



Basic NSP Configuration

This chapter describes how to perform basic configuration for the Cisco 6400 node switch processor (NSP). The Cisco 6400 can contain two NSPs configured for redundancy. This chapter contains the following sections:

- [Methods Available for Configuring the NSP, page 2-1](#)
- [Checking the Software Release Version, page 2-2](#)
- [DHCP, page 2-3](#)
- [Configuring the System Clock and Hostname, page 2-3](#)
- [ATM Address, page 2-4](#)
- [Network Management Ethernet Interface, page 2-6](#)
- [Internal Cross-Connections, page 2-10](#)
- [Network Clocking, page 2-14](#)
- [Network Routing, page 2-18](#)
- [NRP-2 and NRP-2SV Support, page 2-19](#)
- [Storing the NSP Configuration, page 2-23](#)
- [Verifying the NSP Configuration, page 2-23](#)
- [Using the NSP File Systems and Memory Devices, page 2-24](#)

Methods Available for Configuring the NSP

The following methods are available for configuring the NSP:

- From a local console or workstation—Connect to the console port of the NSP. This connection allows you to issue command-line interface (CLI) commands directly to the NSP.
- From a remote console or workstation—Initiate a Telnet connection to the NSP.
- From the Web Console application—See [Appendix A, “Web Console.”](#)
- From the Cisco 6400 Service Connection Manager—See the Cisco 6400 SCM documentation.

**Note**

If your Telnet station or Simple Network Management Protocol (SNMP) network management workstation and the Cisco 6400 are on different networks, you must add a static routing table entry to the routing table. For information on configuring static routes, see the “Configuring ATM Routing and PNNI” chapter of the *ATM Switch Router Software Configuration Guide*.

For general information on basic Cisco IOS configuration, see the *Cisco IOS Configuration Fundamentals Configuration Guide* associated with your software release level.

Checking the Software Release Version

To check the software release version, connect a console terminal or a terminal server to the NSP console port on the NSP faceplate. After you boot the NSP, the following information is displayed to verify that the NSP 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) C6400 Software (C6400S-WP-M), Version 12.3
Copyright (c) 1986-2002 by Cisco Systems, Inc.
Compiled Tue 18-Sep-02 15:00 by jdoe
Image text-base: 0x60010908, data-base: 0x6069A000
```

```
FPGA VERSION: 97/11/25 22:11:51 1383107375 /rhino/fpga/fc_abr_fc3/xil/abr_fpga_r.bit
98/02/24 17:11:36 1332837880 /rhino/fpga/fc_stat_fpga/xilinx/stat_fpga_r.bit
97/11/13 10:03:51 1059421866 /rhino/fpga/fc_traffic_fc3/xil/upc_fpga.bit
97/08/06 13:09:19 288278431 /rhino/fpga/fc_netclk/xilinx/pll_cntl_r.bit
```

```
Initializing FC-PFQ hardware ... done.
cisco C6400S (R4600) processor with 131072K bytes of memory.
R4700 CPU at 100Mhz, Implementation 33, Rev 1.0
Last reset from s/w peripheral
2 Ethernet/IEEE 802.3 interface(s)
11 ATM network interface(s)
507K bytes of non-volatile configuration memory.
```

```
107520K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
8192K bytes of Flash internal SIMM (Sector size 256K).
```

```
Press RETURN to get started!
```

DHCP

Dynamic Host Configuration Protocol (DHCP) is the default IP assignment protocol for a new NSP, or for an NSP 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 the DHCP server, add an entry in the DHCP database using the instructions that came with the server.



Note

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

Verifying DHCP

Use the **show dhcp lease** command to confirm the IP address, subnet mask, default gateway, and static route information obtained from a DHCP server:

```
Switch# show dhcp lease
Temp IP addr: 10.1.1.3 for peer on Interface: unknown
Temp sub net mask: 255.255.0.0
  DHCP Lease server: 172.18.254.254, state: 3 Bound
  DHCP transaction id: 18D9
  Lease: 86400 secs, Renewal: 43200 secs, Rebind: 75168 secs
Temp default-gateway addr: 10.1.0.1
Temp ip static route0: dest 172.18.254.254 router 10.1.0.1
  Next timer fires after: 00:29:59
  Retry count: 0 Client-ID: cisco-0010.7ba9.c600-Ethernet0/0/0
```

Configuring the System Clock and Hostname

Although they are not required, several system parameters should be set as part of the initial system configuration. To set the system clock and hostname, complete the following steps beginning in privileged EXEC mode:

	Command	Purpose
Step 1	Switch# clock set <i>hh:mm:ss day_of_month month year</i>	Sets the system clock.
Step 2	Switch# configure terminal	Enters global configuration mode.
Step 3	Switch(config)# hostname <i>name_string</i>	Sets the system hostname.

Example

In the following example, the system clock and hostname are configured:

```
Switch# clock set 15:01:00 17 October 2002
Switch# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)# hostname Publications
Publications(config)#
```

Verifying the System Clock and Hostname Configuration

To confirm the system clock setting, use the **show clock** command:

