CISCO

Cisco 7304 Network Service Engine Installation and Configuration

Product Number: 7300-NSE-100, 7300-NSE-100=, 7300-NSE-150, 7300-NSE-150=
Platform Supported: Cisco 7304

CONTENTS

Preface

This preface describes the objectives and organization of this document and explains how to find additional information on related products and services. This preface contains the following sections:

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Objectives

This document includes an overview of the network services engine (NSE), instructions for removing and installing the NSE, installing various NSE hardware (such as memory, the CompactFlash Disk, GBIC and SFP modules, and other field-replaceable units), steps for verifying that the installed NSE initializes the system after you power up the router, basic configuration instructions, and some basic troubleshooting information.

Organization

This document contains the following chapters:

:

Section	Title	Description
Chapter 1	NSE-100 Overview	Describes the NSE-100—components, system management functions, memory specifications, cabling, and various other general NSE-100 information.
Chapter 2	NSE-150 Overview	Describes the NSE-150—components, memory specifications, cabling, and various other general NSE-150 information.
Chapter 3	Preparation for Installation	Describes safety considerations, tools required, and procedures you should perform before the actual installation.
Chapter 4	Removing and Installing the NSE	Provides information for installing and removing the NSE-100 and NSE-150, SODIMMs, CompactFlash Disks, and SFP and GBIC modules.
Chapter 5	High Availability NSE Redundancy	Provides information about high availability, upgrading, and troubleshooting.
Chapter 6	Working with a CompactFlash Disk	Provides information about working with a CompactFlash Disk.
Chapter 7	Upgrading, Configuration, and Troubleshooting Tasks	Provides instructions for upgrading, configuring, and troubleshooting the NSE-100 and NSE-150.

Related Documentation

Your router and the Cisco IOS software running on it contain extensive features and functionality, which are documented in the following resources:

- For links to all Cisco 7304-related documentation, see the online *Cisco 7304 Internet Router Documentation Roadmap*.

- Cisco IOS software:

  For configuration information and support, refer to the modular configuration and modular command reference publications in the Cisco IOS software configuration documentation set that corresponds to the software release installed on your Cisco hardware.

  For some useful IOS configuration information, see the "Cisco IOS Documentation" section of the online *Cisco 7304 Internet Router Documentation Roadmap*.

- For links to all Cisco 7304 line card, carrier card, port adapter, MSC, and SPA documentation, see the online *Cisco 7304 Router Line Card, Carrier Card, Port Adapter, Modular Services Card, and Shared Port Adapter Documentation Roadmap*.

- For links to all Cisco 7304 troubleshooting information and tools, see the online *Cisco 7304 Internet Router Troubleshooting Documentation Roadmap*.

- For initial installation and startup information for the Cisco 7304 router, refer to the *Cisco 7304 Quick Start Guide*.

- For hardware installation and maintenance information on the Cisco 7304 routers, refer to the *Cisco 7304 Installation and Configuration Guide.*

- For international agency compliance, safety, and statutory information for wide-area network (WAN) interfaces for the Cisco 7304 router, refer to the *Regulatory Compliance and Safety Information for the Cisco 7304 Internet Router*.

- To view Cisco documentation or obtain general information about the documentation, refer to the following sources:

  - "Obtaining Documentation" section on page v.

  - The *Cisco Information Packet* that shipped with your router

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. This section explains the product documentation resources that Cisco offers.

Cisco.com

You can access the most current Cisco documentation at this URL:

http://www.cisco.com/techsupport

You can access the Cisco website at this URL:

http://www.cisco.com

You can access international Cisco websites at this URL:

http://www.cisco.com/public/countries_languages.shtml

Product Documentation DVD

The Product Documentation DVD is a library of technical product documentation on a portable medium. The DVD enables you to access installation, configuration, and command guides for Cisco hardware and software products. With the DVD, you have access to the HTML documentation and some of the PDF files found on the Cisco website at this URL:

http://www.cisco.com/univercd/home/home.htm

The Product Documentation DVD is created and released regularly. DVDs are available singly or by subscription. Registered Cisco.com users can order a Product Documentation DVD (product number DOC-DOCDVD= or DOC-DOCDVD=SUB) from Cisco Marketplace at the Product Documentation Store at this URL:

http://www.cisco.com/go/marketplace/docstore

Ordering Documentation

You must be a registered Cisco.com user to access Cisco Marketplace. Registered users may order Cisco documentation at the Product Documentation Store at this URL:

http://www.cisco.com/go/marketplace/docstore

If you do not have a user ID or password, you can register at this URL:

http://tools.cisco.com/RPF/register/register.do

Documentation Feedback

You can provide feedback about Cisco technical documentation on the Cisco Technical Support & Documentation site area by entering your comments in the feedback form available in every online document.

Cisco Product Security Overview

Cisco provides a free online Security Vulnerability Policy portal at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

From this site, you will find information about how to do the following:

- Report security vulnerabilities in Cisco products
- Obtain assistance with security incidents that involve Cisco products
- Register to receive security information from Cisco

A current list of security advisories, security notices, and security responses for Cisco products is available at this URL:

http://www.cisco.com/go/psirt

To see security advisories, security notices, and security responses as they are updated in real time, you can subscribe to the Product Security Incident Response Team Really Simple Syndication (PSIRT RSS) feed. Information about how to subscribe to the PSIRT RSS feed is found at this URL:

http://www.cisco.com/en/US/products/products_psirt_rss_feed.html

Reporting Security Problems in Cisco Products

Cisco is committed to delivering secure products. We test our products internally before we release them, and we strive to correct all vulnerabilities quickly. If you think that you have identified a vulnerability in a Cisco product, contact PSIRT:

- For emergencies only—security-alert@cisco.com

  An emergency is either a condition in which a system is under active attack or a condition for which a severe and urgent security vulnerability should be reported. All other conditions are considered nonemergencies.

