information on configuring PVCs, refer to the “Configuring ATM” chapter in the *Cisco IOS Wide-Area Networking Configuration Guide* associated with your software release version.

Note Any PVC configured on the NRP must also be configured for the corresponding ATM interface on the NSP. See the “Internal Cross-Connections” section on page 2-10.

Configuring PVCs on the ATM Interface

To configure a PVC on the ATM interface, complete the following steps beginning in global configuration mode:

	Command	Description
Step 1	`Router(config)# interface atm 0/0/0`	Specifies the NRP ATM interface and enters interface configuration mode.
Step 2	`Router(config-if)# pvc [name] vpi/vci`	Configures a new ATM PVC by assigning a name (optional) and VPI/VCI values. Enters ATM VC configuration mode.

Step 3	`Router(config-if-atm-vc)# encapsulation {aal5snap | aal5nlpid}`
	or
	`Router(config-if-atm-vc)# encapsulation {aal5mux ppp | aal5autoppp | aal5ciscoppp} virtual-template number`
		Configures the ATM adaptation layer (AAL) and encapsulation type for a PVC. May configure a PVC to use a virtual template[1] as the default PPP interface configuration.

1. A virtual template assigns PPP features (such as authentication and IP address assignment method) to a PVC. Virtual templates are used when configuring PPP over ATM (PPPoA), PPP over Ethernet (PPPoE), and Layer 2 Tunneling Protocol (L2TP).

Example—PVC with AAL5 SNAP Encapsulation on an ATM Interface

The following example shows a typical PVC configuration using the ATM adaptation layer 5 (AAL5) Subnetwork Access Protocol (SNAP) encapsulation. AAL5 SNAP is commonly used in IP routing and bridging. For information on IP routing and bridging, see the “RFC1483 Bridging Baseline Architecture” tech notes on Cisco.com.

```
!
interface atm 0/0/0
  pvc 0/40
   encapsulation aal5snap
!
```

Example—PVC with PPPoA on an ATM Interface

The following example shows a typical PVC configuration for PPP over ATM (PPPoA). For information on configuring PPPoA, see the “PPPoA Baseline Architecture” white paper on Cisco.com.

```
!
interface atm 0/0/0
 pvc 0/41
  encapsulation aal5mux ppp virtual-Template 1
!
interface virtual-template 1
 ip unnumbered fastethernet 0/0/0
 ppp authentication pap
!
```

Verifying PVCs on the ATM Interface

To verify successful configuration of PVCs on the main ATM interface, use the **show atm vc** EXEC command. Check that the status (Sts) is up, and that the encapsulation type is correct.

```
NRP# show atm vc
VCD /                                  Peak  Avg/Min Burst
Interface  Name   VPI  VCI  Type   Encaps  SC   Kbps   Kbps   Cells  Sts
0/0/0      1      103  100   PVC    MUX    UBR  155000               UP
0/0/0      2      103  101   PVC    MUX    UBR  155000               UP
0/0/0      3      103  110   PVC    SNAP   UBR  155000               UP
NRP#
```

Configuring PVCs on ATM Subinterfaces

The NRP allows the configuration of multiple virtual interfaces, or subinterfaces, on a single physical interface. The ATM interface on the NRP (interface atm 0/0/0) can be configured with subinterfaces to allow greater flexibility and connectivity when working with subscriber sessions.

A subinterface must be classified as either point-to-point or multipoint. A point-to-point interface supports only a single PVC; a multipoint interface can be configured with multiple PVCs. Because of the standard rule of bridging, a PVC on a multipoint subinterface configured for RFC 1483 bridging cannot send data to another PVC on the same subinterface. This means that an RFC 1483 bridged multipoint interface can offer greater security than a point-to-point interface, but only at the expense of flexibility.

By default, all PVCs use AAL5 SNAP encapsulation. When you specify an encapsulation type for the main ATM interface (ATM 0/0/0), all PVCs on its subinterfaces inherit this encapsulation type. You can, however, override the inherited encapsulation type by specifying the encapsulation type in ATM VC configuration mode.

To configure a PVC on an ATM subinterface, complete the following steps beginning in global configuration mode:

	Command	Description
Step 1	`Router(config)# interface atm 0/0/0.subinterface {multipoint | point-to-point}`	Specifies the NRP ATM subinterface. Also selects multipoint or point-to-point subinterface type.
Step 2	`Router(config-subif)# pvc [name] vpi/vci`	Configures a new ATM PVC by assigning a name (optional) and VPI/VCI values.