```
Publications# show clock
.15:03:12.015 UTC Fri Oct 17 2002
Publications#
```

To confirm the hostname, check the CLI prompt. The new hostname will appear in the prompt.

ATM Address

The Cisco 6400 NSP ships with the ATM address autoconfigured, which enables the switch to automatically configure attached end systems using the Integrated Local Management Interface (ILMI) protocol. Autoconfiguration also enables the NSP to establish itself as a node in a single-level Private Network-Network Interface (PNNI) routing domain.

To manually configure the ATM address, see the [“Configuring the ATM Address Manually”](#) section on page 2-5.



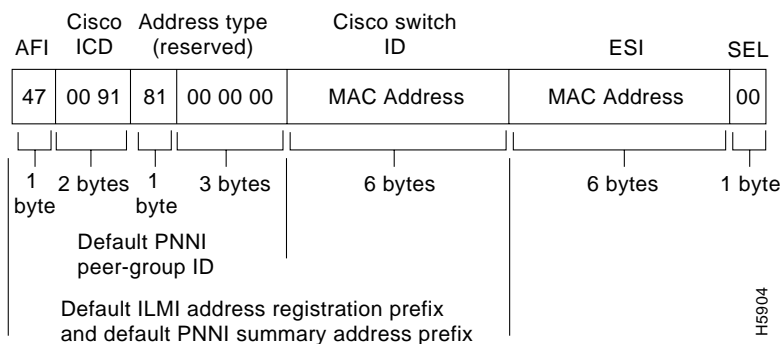
Note

If you chose to manually change any ATM address, it is important to maintain the uniqueness of the address across large networks. Refer to the “Configuring ATM Routing and PNNI” chapter in the *ATM Switch Router Software Configuration Guide* for PNNI address considerations and for information on obtaining registered ATM addresses.

Understanding the Autoconfigured ATM Addressing Scheme

During the initial startup, the NSP generates an ATM address using the defaults shown in [Figure 2-1](#).

Figure 2-1 ATM Address Format



The autoconfigured ATM address includes the following components:

- Authority and format identifier (AFI)—1 byte
- Cisco-specific International Code Designator (ICD)—2 bytes
- Cisco-specific information—4 bytes
- Cisco switch ID—6 bytes (used to distinguish multiple switches)

**Note**

The first 13 bytes of the address make up a switch prefix used by ILMI in assigning addresses to end stations connected to User-Network Interface (UNI) ports.

- MAC address of the NSP—6 bytes (used to distinguish multiple end system identifier [ESI] addresses)

**Note**

Both MAC address fields in the ATM address are the same, but they will not be the same as the address printed on the chassis label.

- Selector equals 0—1 byte

Configuring the ATM Address Manually

Manually configuring the ATM address is required:

- To connect to another system using Interim Interswitch Signaling Protocol (IISP). Using IISP requires disabling PNNI, which results in no ILMI support.
- To configure a new ATM address that replaces the previous ATM address and generates a new PNNI node ID and peer group ID for migrating from flat to hierarchical PNNI.
- To connect to multiple levels of a PNNI hierarchy.
- To connect to a service provider network that requires you to use the addressing scheme for that network.
- To use a particular style of addressing. For instance, in some circumstances a mnemonic scheme might be useful for identifying nodes in an ATM network.

To configure a new ATM address, refer to the chapter “Configuring ATM and PNNI” in the *ATM Switch Router Software Configuration Guide*.

**Caution**

ATM addressing can lead to conflicts if not configured correctly. If you are configuring a new ATM address, the old one must be completely removed from the configuration.

Example

The following example shows how to change the active ATM address, create a new address, verify that it exists, and then delete the current active address. Using the ellipses (...) adds the default Media Access Control (MAC) address as the last six bytes.

```
Switch(config)# atm address 47.0091.8100.5670.0000.0ca7.ce01...
Switch(config)# end
Switch# show atm addresses
```

```
Switch Address(es):
```

```
47.0091810000000410B0A1081.00410B0A1081.00 active
47.00918100567000000CA7CE01.00410B0A1081.00
```

```
Soft VC Address(es):
```

```
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.0000.00 ATM0/0/0
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.0000.63 ATM0/0/0.99
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.0010.00 ATM0/0/1
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.0020.00 ATM0/0/2
```

```

47.0091.8100.0000.0041.0b0a.1081.4000.0c80.0030.00 ATM0/0/3
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.1000.00 ATM0/1/0
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.1010.00 ATM0/1/1
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.1020.00 ATM0/1/2
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.1030.00 ATM0/1/3
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.8000.00 ATM1/0/0
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.8010.00 ATM1/0/1
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.8020.00 ATM1/0/2
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.8030.00 ATM1/0/3
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.9000.00 ATM1/1/0
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.9010.00 ATM1/1/1
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.9020.00 ATM1/1/2
47.0091.8100.0000.0041.0b0a.1081.4000.0c80.9030.00 ATM1/1/3

ILMI Switch Prefix(es):
  47.0091.8100.0000.0041.0b0a.1081
  47.0091.8100.0000.0060.3e5a.db01

ILMI Configured Interface Prefix(es):

LECS Address(es):

Switch# configure terminal
Switch(config)# no atm address 47.0091.8100.0000.0041.0b0a.1081...
```

Verifying the ATM Address

Use the **show atm addresses EXEC** command to confirm correct configuration of the ATM address for the NSP.

Network Management Ethernet Interface

As of Cisco IOS Release 12.0(5)DB and later releases, including 12.3, the Cisco 6400 system can use the Ethernet port on the NSP as a combined network management Ethernet (NME) interface for all cards in the Cisco 6400 chassis. This is called “NME consolidation.” Before Cisco IOS Release 12.0(5)DB, each NRP and NSP used a separate NME interface.

The Cisco IOS software version on your NSP determines the type of NME interface supported by your Cisco 6400 system:

- [Enabling NME Consolidation on the NSP](#)—Cisco IOS Release 12.0(5)DB and later
- [Enabling a Separate NME Interface](#)—Cisco IOS Release 12.0(4)DB and earlier, optional task for later releases

Enabling NME Consolidation on the NSP

The method used to enable the combined NME interface on the NSP depends on whether or not the NSP was *upgraded* to or preloaded with Cisco IOS Release 12.0(5)DB or later.

Enabling NME Consolidation on a New NSP Preloaded with Cisco IOS Release 12.0(5)DB or Later

On an NSP that is preloaded with a Cisco IOS Release 12.0(5)DB or later software image, NME consolidation is already included in the default configuration.

If your NSP does not use a DHCP server to obtain an IP address, you must configure a static IP address. Complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# interface BV11	Selects the interface used for NME consolidation.
Step 2	Switch(config-if)# ip address address subnet	Configures the static IP and subnetwork address.

Example—NME Consolidation