- For nonemergencies—psirt@cisco.com

In an emergency, you can also reach PSIRT by telephone:

- 1 877 228-7302
- 1 408 525-6532

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Tip We encourage you to use Pretty Good Privacy (PGP) or a compatible product (for example, GnuPG) to encrypt any sensitive information that you send to Cisco. PSIRT can work with information that has been encrypted with PGP versions 2.*x* through 9.*x*.

Never use a revoked encryption key or an expired encryption key. The correct public key to use in your correspondence with PSIRT is the one linked in the Contact Summary section of the Security

Vulnerability Policy page at this URL:

http://www.cisco.com/en/US/products/products_security_vulnerability_policy.html

The link on this page has the current PGP key ID in use.

If you do not have or use PGP, contact PSIRT to find other means of encrypting the data before sending any sensitive material.

Product Alerts and Field Notices

Modifications to or updates about Cisco products are announced in Cisco Product Alerts and Cisco Field Notices. You can receive Cisco Product Alerts and Cisco Field Notices by using the Product Alert Tool on Cisco.com. This tool enables you to create a profile and choose those products for which you want to receive information.

To access the Product Alert Tool, you must be a registered Cisco.com user. (To register as a Cisco.com user, go to this URL: http://tools.cisco.com/RPF/register/register.do) Registered users can access the tool at this URL: http://tools.cisco.com/Support/PAT/do/ViewMyProfiles.do?local=en

Obtaining Technical Assistance

Cisco Technical Support provides 24-hour-a-day award-winning technical assistance. The Cisco Technical Support & Documentation website on Cisco.com features extensive online support resources. In addition, if you have a valid Cisco service contract, Cisco Technical Assistance Center (TAC) engineers provide telephone support. If you do not have a valid Cisco service contract, contact your reseller.

Cisco Technical Support & Documentation Website

The Cisco Technical Support & Documentation website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day at this URL:

http://www.cisco.com/techsupport

Access to all tools on the Cisco Technical Support & Documentation website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a user ID or password, you can register at this URL:

http://tools.cisco.com/RPF/register/register.do

Note Use the **Cisco Product Identification Tool** to locate your product serial number before submitting a request for service online or by phone. You can access this tool from the Cisco Technical Support & Documentation website by clicking the **Tools & Resources** link, clicking the **All Tools (A-Z)** tab, and then choosing **Cisco Product Identification Tool** from the alphabetical list. This tool offers three search options: by product ID or model name; by tree view; or, for certain products, by copying and pasting

show command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

Tip Displaying and Searching on Cisco.com

If you suspect that the browser is not refreshing a web page, force the browser to update the web page by holding down the Ctrl key while pressing F5.

To find technical information, narrow your search to look in technical documentation, not the entire Cisco.com website. On the Cisco.com home page, click the **Advanced Search** link under the Search box and then click the **Technical Support & Documentation** radio button.

To provide feedback about the Cisco.com website or a particular technical document, click **Contacts & Feedback** at the top of any Cisco.com web page.

Submitting a Service Request

Using the online TAC Service Request Tool is the fastest way to open S3 and S4 service requests. (S3 and S4 service requests are those in which your network is minimally impaired or for which you require product information.) After you describe your situation, the TAC Service Request Tool provides recommended solutions. If your issue is not resolved using the recommended resources, your service request is assigned to a Cisco engineer. The TAC Service Request Tool is located at this URL:

http://www.cisco.com/techsupport/servicerequest

For S1 or S2 service requests, or if you do not have Internet access, contact the Cisco TAC by telephone. (S1 or S2 service requests are those in which your production network is down or severely degraded.) Cisco engineers are assigned immediately to S1 and S2 service requests to help keep your business operations running smoothly.

To open a service request by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411
Australia: 1 800 805 227
EMEA: +32 2 704 55 55
USA: 1 800 553 2447

For a complete list of Cisco TAC contacts, go to this URL:

http://www.cisco.com/techsupport/contacts

Definitions of Service Request Severity

To ensure that all service requests are reported in a standard format, Cisco has established severity definitions.

Severity 1 (S1)—An existing network is "down" or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

Severity 2 (S2)—Operation of an existing network is severely degraded, or significant aspects of your business operations are negatively affected by inadequate performance of Cisco products. You and Cisco will commit full-time resources during normal business hours to resolve the situation.

Severity 3 (S3)—Operational performance of the network is impaired while most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Severity 4 (S4)—You require information or assistance with Cisco product capabilities, installation, or configuration. There is little or no effect on your business operations.

Obtaining Additional Publications and Information

Information about Cisco products, technologies, and network solutions is available from various online and printed sources.