Step 3	`Router(config-if-atm-vc)# encapsulation {aal5snap | aal5nlpid}`
	or
	`Router(config-if-atm-vc)# encapsulation {aal5mux ppp | aal5autoppp | aal5ciscoppp} virtual-template number`
		Configures the ATM adaptation layer (AAL) and encapsulation type for a PVC. May configure a PVC to use a virtual template[1] as the default PPP interface configuration.

1. A virtual template assigns PPP features (such as authentication and IP address assignment method) to a PVC. Virtual templates are used when configuring PPP over ATM (PPPoA), PPP over Ethernet (PPPoE), and Layer 2 Tunneling Protocol (L2TP).

Example—PVC on a Point-to-Point Subinterface

In the following example, the ATM 0/0/0.20 subinterface is configured as a point-to-point interface. Attempting to configure a second PVC results in the "`P2P Interface already has VC`" message.

```
Router(config)# interface atm 0/0/0.20 point-to-point
Router(config-subif)# pvc 0/40
Router(config-if-atm-vc)# exit
Router(config-subif)# pvc 0/41
→ P2P Interface already has VC
Router(config-subif)# exit
```

The previous example results in the following configuration fragment:

```
!
interface atm 0/0/0.20 point-to-point
 pvc 0/40
!
```

Example—PVCs on a Multipoint Subinterface

In the following example, the ATM 0.0.21 subinterface is a multipoint interface, so it accepts multiple PVCs.

```
Router(config)# interface atm 0/0/0.21 multipoint
Router(config-subif)# pvc 0/50
Router(config-if-atm-vc)# exit
Router(config-subif)# pvc 0/51
Router(config-if-atm-vc)# exit
```

The previous example results in the following configuration fragment:

```
!
interface atm 0/0/0.21 multipoint
 pvc 0/50
 !
 pvc 0/51
 !
!
```

Example—PVCs on Subinterfaces with Encapsulation Type Inherited from the Main ATM Interface

In the following example, PVCs 0/70 and 0/71 on ATM subinterface 0/0/0.40 inherit the AAL5 multiplex (MUX) encapsulation type from the main ATM interface. PVC 0/72 is specifically configured for AAL5 SNAP, overriding the inherited encapsulation type.

```
Router(config)# interface atm 0/0/0
Router(config-if)# encapsulation aal5mux ppp virtual-template 1

Router(config)# interface atm 0/0/0.40 multipoint
Router(config-subif)# pvc 0/70
Router(config-if-atm-vc)# exit
Router(config-subif)# pvc 0/71
Router(config-if-atm-vc)# exit
Router(config-subif)# pvc 0/72
Router(config-if-atm-vc)# encapsulation aal5snap
Router(config-if-atm-vc)# ^z
```

The previous example results in the following configuration fragment:

```
!
interface atm 0/0/0
 encapsulation aal5mux ppp virtual-template 1
!
interface atm 0/0/0.40 multipoint
 pvc 0/70
 !
 pvc 0/71
 !
 pvc 0/72
  encapsulation aal5snap
 !
!
```

Verifying PVCs on ATM Subinterfaces

To verify successful configuration of PVCs on ATM subinterfaces, use the **show atm vc** EXEC command. Check that the status (Sts) is up, and that the encapsulation type is correct.

```
NRP# show atm vc
           VCD /                                  Peak  Avg/Min Burst
Interface  Name   VPI  VCI  Type   Encaps  SC   Kbps   Kbps   Cells  Sts
0/0/0.1    1      101  100   PVC    MUX    UBR  155000               UP
0/0/0.2    2      101  101   PVC    MUX    UBR  155000               UP
0/0/0.3    3      101  110   PVC    SNAP   UBR  155000               UP
NRP#
```

Configuring VC Classes

VC classes allow you to define a template for a particular VC. You can then apply this template directly to a PVC, or to an interface or subinterface whose PVCs inherit the VC class properties.

To configure and apply a VC class directly to a PVC, complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# vc-class atm name`	Creates or selects a map class.
Step 2	`Router(config-vc-class)# encapsulation aal-encap [ppp virtual-template number]`	Configures the ATM adaptation layer (AAL) and encapsulation type. Optionally configures a PVC to use a virtual-template as the default PPP interface configuration.
Step 3	`Router(config-vc-class)# exit`	Returns to global configuration mode.
Step 4	`Router(config)# interface atm 0/0/0 [.subinterface-number {multipoint | point-to-point}]`	Specifies the ATM interface and optional subinterface.
Step 5	`Router(config-if)# pvc [name] vpi/vci`	Configures a PVC on the ATM interface or subinterface.
Step 6	`Router(config-atm-vc)# class-vc vc-class-name`	Associates a VC class with the PVC.