```
!
interface BV11
 ip address 172.20.40.93 255.255.255.0
!
```

Enabling NME Consolidation on an NSP Upgraded to Cisco IOS Release 12.0(5)DB or Later

To enable NME consolidation on an NSP upgraded from a Cisco IOS Release 12.0(4)DB or earlier software image, complete the following tasks:

- [Task 1: Removing the IP Addresses from the Ethernet 0/0/0 and Ethernet 0/0/1 Interfaces](#)
- [Task 2: Setting up the Bridge Group](#)
- [Task 3: Configuring the NME Interface](#)

Task 1: Removing the IP Addresses from the Ethernet 0/0/0 and Ethernet 0/0/1 Interfaces

To remove the IP addresses from the Ethernet 0/0/0 and Ethernet 0/0/1 interfaces, complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# interface ethernet 0/0/0	Selects the Ethernet 0/0/0 interface.
Step 2	Switch(config-if)# no ip address	Removes the IP address from the interface.
Step 3	Switch(config-if)# interface ethernet 0/0/1	Selects the Ethernet 0/0/1 interface.
Step 4	Switch(config-if)# no ip address	Removes the IP address from the interface.
Step 5	Switch(config-if)# exit	Returns to global configuration mode

Task 2: Setting up the Bridge Group

To set up the bridge group, complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# bridge irb	Enables integrated routing and bridging.
Step 2	Switch(config)# bridge 1 protocol ieee	Selects the IEEE Ethernet Spanning-Tree Protocol for bridge group 1.
Step 3	Switch(config)# bridge 1 route ip	Enables IP routing in bridge group 1.
Step 4	Switch(config-if)# interface ethernet 0/0/1	Selects the Ethernet 0/0/1 interface.
Step 5	Switch(config-if)# bridge-group 1	Assigns the Ethernet 0/0/1 interface to bridge group 1.

Task 3: Configuring the NME Interface

To configure the NME interface, complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# interface BV11	Creates or selects the interface used for NME consolidation.
Step 2	Switch(config-if)# ip address address subnet or, if using DHCP, Switch(config-if)# ip address negotiated	Configures a static IP address and subnetwork address. Enables the interface to obtain an IP address, subnet mask, router address, and static routes from a DHCP server.

Example—NME Consolidation Configuration on the NSP

```

!
bridge irb
!
bridge 1 protocol ieee
bridge 1 route ip
!
interface ethernet 0/0/0
no ip address
!
interface ethernet 0/0/1
no ip address
bridge-group 1
!
interface BV11
ip address 172.20.40.93 255.255.255.0
!

```


Enabling NME Consolidation on the NRP

In addition to configuring the NSP for NME consolidation, you must configure the NRP Ethernet interfaces to also support NME consolidation. Complete the following steps, beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# interface ethernet 0/0/0	Selects the Ethernet 0/0/0 interface.
Step 2	Router(config-if)# no ip address	Removes the IP address from the interface.
Step 3	Router(config-if)# interface ethernet 0/0/1	Selects the Ethernet 0/0/1 interface.
Step 4	Router(config-if)# ip address address subnet	Configures a static IP address and subnetwork address. Use the same subnet from the Ethernet 0/0/1 interface on the NSP.

Example—NME Consolidation Configuration on the NRP

```
!
interface ethernet 0/0/0
  no ip address
!
interface ethernet 0/0/1
  ip address 172.20.40.10 255.255.255.0
!
```

Enabling a Separate NME Interface

Cisco IOS Release 12.0(4)DB and earlier images do not support NME consolidation. You must configure the NSP Ethernet interface as a separate NME interface that is unable to handle network management of the NRPs in the Cisco 6400 system.

Enabling the NME on an NSP Running Cisco IOS Release 12.0(4)DB or Earlier

Complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# interface ethernet 0/0/0	Selects the NME interface to be configured.
Step 2	Switch(config-if)# ip address address subnet or, if using DHCP, Switch(config-if)# ip address negotiated	Configures a static IP address and subnetwork address. Enables the interface to obtain an IP address, subnet mask, router address, and static routes from a DHCP server.

Example—Separate NME

In the following example, the NSP is configured to use the separate NME interface:

```
!
interface ethernet 0/0/0
  ip address negotiated
```

!

Verifying the NME Interface Configuration

Use the **show interface EXEC** command to verify successful configuration of the NME interface on the NSP. If the NSP is configured for NME consolidation, use **show interface BVI 1**. On an NSP configured to use a separate NME interface, use **show interface ethernet 0/0/0**. Check that the output shows:

- That the NME interface and line protocol is “up”
- A valid IP address
- That packets are input and output