- The Cisco Online Subscription Center is the website where you can sign up for a variety of Cisco e-mail newsletters and other communications. Create a profile and then select the subscriptions that you would like to receive. To visit the Cisco Online Subscription Center, go to this URL:

  http://www.cisco.com/offer/subscribe

- The *Cisco Product Quick Reference Guide* is a handy, compact reference tool that includes brief product overviews, key features, sample part numbers, and abbreviated technical specifications for many Cisco products that are sold through channel partners. It is updated twice a year and includes the latest Cisco channel product offerings. To order and find out more about the *Cisco Product Quick Reference Guide*, go to this URL:

  http://www.cisco.com/go/guide

- Cisco Marketplace provides a variety of Cisco books, reference guides, documentation, and logo merchandise. Visit Cisco Marketplace, the company store, at this URL:

  http://www.cisco.com/go/marketplace/

- Cisco Press publishes a wide range of general networking, training, and certification titles. Both new and experienced users will benefit from these publications. For current Cisco Press titles and other information, go to Cisco Press at this URL:

  http://www.ciscopress.com

- *Internet Protocol Journal* is a quarterly journal published by Cisco Systems for engineering professionals involved in designing, developing, and operating public and private internets and intranets. You can access the *Internet Protocol Journal* at this URL:

  http://www.cisco.com/ipj

- Networking products offered by Cisco Systems, as well as customer support services, can be obtained at this URL:

  http://www.cisco.com/en/US/products/index.html

- Networking Professionals Connection is an interactive website where networking professionals share questions, suggestions, and information about networking products and technologies with Cisco experts and other networking professionals. Join a discussion at this URL:

  http://www.cisco.com/discuss/networking

- "What's New in Cisco Documentation" is an online publication that provides information about the latest documentation releases for Cisco products. Updated monthly, this online publication is organized by product category to direct you quickly to the documentation for your products. You can view the latest release of "What's New in Cisco Documentation" at this URL:

  http://www.cisco.com/univercd/cc/td/doc/abtunicd/136957.htm

- World-class networking training is available from Cisco. You can view current offerings at this URL:

  http://www.cisco.com/en/US/learning/index.html

C H A P T E R 1

NSE-100 Overview

This chapter describes the NSE-100 and contains the following sections:

For NSE-100 configuration information, see Chapter 7, "Upgrading, Configuration, and Troubleshooting Tasks."

Supported Platforms

The NSE-100 is only supported on the Cisco 7304 router. Most Cisco IOS releases, including Cisco IOS Release 12.1EX, 12.2S, 12.2SBC, and 12.2SB, used to run the Cisco 7304 router can be used while running an NSE-100.

NSE-100 Description

This section contains information about the NSE-100 components and the system management functions. The NSE-100 contains a Route Processor and PXF processors. The Route Processor maintains and executes the system management functions for the Cisco 7304 router. The PXF processors work with the Route Processor to provide accelerated packet switching, as well as accelerated IP Layer 3 feature processing.

NSE-100 Hardware MAC Addresses Filtering

Each native Gigabit Ethernet port on the NSE-100 can support up to 64 hardware MAC addresses. Each port's MAC addresses are stored in a hardware MAC address filtering table. With two NSE-100s installed, the chassis can support up to four native Gigabit Ethernet ports.

Interfaces and LEDs

Figure 1-1   NSE-100 LEDs
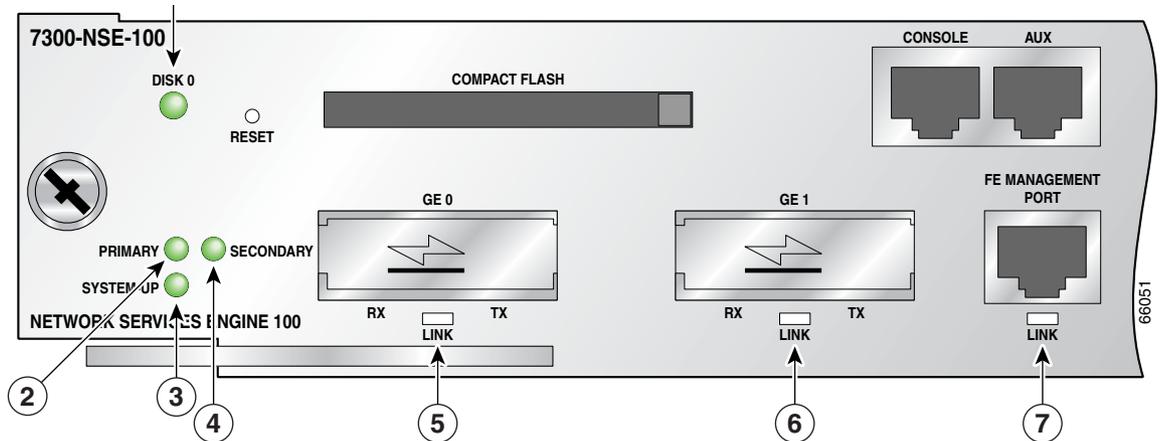
LED Label	Color	State	Function
DISK 0	Green/Yellow	Green	CompactFlash Disk is being accessed.
		Yellow	CompactFlash Disk access failure.
		Off	Default state on power up.
GE0 LINK	Green/Yellow	Green	Gigabit Ethernet port 0 is up.
		Yellow	Gigabit Ethernet port 0 line protocol is down due to a link error or other conditions.
		Off	Default state on power up, Gigabit Ethernet port 0 has been administratively shut down, or a fatal hardware error has occurred.
GE1 LINK	Green/Yellow	Green	Gigabit Ethernet port 1 is up.
		Yellow	Gigabit Ethernet port 1 line protocol is down due to a link error or other conditions.
		Off	Default state on power up, Gigabit Ethernet port 1 has been administratively shut down, or a fatal hardware error has occurred.
FE Management Port LINK	Green/Yellow	Green	Fast Ethernet physical link is up.
		Yellow	Line protocol is down due to a link error.
		Off	Default state on power up or has been administratively shut down.
PRIMARY	Green	On	NSE is up and running.
		Off	Default state on power up, or NSE is powered off.
SECONDARY	Green	On	The NSE is the standby NSE.
		Off	The NSE is not active.
SYSTEM-UP	Green/Yellow	Green	Cisco IOS is up and running.
		Yellow	ROMmon is booting up, ROMmon detects a fatal hardware error, or ROMmon is hanging before the system completes the bootup process.
		Off	ROMmon has completed the bootup process and the system either is in the autoboot stage or is waiting for a user command at a rommon#> prompt, or the power is off.