To configure and apply a VC class to an interface or subinterface, complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# vc-class atm name`	Creates or selects a map class.
Step 2	`Router(config-vc-class)# encapsulation aal-encap [ppp virtual-template number]`	Configures the ATM adaptation layer (AAL) and encapsulation type. Optionally configures a PVC to use a virtual-template as the default PPP interface configuration.
Step 3	`Router(config-vc-class)# exit`	Returns to global configuration mode.
Step 4	`Router(config)# interface atm 0/0/0 [.subinterface-number {multipoint | point-to-point}]`	Specifies the ATM interface and optional subinterface.
Step 5	`Router(config-if)# class-int vc-class-name`	Associates a VC class to the interface or subinterface.
Step 6	`Router(config-if)# pvc [name] vpi/vci`	Configures a PVC on the ATM interface or subinterface. All PVCs configured on the interface or subinterface will inherit the VC class properties.

Example—VC Classes

In the following example, ATM 0/0/0 is assigned the VC class “snap.” PVC 0/40 and PVC 0/41 inherit the properties of VC class “snap.” PVC 0/42 is configured to override the VC class properties by assigning a static IP address. ATM subinterface 0/0/0.2 inherits the properties of ATM 0/0/0, so PVC 0/43 also inherits the properties of VC class “snap.” By assigning a different VC class, “ppp-atm,” PVC 0/44 overrides the properties of the “snap” VC class.

```
!
vc-class atm snap
 encapsulation aal5snap
 ip address unnumbered fastethernet 0/0/0
!
vc-class atm ppp-atm
 encapsulation aal5mux ppp virtual-template 1
!
interface atm 0/0/0
 class-int snap
 pvc 0/40
 !
 pvc 0/41
 !
 pvc 0/42
  ip address 172.25.14.198 255.255.255.0
 !
!
interface atm 0/0/0.2 multipoint
 pvc 0/43
 !
 pvc 0/44
  class-vc ppp-atm
 !
!
```

Verifying VC Classes

To verify successful configuration of VC classes, use the **show atm vc** EXEC command. Check that the VC class properties (encapsulation) are inherited by the appropriate PVCs.

Configuring PVC Discovery

You can configure the NRP to automatically discover internal PVCs that are configured on the NSP. The discovered PVCs and their traffic parameters are configured on the ATM main interface or on the subinterface that you specify. The NRP Interim Local Management Interface (ILMI) receives the PVC parameter information from the NSP.

Configuring PVC discovery on subinterfaces allows you to sort PVCs on a per-VP basis. The subinterface PVC discovery configuration associates all VCs with non-zero VPI values with the subinterface of the same number. For example, if the NSP reports PVC 2/123, the NRP associates that PVC with ATM 0/0/0.2, and the PVC inherits parameters applied to the subinterface.

To configure the NRP for PVC discovery, complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# vc-class atm name`	Creates or selects a map class.
Step 2	`Router(config-vc-class)# encapsulation aal-encap [ppp virtual-template number]`	Configures the ATM adaptation layer (AAL) and encapsulation type. Optionally configures a PVC to use a virtual-template as the default PPP interface configuration.
Step 3	`Router(config-vc-class)# exit`	Returns to global configuration mode.
Step 4	`Router(config)# interface atm 0/0/0`	Specifies the main ATM interface.
Step 5	`Router(config-if)# pvc [name] 0/16 ilmi`	Configures an ILMI PVC on the main ATM interface. PVC 0/16 is reserved for the ILMI.
Step 6	`Router(config-if-atm-vc)# exit`	Returns to configuration mode.
Step 7	`Router(config-if)# atm ilmi-pvc-discovery [subinterface]`	Enables PVC discovery on the main interface, and optionally specifies that discovered PVCs will be assigned to a subinterface.
Step 8	`Router(config-if)# interface atm 0/0/0.subinterface-number {multipoint | point-to-point}`	(Optional) Specifies the ATM subinterface. Also selects multipoint or point-to-point subinterface type.

Step 9	`Router(config-if)# class-int vc-class-name`
	or
	`Router(config-subif)# class-int vc-class-name`
		Associates a VC class with the interface or subinterface.