```
Switch# show interface BVI 1
BVI1 is up, line protocol is up
  Hardware is BVI, address is 0050.736f.5756 (bia 0000.0000.0000)
  Internet address is 172.194.71.11/24
  MTU 4470 bytes, BW 10000 Kbit, DLY 5000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/0, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    53 packets input, 3180 bytes, 0 no buffer
      Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
      0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    57 packets output, 0 bytes, 0 underruns
      0 output errors, 0 collisions, 0 interface resets
      0 output buffer failures, 0 output buffers swapped out
```

Switch#

Internal Cross-Connections

The following sections describe minimal procedures for creating virtual circuits (VCs) and virtual paths (VPs).



Note

Soft VCs between the NRP and NSP are not supported.

For more information, see the following chapters of the *ATM Switch Router Software Configuration Guide*:

- “Configuring Virtual Connections” (VCs)
- “Configuring ATM Network Interfaces” (VPs, including shared and hierarchical VP tunnels)

Configuring PVCs (VC Switching)

A permanent virtual circuit (PVC) is a permanent logical connection that you must configure manually, from source to destination, through the ATM network. Once configured, the ATM network maintains the connection at all times, regardless of traffic flow. That is, the connection is always up whether or not there is traffic to send.

The Cisco 6400 uses PVCs to pass traffic between the node line card (NLC) ATM interfaces and node route processors (NRPs). Typically, when VC switching is used, each subscriber is bound to a specific NRP and should be configured as a separate PVC. If the Cisco 6400 is used as an ATM switch, VCs are simply connected between the ATM interfaces.

To create a PVC between an ATM interface and an NRP, complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# interface atm slot/subslot/port	Selects the NLC interface to be configured.
Step 2	Switch(config-if)# atm pvc vpi vci interface atm slot/subslot/port vpi vci	Configures the PVC, using the slot/subslot/port of the NRP to which you want to connect the NLC.

You must also configure the PVC on the NRP side. For instructions on configuring PVCs on the NRP, see the [“Permanent Virtual Circuits” section on page 3-20](#).

Example—Internal PVC

In the following example, an internal PVC is configured between the NLC ATM interface 1/0/0 and an NRP in slot 5. Both the NRP and NSP must be configured to create the PVC.

Configuration fragment on the NSP:

```
!
interface atm 1/0/0
  atm pvc 0 50 interface atm 5/0/0 2 100
!
```

Configuration fragment on the NRP:

```
!
interface atm 0/0/0
  pvc 2/100
!
```

Configuring PVPs (VP Switching)

A permanent virtual path (PVP) allows you to connect two ATM switch routers at different locations across a public ATM network that does not support ATM signaling. Signaling traffic is mapped into the PVP, and the switches allocate a virtual channel connection (VCC) on that VP, instead of the default VP 0. This mapping allows the signaling traffic to pass transparently through the public network. VP switching also provides NSP redundancy at the ATM layer.

To create a PVP between an ATM interface and an NRP, complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# interface atm slot/subslot/port	Selects the NLC interface to be configured.
Step 2	Switch(config-if)# atm pvp vpi interface atm slot/subslot/port vpi	Configures the PVP, using the slot/subslot/port of the NRP to which you want to connect the NLC.

You must also configure PVCs on the NRP that will use the VP switch. For instructions on configuring PVCs on the NRP, see the [“Permanent Virtual Circuits”](#) section on page 3-20.

Example—Internal PVP

In the following example, an internal PVP is configured between the NLC ATM interface at 1/0/0 and an NRP in slot 5. Both the NRP and NSP must be configured to create the PVP.

Configuration fragment on the NSP:

```
!
interface atm 1/0/0
  atm pvp 0 interface atm 5/0/0 2
!
```

Configuration fragment on the NRP:

```
!
interface atm 0/0/0
  pvc 2/100
  pvc 2/101
  pvc 2/102
!
```

Verifying Internal Cross-Connections

Use the **show atm vc EXEC** command to confirm the status of ATM virtual channels:

```
Switch# show atm vc
Interface      VPI  VCI  Type  X-Interface      X-VPI X-VCI  Encap  Status
ATM0/0/0      0    35   PVC   ATM1/0/0         0     16   ILMI   DN
ATM0/0/0      0    36   PVC   ATM1/0/0         0     5    QSAAL  DN
ATM0/0/0      0    37   PVC   ATM1/0/1         0     16   ILMI   DN
ATM0/0/0      0    38   PVC   ATM1/0/1         0     5    QSAAL  DN
ATM0/0/0      0    39   PVC   ATM5/0/0         0     16   ILMI   DN
ATM0/0/0      0    40   PVC   ATM5/0/0         0     5    QSAAL  DN
ATM0/0/0      0    41   PVC   ATM6/0/0         0     16   ILMI   DN
ATM0/0/0      0    42   PVC   ATM6/0/0         0     5    QSAAL  DN
ATM0/0/0      0    43   PVC   ATM7/1/0         0     16   ILMI   UP
ATM0/0/0      0    44   PVC   ATM7/1/0         0     5    QSAAL  UP
ATM0/0/0      0    45   PVC   ATM7/1/1         0     16   ILMI   DN
Interface      VPI  VCI  Type  X-Interface      X-VPI X-VCI  Encap  Status
ATM0/0/0      0    46   PVC   ATM7/1/1         0     5    QSAAL  DN
ATM0/0/0      0    47   PVC   ATM8/1/0         0     16   ILMI   UP
ATM0/0/0      0    48   PVC   ATM8/1/0         0     5    QSAAL  UP
ATM0/0/0      0    49   PVC   ATM8/1/1         0     16   ILMI   DN
ATM0/0/0      0    50   PVC   ATM8/1/1         0     5    QSAAL  DN
ATM0/0/0      0    51   PVC   ATM7/0/0         0     16   ILMI   UP
ATM0/0/0      0    52   PVC   ATM7/0/0         0     5    QSAAL  UP
ATM0/0/0      0    53   PVC   ATM7/0/1         0     16   ILMI   DN
```