Components

Figure 1-2   NSE-100

Rear

Front

57739
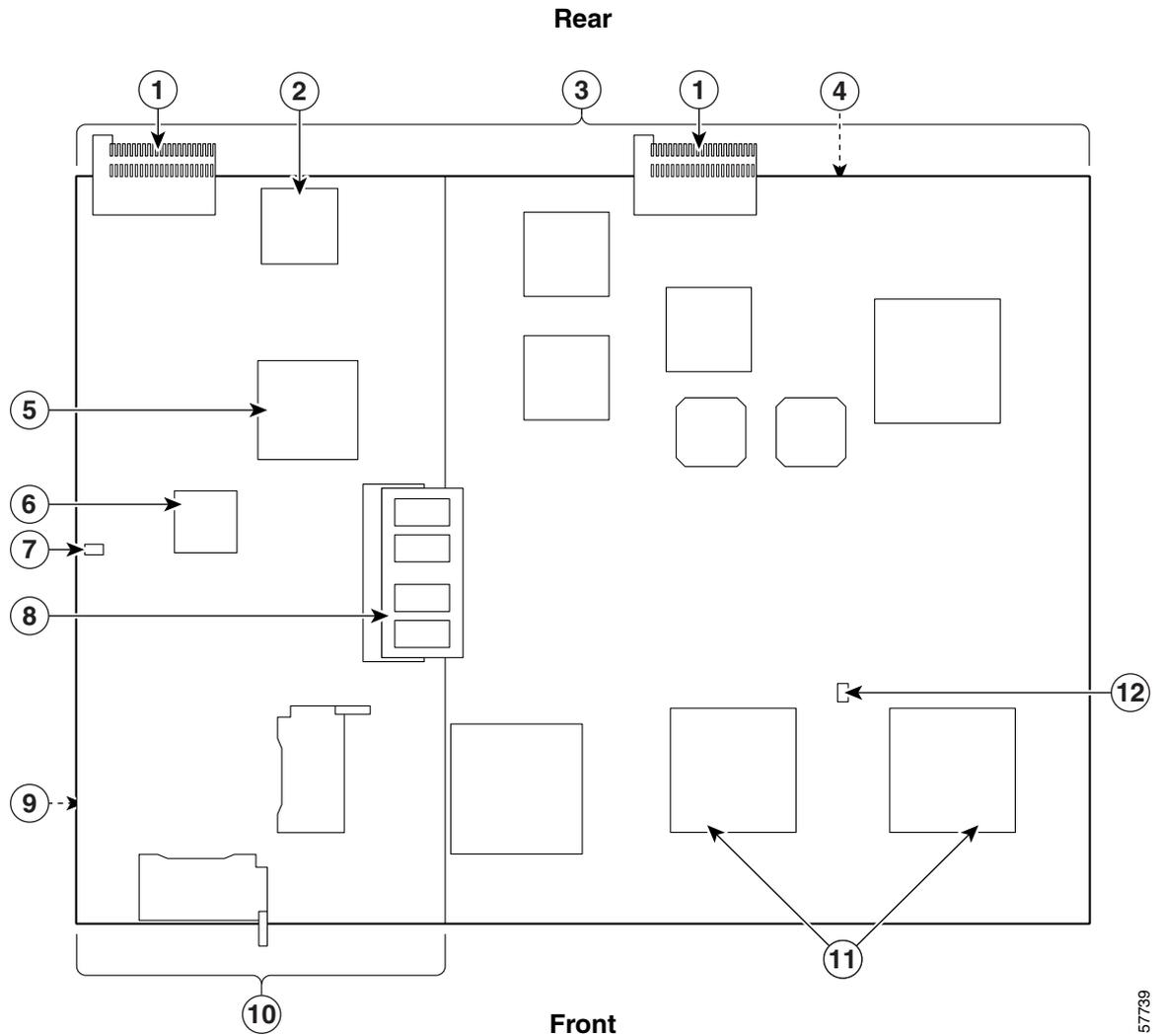
1	Midplane connectors	7	Daughter board temperature sensor
2	Route Processor	8	SODIMM
3	Motherboard	9	Inlet temperature sensor (under daughter board)
4	Outlet temperature sensor (bottom of board)	10	Daughter board
5	System controller	11	PXF processors
6	Boot ROM (ROM 0)	12	Temperature sensor