Example—PVC Discovery on the Main ATM Interface

The following example shows a typical PVC discovery configuration for the Cisco 6400 NRP:

```
!
vc-class atm ppp-atm
 encapsulation aal5mux ppp virtual-Template 1
!
interface atm 0/0/0
 pvc 0/16 ilmi
 atm ilmi-pvc-discovery
 class-int ppp-atm
!
```

Example—PVC Discovery on ATM Subinterfaces

In the following example, PVC discovery is applied to two subinterfaces: ATM 0/0/0.1 and ATM 0/0/0.2. Discovered PVCs with VPI value of 1 are associated with ATM 0/0/0.1 and inherit properties from the "ppp-atm-General" VC class. Discovered PVCs with VPI value of 2 are associated with ATM 0/0/0.2 and inherit properties from the "ppp-atm-Admin" VC class.

```
!
vc-class atm ppp-atm-General
 encapsulation aal5mux ppp virtual-template 1
!
vc-class atm ppp-atm-Admin
 encapsulation aal5mux ppp virtual-template 2
!
interface atm 0/0/0
 pvc 0/16 ilmi
 atm ilmi-pvc-discovery subinterface
!
interface ATM 0/0/0.1 multipoint
 class-int ppp-atm-General
!
interface ATM 0/0/0.2 multipoint
 class-int ppp-atm-Admin
!
```

Note PVCs with VPI values that do not match a configured ATM subinterface will not be discovered.

Verifying PVC Discovery

To verify successful configuration of PVC discovery, use the **show atm vc interface atm 0/0/0** EXEC command. Discovered interfaces appear with the "PVC-D" type.

```
Router# show atm vc interface atm 0/0/0
            VCD /                                        Peak  Avg/Min Burst
Interface   Name       VPI   VCI  Type   Encaps   SC   Kbps   Kbps   Cells    Sts
0/0/0      1            0    16   PVC    ILMI     UBR  155000                 UP
0/0/0.1    2            1    32   PVC-D  MUX      UBR  155000                 UP
0/0/0.1    3            1    33   PVC-D  MUX      UBR  155000                 UP
0/0/0.2    4            2    32   PVC-D  MUX      UBR  155000                 UP
0/0/0.2    5            2    33   PVC-D  MUX      UBR  155000                 UP
Router#
```

Configuring PVC Traffic Shaping

The NRP-1 supports the following quality of service (QoS) classes:

- UBR—unspecified bit rate
- VBR-NRT—variable bit rate nonreal time

For information on NRP-2 traffic shaping support, see the release notes for your software release.

Note Only one QoS class can be specified per PVC. When a new QoS class is entered, it replaces the existing one.

To configure PVC traffic shaping and a QoS class for a PVC, use one of the following commands in VC configuration mode or VC class mode:

Command (VC or VC class)	Purpose
ubr *peak*	Specifies the UBR QoS. Also sets the peak cell rate, in kbps.
vbr-nrt *peak sustain burst*	Configures the nonreal-time VBR QoS. Also sets the peak cell rate, sustained cell rate, and burst rate, in kbps.

Note If you do not specify a QoS class for a PVC, the PVC defaults to UBR, with a peak rate set to the maximum physical line speed.

Example—Traffic Shaping a PVC with UBR QoS

In the following example, PVC 0/40 is configured with the UBR QoS class, at a peak cell rate of 512 kbps:

```
!
interface atm 0/0/0
  pvc 0/40
    encapsulation aal5snap
    ubr 512
!
```

Example—Traffic Shaping a PVC with VBR-NRT

In the following example, PVC 103/100 is configured with the VBR-NRT QoS class, with a peak cell rate of 512 kbps, a sustained cell rate of 16 kbps, and a burst rate of 10 kbps:

```
!
interface ATM0/0/0.1 point-to-point
  pvc 103/100
   vbr-nrt 512 16 10
   encapsulation aal5mux ppp Virtual-Template1
  !
!
```

Verifying PVC Traffic Shaping

To verify successful configuration of PVC traffic shaping, use the **show atm vc** EXEC command. Check that the traffic shaping parameters are displayed correctly.

```
NRP# show atm vc
           VCD /                                   Peak  Avg/Min Burst
Interface  Name   VPI  VCI  Type   Encaps  SC   Kbps   Kbps   Cells  Sts
0/0/0.1    1      103  100   PVC    MUX    VBR  512    16     10     UP
0/0/0.2    2      101  101   PVC    MUX    UBR  155000               UP
0/0/0.3    3      101  110   PVC    SNAP   UBR  155000               UP
NRP#
```