```

ATM0/0/0          0    54    PVC    ATM7/0/1          0    5    QSAAL  DN
ATM0/0/0          0    55    PVC    ATM7/1/0          0    18   PNNI   UP
ATM0/0/0          0    56    PVC    ATM8/1/0          0    18   PNNI   UP
ATM0/0/0          0    57    PVC    ATM7/0/0          0    18   PNNI   UP
ATM1/0/0          0    5    PVC    ATM0/0/0          0    36   QSAAL  DN
ATM1/0/0          0    16    PVC    ATM0/0/0          0    35   ILMI   DN
ATM1/0/1          0    5    PVC    ATM0/0/0          0    38   QSAAL  DN
Interface         VPI   VCI   Type   X-Interface       X-VPI X-VCI  Encap  Status
ATM1/0/1          0    16    PVC    ATM0/0/0          0    37   ILMI   DN
ATM5/0/0          0    5    PVC    ATM0/0/0          0    40   QSAAL  DN
ATM5/0/0          0    16    PVC    ATM0/0/0          0    39   ILMI   DN
ATM6/0/0          0    5    PVC    ATM0/0/0          0    42   QSAAL  DN
ATM6/0/0          0    16    PVC    ATM0/0/0          0    41   ILMI   DN
ATM7/0/0          0    5    PVC    ATM0/0/0          0    52   QSAAL  UP
ATM7/0/0          0    16    PVC    ATM0/0/0          0    51   ILMI   UP
ATM7/0/0          0    18    PVC    ATM0/0/0          0    57   PNNI   UP
ATM7/0/1          0    5    PVC    ATM0/0/0          0    54   QSAAL  DN
ATM7/0/1          0    16    PVC    ATM0/0/0          0    53   ILMI   DN
ATM7/1/0          0    5    PVC    ATM0/0/0          0    44   QSAAL  UP
ATM7/1/0          0    16    PVC    ATM0/0/0          0    43   ILMI   UP
ATM7/1/0          0    18    PVC    ATM0/0/0          0    55   PNNI   UP
ATM7/1/1          0    5    PVC    ATM0/0/0          0    46   QSAAL  DN
Interface         VPI   VCI   Type   X-Interface       X-VPI X-VCI  Encap  Status
ATM7/1/1          0    16    PVC    ATM0/0/0          0    45   ILMI   DN
ATM8/1/0          0    5    PVC    ATM0/0/0          0    48   QSAAL  UP
ATM8/1/0          0    16    PVC    ATM0/0/0          0    47   ILMI   UP
ATM8/1/0          0    18    PVC    ATM0/0/0          0    56   PNNI   UP
ATM8/1/1          0    5    PVC    ATM0/0/0          0    50   QSAAL  DN
ATM8/1/1          0    16    PVC    ATM0/0/0          0    49   ILMI   DN

```

Switch#

Use the **show atm vc interface atm EXEC** command to confirm the status of ATM virtual channels on a specific interface:

```

Switch# show atm vc interface atm 7/0/0
Interface         VPI   VCI   Type   X-Interface       X-VPI X-VCI  Encap  Status
ATM7/0/0          0    5    PVC    ATM0/0/0          0    52   QSAAL  UP
ATM7/0/0          0    16    PVC    ATM0/0/0          0    51   ILMI   UP
ATM7/0/0          0    18    PVC    ATM0/0/0          0    57   PNNI   UP
Switch#

```

Use the **show atm vc interface atm EXEC** command to confirm the status of a specific ATM interface and virtual channel:

```

Switch# show atm vc interface atm 7/0/0 0 16

Interface: ATM7/0/0, Type: oc3suni
VPI = 0  VCI = 16
Status: UP
Time-since-last-status-change: 2d20h
Connection-type: PVC
Cast-type: point-to-point
Packet-discard-option: enabled
Usage-Parameter-Control (UPC): pass
Wrr weight: 15
Number of OAM-configured connections: 0
OAM-configuration: disabled
OAM-states: Not-applicable
Cross-connect-interface: ATM0/0/0, Type: CPU card
Cross-connect-VPI = 0
Cross-connect-VCI = 51
Cross-connect-UPC: pass
Cross-connect OAM-configuration: disabled

```

```

Cross-connect OAM-state: Not-applicable
Encapsulation: AAL5ILMI
Threshold Group: 6, Cells queued: 0
Rx cells: 35, Tx cells: 35
Tx Clp0:35, Tx Clp1: 0
Rx Clp0:35, Rx Clp1: 0
Rx Upc Violations:0, Rx cell drops:0
Rx pkts:16, Rx pkt drops:0
Rx connection-traffic-table-index: 3
Rx service-category: VBR-RT (Realtime Variable Bit Rate)
Rx pcr-clp01: 424
Rx scr-clp01: 424
Rx mcr-clp01: none
Rx      cdvt: 1024 (from default for interface)
Rx      mbs: 50
Tx connection-traffic-table-index: 3
Tx service-category: VBR-RT (Realtime Variable Bit Rate)
Tx pcr-clp01: 424
Tx scr-clp01: 424
Tx mcr-clp01: none
Tx      cdvt: none
Tx      mbs: 50
AAL5 statistics:
Crc Errors:0, Sar Timeouts:0, OverSizedSDUs:0
BufSzOvfl: Small:0, Medium:0, Big:0, VeryBig:0, Large:0

Switch#

```

Network Clocking

This section describes the network clocking configuration of the Cisco 6400. Each port has a transmit clock that is derived from the receive data. The transmit clock can be configured for each port in one of the following ways:

- **Free-running**—The transmit clock on the interface is derived from the port adapter's local oscillator, if one exists. If the port adapter does not have a local oscillator, the oscillator from the NSP is used. In this mode, the transmit clock is not synchronized with any receive clocks in the system. This mode should be used only if synchronization is not required, as in some LAN environments.
- **Network derived**—The transmit clock is derived from the highest priority configured network clock source—the system clock (the local oscillator on the NSP), the Building Integrated Timing Supply (BITS), or the public network.
- **Loop-timed**—The transmit clock is derived from the clock source received on the same interface. This mode can be used when connecting to a device with a very accurate clock source.

Any NLC in a Cisco 6400 chassis capable of receiving and distributing a network timing signal can propagate that signal to any similarly capable module in the chassis. Using the **network-clock-select** global configuration command, you can cause a particular port in a Cisco 6400 chassis to serve as the primary reference source (PRS) for the entire chassis or for other devices in the networking environment. In other words, you can designate a particular port in a Cisco 6400 chassis to serve as a “master clock” source for distributing a single clocking signal throughout the chassis or to other network devices. This reference signal can be distributed wherever needed in the network and can globally synchronize the flow of constant bit rate (CBR) data.

For more information on network clocking, see the chapter “Initially Configuring the ATM Switch” in the *ATM Switch Router Software Configuration Guide*.

Configuring the Transmit Clock Source

By default, the interface uses a network-derived clock source. To modify how an interface derives its transmit clock, complete the following steps beginning in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# interface atm slot/subslot/port	Selects the interface to be configured.
Step 2	Switch(config-if)# clock source {free-running loop-timed network-derived}	Specifies how the interface derives its transmit clock.

Example

In the following example, ATM interface 4/0/0 is configured to derive its transmit clock from the clock source received on the same interface:

```
!
interface atm 4/0/0
  clock source loop-timed
!
```

Configuring Network Clock Priorities and Sources

You can configure multiple network clock sources and assign priority values to each source. The system uses the highest priority clock source available as the “network-derived” clock source for the transmit clock.

To configure the network clock priorities and sources, use the following command in global configuration mode:

Command	Purpose
Switch(config)# network-clock-select priority {system atm slot/subslot/port}	Configures a network clock priority and source. <i>Priority</i> ¹ values range from 1 (highest) to 4 (lowest). System selects the local oscillator on the NSP.

1. Priorities 1 to 4 initially default to “no clock.” Priority 5 is a pseudo-priority that defaults to “system clock” and is not configurable. If priorities 1 to 4 are not configured, the priority 5 system (NSP) clock is used as the derived clock.

Example

In the following example, interface ATM 2/0/0 is configured as the highest priority network clock source:

```
!
network-clock-select 1 atm 2/0/0
network-clock-select 2 atm 2/0/1
network-clock-select 3 atm 1/0/0
!
interface atm 1/0/0
  clock source network-derived
!
```

As long as interface ATM 2/0/0 is available, all transmit clocking on ATM 1/0/0 will be derived from ATM 2/0/0. If the ATM 2/0/0 clock source fails, the system will attempt to use the next highest priority clock source, which in this case is ATM 2/0/1.

Configuring Network Clock Revertive Behavior

Revertive behavior enables the network clock to automatically switch to the highest priority clock source available. When a clock failure is detected, the next highest priority clock source is selected. If revertive behavior is not configured, the clock source will not switch back even when the failed (but higher priority) clock source is restored.

To enable network clock revertive behavior on the NSP, use the following command in global configuration mode:

Command	Purpose
Switch(config)# network-clock-select revertive	Configures revertive behavior on the network clock.

Example

In the following example, the network clock reverts to the highest priority clock source after a failure:

```
!
network-clock-select 1 atm 2/0/0
network-clock-select 2 atm 2/0/1
network-clock-select 3 atm 1/0/0
→ network-clock-select revertive
!
```

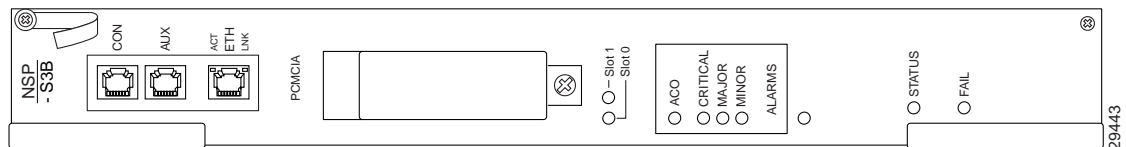
Configuring Building Integrated Timing Supply Network Clocking

BITS network clocking enables the Cisco 6400 to derive network timing from the central office (CO) BITS as well as from a clock recovered from a specified NLC interface. The Cisco 6400 can also distribute the BITS network timing with stratum level 3 accuracy to other network devices.

The BITS Network Clocking feature requires the NSP with stratum 3/BITS (NSP-S3B) module.

[Figure 2-2](#) shows the NSP-S3B module faceplate.

Figure 2-2 NSP-S3B Module Faceplate



In addition to enabling the BITS Network Clocking feature, the NSP-S3B allows the Cisco 6400 to serve as a stratum 3 network clock source for other network devices. When no external clock source is available, the NSP-S3B provides stratum level 3 internal timing on the Cisco 6400. Otherwise, the NSP-S3B is identical to the default NSP.

For information about installing the NSP-S3B, see the *Cisco 6400 UAC Hardware Installation and Maintenance Guide*. To see if the NSP-S3B is installed in the Cisco 6400 chassis, use the **show hardware EXEC** command. The output will contain an “NSP-NC” controller type (Ctrlr-Type) for each NSP-S3B in the chassis.


```
NSP# show hardware
```

```
6400 named NSP, Date:16:59:29 UTC Wed Feb 28 2001
Feature Card's FPGA Download Version:0
```

Slot	Ctrlr-Type	Part No.	Rev	Ser No	Mfg Date	RMA No.	Hw Vrs	Tst	EEP
1/0	NRP2	00-0000-00	01	00000000	Jan 01 00	00-00-00	1.0	0	2
2/0	622SM NLC	73-3868-02	A0	16097980	Feb 04 00	00-00-00	1.0	0	2
3/0	NRP2	UNKNOWN	01	UNKNOWN	Jul 00 00	00-00-00	1.0	0	2
4/0	NRP2	UNKNOWN	01	UNKNOWN	Jul 00 00	00-00-00	1.0	0	2
5/0	155SM NLC	73-2892-03	01	09156394	Aug 28 98	00-00-00	3.1	0	FF
6/0	NRP2	UNKNOWN	01	UNKNOWN	Jul 00 00	00-00-00	1.0	0	2
7/0	622SM NLC	73-3868-02	A0	14327654	Oct 15 99	00-00-00	1.0	0	2
8/0	NRP2	00-0000-00	01	00000000	Jan 01 00	00-00-00	1.0	0	2
5/1	155SM NLC	73-2892-02	02	09690988	Jul 20 98	00-00-00	1.0	0	2
0A/PC	NSP-PC	73-2996-02	02	09702853	Sep 01 98	00-00-00	1.0	0	2
0A/FC	FC-PFQ	73-2281-04	A0	09694957	Aug 20 98	00-00-00	4.1	0	2
0A/SC	NSP-SC	73-2997-02	07	12345678	Aug 27 98	00-00-00	1.0	0	2
→ 0A/NC	NSP-NC	73-3243-01	00	14012804	Jul 01 99	00-00-00	1.0	0	2
0B/PC	NSP-PC	73-2996-02	02	09702826	Sep 01 98	00-00-00	1.0	0	2
0B/FC	FC-PFQ	73-2281-04	A0	09694884	Aug 06 98	00-00-00	4.1	0	2
0B/SC	NSP-SC	73-2997-02	07	12345678	Aug 28 98	00-00-00	1.0	0	2
→ 0B/NC	NSP-NC	73-3243-01	00	14012806	Jul 01 99	00-00-00	1.0	0	2