Figure 1-3   NSE-100 CompactFlash Disk Names
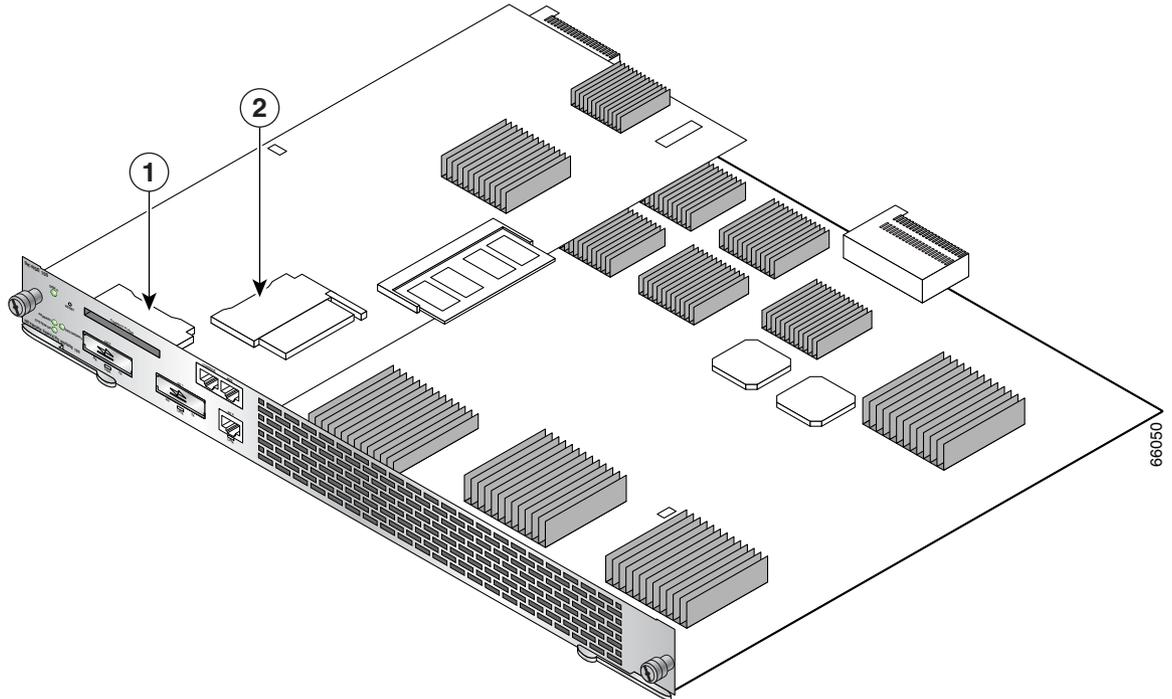
1	disk0:	**2**	bootdisk:

The NSE-100 consists of the following components:

- Reduced instruction set computing (RISC) microprocessor

  The NSE-100 uses an RM7000 microprocessor that operates at an internal clock speed of 350 MHz.

- Parallel eXpress Forwarding processors

  The Parallel eXpress Forwarding (PXF) processors enable parallel IP multipacket processing functions, and work with the Route Processor to provide accelerated packet switching, as well as accelerated IP Layer 3 feature processing.

- System controller

  The system controller provides hardware logic to interconnect the processor, DRAM, and the system backplane bus. The NSE-100 has one system controller that provides processor access to the two midplanes.

- Upgradeable memory modules

  The NSE-100 uses a SDRAM SODIMM for providing code, data, and punted packet storage. Generally, packets are stored in packet memory.

- Cache memory

  The NSE-100 has three levels of cache: primary and secondary cache that are internal to the microprocessor with secondary unified cache for data and instruction, and tertiary, 2-MB external cache.

- Four environmental sensors for monitoring the cooling air as it enters, moves across the system board, and leaves the chassis

- Upgradeable boot ROM for storing sufficient code for booting the Cisco IOS software
- CompactFlash Disk: Stores sufficient code for booting the Cisco IOS boot loader image (bootdisk:)
- NVRAM for storing the system configuration and environmental monitoring logs. NVRAM uses a lithium battery to maintain its contents when disconnected from power.
- Non-upgradeable boot ROM provides a "golden copy" of the default ROMmon image.
- Auxiliary port with full data terminal equipment (DTE) functionality
- Console port with full data communications equipment (DCE) functionality

System Management Functions

The NSE-100 performs the following system management functions:

- Sending and receiving routing protocol updates
- Managing tables, caches, and buffers
- Monitoring interface and environmental status
- Providing Simple Network Management Protocol (SNMP) management
- Booting and reloading images
- Managing line cards (including recognition and initialization during online insertion and removal)
- High availability (HA) support and management for two NSE-100s, one active and one standby
- Routing and forwarding traffic

⚠

Caution   Two NSE-100s, two NSE-150s, or two NPE-G100s are supported in the Cisco 7304. You cannot use two different processors in the same Cisco 7304 router.

NSE-100 Memory Information

The following sections describe NSE-100 memory:

Memory Systems Overview

The memory systems on the NSE-100 provide the following functions:

- Main memory of the Route Processor—Stores the configuration and routing tables for non-IP traffic. The Cisco IOS software executes from main memory, and the Route Processor is responsible for forwarding all non-IP traffic and analyzing routing protocols.

✎

Note   The main memory of the Route Processor is stored on the SDRAM SODIMM.

- Main memory for Parallel eXpress Forwarding (PXF)—Stores the tables for PXF routing and other PXF features. On the NSE-100, IP traffic, with a few exceptions, is always forwarded using PXF.

- Packet memory—Used for packet buffering by the router's network interfaces.

- Flash memory—Stores the boot helper image software. The boot helper image allows you to boot the router when the CompactFlash Disk does not contain a valid system image. It also allows you to boot the router from a network server.