```
Primary NSP:Slot 0A
```

```
DS1201 Backplane EEPROM:
```

Model	Ver.	Serial	MAC-Address	MAC-Size	RMA	RMA-Number	MFG-Date
C6400	2	10036118	00107BB9B600	128	0	0	Aug 26 1998

```
NSP#
```



Note

To derive network clocking from the CO BITS, the BITS input must be less than 9.2 parts per million (ppm) off center. Otherwise, the NSP-S3B declares the clock source invalid.

To derive network clocking from the BITS signal, use the following commands on the NSP-S3B in global configuration mode:

	Command	Purpose
Step 1	Switch(config)# network-clock-select <i>priority</i> BITS	Selects the BITS network clock and specifies the priority.
Step 2	Switch(config)# network-clock-select BITS {T1 E1}	Specifies BITS port as either T1 or E1.

Example

In the following example, the CO BITS is selected as the priority 1 network clock source. Lower priority clock sources are also configured for redundancy, and revertive behavior is selected.

```
!
network-clock-select revertive
network-clock-select bits e1
network-clock-select 1 bits
network-clock-select 2 ATM1/0/0
network-clock-select 3 ATM5/0/0
network-clock-select 4 ATM7/0/0
!
```

Verifying the Network Clock Configuration

To verify the switch network clocking configuration, use the **show network-clocks** EXEC command:

```
Switch# show network-clocks
clock configuration is NON-Revertive
Priority 1 clock source: ATM2/0/0 up
Priority 2 clock source: ATM7/0/0 down
Priority 3 clock source: ATM6/0/0 up
Priority 4 clock source: unconfigured
Priority 5 clock source: system

Current clock source: ATM2/0/0, priority: 1

Switch#
```

To verify BITS network clocking, make sure the **show network-clocks** command output includes the following lines:

```
Priority 1 clock source: bits up
Current clock source: bits, priority: 1
```

Network Routing

The default software image for the Cisco 6400 contains the PNNI routing protocol. The PNNI protocol provides the route dissemination mechanism for complete plug-and-play capability. The following section, “[Configuring ATM Static Routes for IISP or PNNI](#),” describes modifications that can be made to the default PNNI or IISP routing configurations.

For more routing protocol configuration information, see the chapters “Configuring ILMI” and “Configuring ATM Routing and PNNI” in the *ATM Switch Router Software Configuration Guide*.

Configuring ATM Static Routes for IISP or PNNI

Static route configuration allows ATM call setup requests to be forwarded on a specific interface if the addresses match a configured address prefix. To configure a static route, use the following command in global configuration mode:

Command	Purpose
Switch(config)# atm route <i>addr-prefix atm slot/subslot/port</i>	Specifies a static route to a reachable address prefix.



Note

An interface must be UNI or IISP to be configured with a static route. Static routes configured as PNNI interfaces default to down state.

Example

In the following example, the **atm route** command is used to configure the 13-byte peer group prefix 47.0091.8100.567.0000.0ca7.ce01 at interface 3/0/0:

```
!
atm route 47.0091.8100.567.0000.0ca7.ce01 atm 3/0/0
!
```

Verifying ATM Static Routes for IISP or PNNI

To verify successful configuration of an ATM static route, use the **show atm route** and **show atm pnni topology EXEC** commands.

NRP-2 and NRP-2SV Support

The NSP provides the following functions for the NRP-2 and NRP-2SV:

- [Image and File Storage, page 2-19](#)
- [System Logging, page 2-21](#)
- [Console and Telnet Access, page 2-21](#)
- [SNMPv3 Proxy Forwarder, page 2-22](#)
- [Troubleshooting and Monitoring the NRP-2, page 2-22](#)



Note

Unless a clear distinction is made, all references to the NRP-2 also apply to the NRP-2SV.

Image and File Storage

The NRP-2 has no local image or file storage. The NSP stores the following NRP-2 files on the Personal Computer Memory Card International Association (PCMCIA) disk:

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



Note

A PCMCIA disk must be in NSP disk slot 0.

Whenever the NSP reloads, a PCMCIA disk is inserted, or the PCMCIA disk is formatted, the NSP checks for the following directories on the PCMCIA disk and automatically creates those that are missing:

- images—One directory for storing NRP-2 images.
- slot1, slot2,..., slot8—Eight directories for storing files for specific NRP-2 slots. Each slot directory normally contains the following files when an NRP-2 is present in the slot:
 - Startup configuration file (nrp2-startup-config)
 - ROMMON variables (nrp2_rommon_nv.0)
 - Crash information (crashinfo_yyyyymmdd-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 the “Cisco IOS File Management” chapter in the *Cisco IOS Configuration Fundamentals Configuration Guide*.

Configuring NRP-2 Image Management on the NSP

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.

You can also assign priority values to each NRP-2 image and path. This allows you to enter multiple **hw-module (image)** commands in any order, while still having control over how they are executed.

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-path 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.121-4.DC.bin priority 2
hw-module slot 2 image tftp://10.1.1.1/c6400r2sp-g4p5-mz.121-4.DC.bin priority 3
hw-module slot 2 image disk0:MyDir/c6400r2sp-g4p5-mz.121-4.DC.bin priority 4
hw-module slot 3 image c6400r2sp-g4p5-mz.121-4.DC.bin priority 2
!
```

In the first and last entries of the example, the system tries to find the images (with no specified path) in the disk0:/images/ directory.

Changing the NRP-2 Configuration Register Setting

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 value¹	Changes the configuration register setting of the NRP-2 in the specified slot.

1. For specific configuration register values, see “hw-module” in the *Cisco 6400 Command Reference*.

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.121-4.DC.bin priority 2
```

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. If console logging is enabled, each system log message also appears on the NRP-2 console.

For more information on NRP-2 console and system logging, see the [“Using NRP-2 Console and System Logging” section on page 3-15](#).

Disabling NRP-2 System Logging on the NSP

To disable the appearance of NRP-2 system log messages on the NSP, use the following EXEC command:

Command	Purpose
Switch# no logging console	Stops NRP-2 system log messages from appearing on the NSP.

Console and Telnet Access

The NSP has been equipped with an internal communication server to access the NRP-2 console lines. The NSP also has alias commands for using Telnet to connect to the NRP-2. For more information, see the [“Methods Available for Configuring the NRP-2” section on page 3-9](#).

SNMPv3 Proxy Forwarder

The NSP and NRP-2 support SNMPv1, SNMPv2c, and SNMPv3. The NSP can use 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 the “Configuring Simple Network Management Protocol (SNMP)” section in the “System Management” part of the *Cisco IOS Configuration Fundamentals Configuration Guide*. For information on the Proxy Forwarder feature, see the “Using the NSP as the SNMPv3 Proxy Forwarder for the NRP-2” section on page 6-1.

Troubleshooting and Monitoring the NRP-2

Use the following NSP commands to troubleshoot or monitor the NRP-2:

Command	Purpose
Switch# clear line slot	Clears NRP-2 console connections from the NSP.
Switch> who	Displays the console and Telnet connections.
Switch> show line [line-type] number	Displays the parameters of a terminal line.
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 pmbbox	Displays debug messages for traffic flowing on the NRP-2 PAM mailbox serial interface.

More troubleshooting and monitoring commands can be entered on the NRP-2. See the “Troubleshooting and Monitoring the NRP-2” section on page 3-16.

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#

```

Storing the NSP Configuration

When autoconfiguration and any manual configurations are complete, you should copy the configuration into nonvolatile random-access memory (NVRAM). If you reload the NSP before you save the configuration in NVRAM, you will lose all manual configuration changes.

To save your running configuration as the startup configuration in NVRAM, use the **copy system:running-config EXEC** command:

```

Switch# copy system:running-config nvram:startup-config
Building configuration...
[OK]
Switch#

```

Verifying the NSP Configuration

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

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

Using the NSP File Systems and Memory Devices

File systems on the NSP include read-only memory (NVRAM, or system), Flash memory (such as PCMCIA disks 0 and 1, and boot flash), and remote file systems (such as TFTP or rcp servers). Use the **show file systems** privileged EXEC command to display the valid file systems on your NSP:

```
Switch# show file systems

File Systems:

      Size(b)      Free(b)      Type  Flags  Prefixes
      -          -          -    -    -
      -          -          flash rw   sec-slot0:
      -          -          flash rw   sec-slot1:
      -          -          flash rw   sec-disk0:
      -          -          flash rw   sec-disk1:
      -          -          flash rw   sec-bootflash:
      -          -          nvr   rw   sec-nvr   :
* 20819968      10022912      flash rw   disk0:flash:
109760512      109760512      flash rw   disk1:
      -          -          flash rw   slot0:
      -          -          flash rw   slot1:
      7602176      2363376      flash rw   bootflash:
      -          -          opaque rw   null:
      -          -          opaque rw   system:
      -          -          network rw   tftp:
      520184        515975      nvr   rw   nvr   :
      20819968      10022912      flash rw   mir-disk0:
109760512      109760512      flash rw   mir-disk1
      -          -          network rw   rcp:
      -          -          network rw   ftp:
      5242880        0          opaque ro   atm-acct-ready:
      5242880        5242880      opaque ro   atm-acct-active:
```

```
Switch#
```

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

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

  1  -rw-      3728308   Jan 01 2000 00:02:44  c6400s-wp-mz.120-5.DB

7602176 bytes total (3873740 bytes free)
Switch#
```

If your Cisco 6400 system contains an additional (secondary) NSP, use the **dir** command with file systems that begin with **sec-** to show file systems on the secondary NSP. For example, **dir sec-nvr** will show the contents of the NVRAM on the secondary NSP.



Caution

Do not use **slot0:** and **slot1:** to refer to the NSP PCMCIA disks. Use **disk0:** and **disk1:** instead.

Example—Disk0: versus Slot0:

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

   3  -rw-          628224   Jan 01 2000 00:08:55  c6400s-html.tar.120-4.DB
  157 drw-           0     Jan 01 2000 00:11:01  nsp-html
  376 -rw-          2134   Jan 05 2000 22:05:27  startup.config

109760512 bytes total (108228608 bytes free)

Switch# dir slot0:
%Error opening slot0:/ (Device not ready)
Switch#
```

In Cisco IOS Release 12.1(5)DB, the PCMCIA Disk Mirroring feature introduced the **mir-disk0:** and **mir-disk1:** labels. These labels enable you to perform any integrated file system (IFS) operation (such as **copy**, **rename**, and **delete**) on the same file on both the primary and secondary PCMCIA disks. For more information, see the [“Performing Mirrored IFS Operations” section on page 5-11](#).