- CompactFlash Disk (disk0:)—Stores the Cisco IOS software image and any other data that is stored in Flash memory. On the NSE-100, the router CLI refers to the CompactFlash Disk slot on the NSE-100 faceplate as disk0:.

- CompactFlash Disk (bootdisk:)—Stores the boot helper image software. The boot helper image allows you to boot from the router when the CompactFlash Disk in disk0: does not contain a valid system image. It also allows you to boot the router from a network server.

- Boot one time programmable (OTP) read-only memory (ROM)—Performs power-on diagnostics and initialization; initiates system bootup based on virtual configuration register. Contains the ROM monitor boot image, which permits you to boot the Cisco IOS image from either bootflash or a CompactFlash Disk. The boot OTP ROM cannot be upgraded; ROM can be upgraded using upgradeable boot ROM, also called the "golden ROM" for Cisco 7304 routers in some Cisco documentation.

- Upgradeable boot ROM—The upgradeable boot ROM performs the same functions as the boot OTP ROM, but is upgradeable. If the boot code is upgraded, the upgraded boot code is stored in upgradeable boot ROM.

Note   Boot ROM is upgraded using the Cisco IOS software. Boot ROM cannot be upgraded by physically changing a component on the NSE-100 board.

- Nonvolatile random-access memory (NVRAM)—Stores the system configuration, environmental monitoring logs, and the virtual configuration register.

Memory Specifications

Table 1-1 provides memory specifications and Table 1-2 provides user-replaceable memory configuration information for the NSE-100. Table 1-3 provides information on the CompactFlash disks supported on the NSE-100.

Table 1-1   NSE-100 Memory Specifications

Memory Type	Memory Size	Quantity	Description	Location on NSE-100 Board
SDRAM[1]	256 or 512 MB	1	256-MB or 512-MB SODIMM	U19
Non-upgradeable boot ROM	512 KB	1	OTP[2] ROM for the ROM monitor (ROMmon)	U11
Upgradeable boot ROM	1 MB	2	Programmable ROM	U14, U34
NVRAM	512 KB	1	Stores the system configuration and environmental monitoring logs	—

Table 1-1   NSE-100 Memory Specifications (continued)

Memory Type	Memory Size	Quantity	Description	Location on NSE-100 Board
Flash memory	disk 0: 64 MB or 128 MB bootdisk: 32 MB	2	CompactFlash Disks	P2 (bootdisk:), P3 (disk0:)
Primary cache	16 KB (instruction), 16 KB (data)	—	RM7000 processor, internal cache	U2
Secondary cache	256 KB	—	RM7000 processor; internal, unified instruction and data cache	U2
Tertiary cache	2 MB (fixed)	—	RM7000 processor, external cache	U5, U32, U33

1. On November 3, 2003, the 512-MB SDRAM memory option became the default SDRAM memory option for the NSE-100 processor. The 256-MB SDRAM memory option is still available as a spare, but the 128-MB SDRAM memory option that was once available for the NSE-100 processor became unavailable for the NSE-100 processor.

2. OTP = one time programmable. Although the OTP ROMmon cannot be upgraded, the boot code can be upgraded using the Cisco IOS software. If the boot code is upgraded, the updated boot code is stored in upgradeable boot ROM.

Table 1-2   NSE-100 SODIMM Configurations—Configurable Memory

Total SDRAM	SDRAM SODIMM	Quantity	Product Number
128 MB[1]	U19	1 128-MB SODIMM	7300-MEM-128=
256 MB	U19	1 256-MB SODIMM	7300-MEM-256=
512 MB	U19	1 512-MB SODIMM	7300-MEM-512=

1. On November 3, 2003, the 512-MB SDRAM memory option became the default SDRAM memory option for the NSE-100 processor. The 256-MB SDRAM memory option is still available as a spare, but the 128-MB SDRAM memory option that was once available for the NSE-100 processor became unavailable for the NSE-100 processor.

Table 1-3   CompactFlash Disk Configurations

Memory Size	Product Number
64 MB	7300-I/O-CFM-64MB=
128 MB	7300-I/O-CFM-128MB=

Memory Locations

Use Figure 1-4 and the proceeding tables for information about the NSE-100 memory locations.

Figure 1-4   Memory Locations on the NSE-100
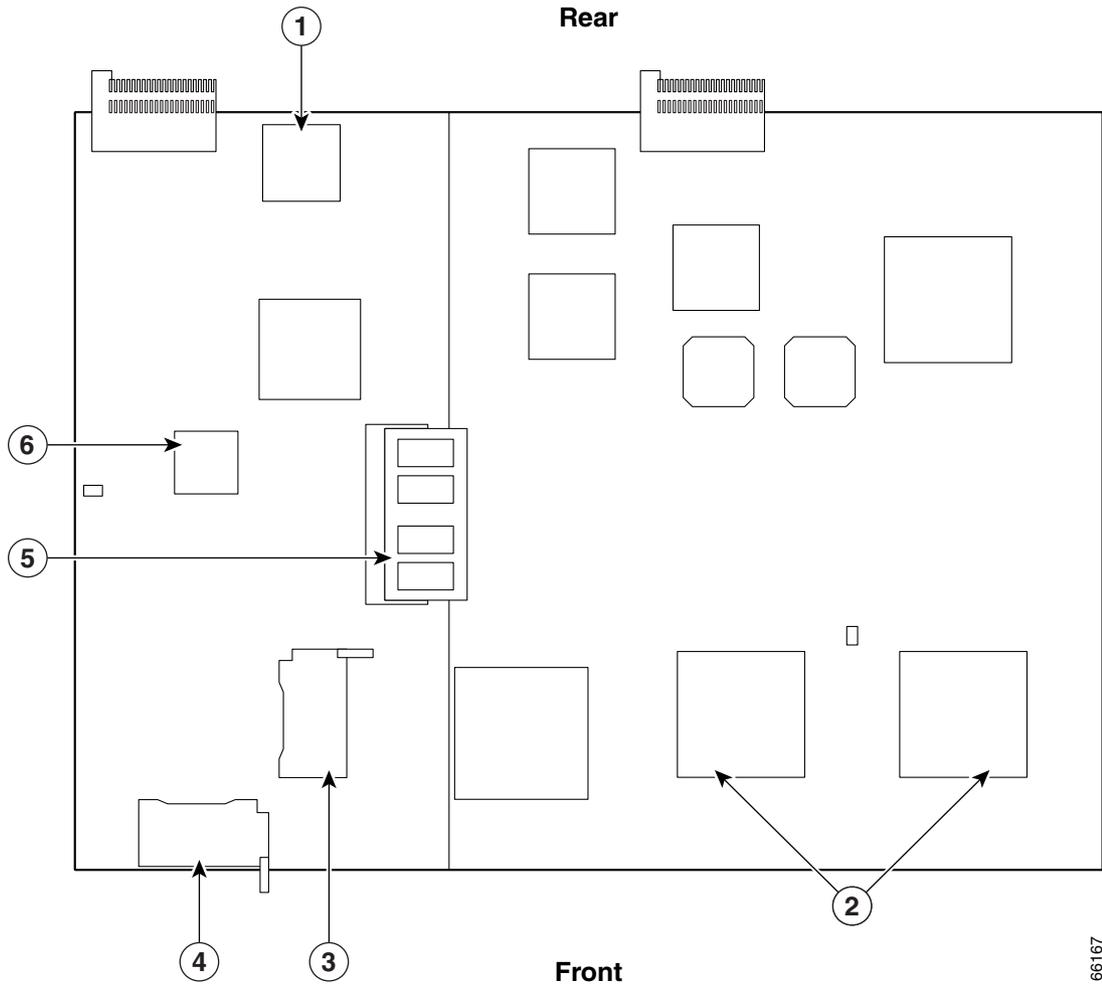
1	Route Processor	4	CompactFlash Disk slot (disk0:)
2	PXF processors	5	SDRAM SODIMM (U19)
3	CompactFlash Disk slot (bootdisk:)	6	Boot OTP ROM

Determining the Memory Configuration

To determine the memory configuration of your NSE-100, use the **show version** command.

The following example shows an NSE-100 installed in a Cisco 7304 router:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7300 Software (C7300-JS-M), Version 12.2(14)S3, EARLY DEPLOYMENT RELEASE SOFTWARE
(fc1)
Copyright (c) 1986-2003 by cisco Systems, Inc.
Compiled Fri 01-Jul-03 18:17 by anonymous
Image text-base:0x40008970, data-base:0x4197C000

ROM:System Bootstrap, Version 12.1(20020207:195837) [biff-ha02 104],
RELEASED SOFTWARE
Currently running ROMMON from ROM 1

Router uptime is 0 minutes
System returned to ROM by power-on
System image file is "disk0:c7300-js-mz.NSE100CR_20020322"

cisco 7300 (NSE100) processor (revision 0x00) with 114688K/16384K bytes
of memory.
Processor board ID
R7000 CPU at 350Mhz, Implementation 39, Rev 4.0, 256KB L2, 1024KB L3 Cache
4 slot midplane, Version 65.48

Last reset from software reset or reload
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
PXF processor tmc0 running 'system:pxf/ucode1' v1.7 is active
PXF processor tmc1 running 'system:pxf/ucode1' v1.7 is active
1 FastEthernet/IEEE 802.3 interface(s)
4 Gigabit Ethernet/IEEE 802.3 interface(s)
1 Packet over SONET network interface(s)
509K bytes of non-volatile configuration memory.

31360K bytes of ATA compact flash in bootdisk (Sector size 512 bytes).
62720K bytes of ATA compact flash in disk0 (Sector size 512 bytes).
Configuration register is 0x0
```

Gigabit Ethernet GBIC Port and Cabling Specifications

Table 1-4 provides GBIC port and cabling specification information.

Table 1-4   GBIC Module Product Numbers, Descriptions, and Operating Distances

Product Number	GBIC Module	Description	Operating Distance	Minimum Cisco IOS Release
WS-G5483=	1000BASE-T GBIC	Connects a GBIC port to Category 5 wiring via a standard RJ-45 interface.	The maximum Category 5 wiring distance is 328 feet (100 meters).	Cisco IOS Release 12.2(28)SB
GBIC-SX= or WS-G5484=	Short wavelength (1000BASESX)	Contains a Class 1 laser of 850 nm for 1000BASESX (short wavelength) applications.	Operates on standard multimode fiber-optic link spans of up to 1804 feet (550 m).	This GBIC will operate on all Cisco IOS releases running a Cisco 7304 using an NSE-100.
GBIC-LX/LH= or WS-G5486=	Long wavelength/ long haul (1000BASELX/ LH)	Contains a Class 1 laser of 1300 nm for 1000BASELX/LH (long wavelength) applications.	Operates on single-mode fiber-optic link spans of up to 6.2 miles (10 km) or multimode spans up to 1804 feet (550 m) with mode-conditioning patch cord.	This GBIC will operate on all Cisco IOS releases running a Cisco 7304 using an NSE-100.
GBIC-ZX =or WS-G5487=	Extended distance wavelength (1000BASEZX)	Contains a Class 1 laser of 1550 nm for 1000BASEZX (extended wavelength) applications.	Operates on ordinary single-mode fiber-optic link spans of up to 43.5 miles (70 km). Link spans of up to 62.1 miles (100 km) are possible using premium single-mode fiber or dispersion-shifted single-mode fiber (premium single-mode fiber has a lower attenuation per unit length than ordinary single-mode fiber; dispersion-shifted single-mode fiber has both lower attenuation and less dispersion).	This GBIC will operate on all Cisco IOS releases running a Cisco 7304 using an NSE-100.

For more detailed information on these GBIC modules, see the *Cisco Gigabit Interface Converter Data Sheet.*

Mode-Conditioning Patch Cord Description

A mode-conditioning patch cord can be used with the GBIC-LH or WS-G5486 to allow reliable laser transmission between the single-mode laser source on the GBIC and a multimode optical fiber cable.

When an unconditioned laser source designed for operation on single-mode optical fiber is directly coupled to a multimode optical fiber cable, an effect known as differential mode delay (DMD) might result in a degradation of the modal bandwidth of the optical fiber cable.

This degradation results in a decrease in the link span (the distance between a transmitter and a receiver) that can be supported reliably. The effect of DMD can be overcome by conditioning the launch characteristics of a laser source. A practical means of performing this conditioning is to use a device called a mode-conditioning patch cord.

A mode-conditioning patch cord is an optical fiber cable assembly that consists of a pair of optical fibers terminated with connector hardware. Specifically, the mode-conditioning patch cord is composed of a single-mode optical fiber permanently coupled off-center (see Offset in Figure 1-5) to a graded-index multimode optical fiber. Figure 1-5 shows a diagram of the mode-conditioning patch cord assembly.

The mode-conditioning patch cord assembly is composed of duplex optical fibers, including a single-mode-to-multimode offset launch fiber connected to the transmitter, and a second conventional graded-index multimode optical fiber connected to the receiver. The use of a plug-to-plug patch cord maximizes the power budget of multimode 1000BASE-LX and 1000BASE-LH links.

Note   The mode-conditioning patch cord is required to comply with IEEE standards. The IEEE found that link distances could not be met with certain types of fiber-optic cable cores. The solution is to launch light from the laser at a precise offset from the center, which is accomplished by using the mode-conditioning patch cord. At the output of the patch cord, the GBIC-LX/LH is compliant with the IEEE 802.3z standard for 1000BASE-LX.

Figure 1-5   *Mode Conditioning Patch Cord*
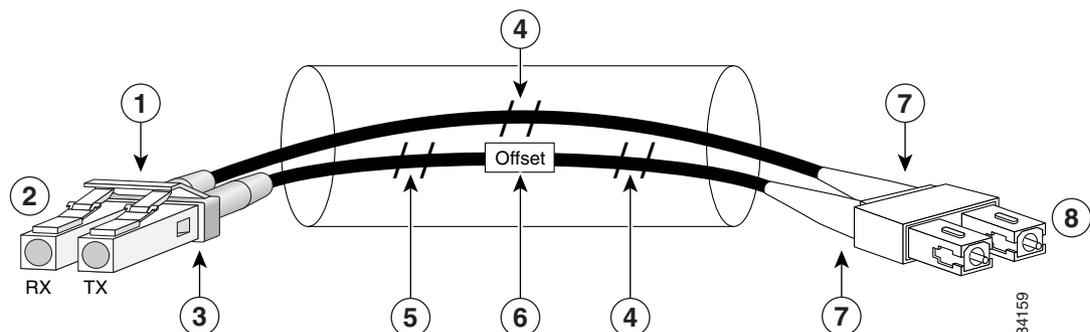
1	Gray color identifier	**5**	Single-mode bar
2	To Gigabit Ethernet interface	**6**	Offset
3	Blue color identifier	**7**	Beige color identifier
4	Multimode bar	**8**	To cable plant

> **Note** Figure 1-5 shows one type of mode-conditioning patch cord.

CWDM GBIC Modules

All of the Coarse Wavelength-Division Multiplexing (CWDM) GBIC modules documented in this section were initially introduced for Cisco 7304 routers using an NSE-100 on Cisco IOS Release 12.2(28)SB.

CWDM GBIC modules for the NSE-100 come in eight wavelengths that range from 1470 nm to 1610 nm. Color markings on the devices identify the wavelength to which the Gigabit Ethernet channel is mapped. Table 1-5 lists the CWDM GBIC modules with the wavelengths and color codes that are supported on the NSE-100.

Table 1-5   CWDM GBIC Module Wavelengths and Color Coding

CWDM GBIC Module Product Number	Wavelength	Color Identifier
CWDM-GBIC-1470=	Cisco 1000BASE-CWDM GBIC, 1470 nm	Gray
CWDM-GBIC-1490=	Cisco 1000BASE-CWDM GBIC, 1490 nm	Violet
CWDM-GBIC-1510=	Cisco 1000BASE-CWDM GBIC, 1510 nm	Blue
CWDM-GBIC-1530=	Cisco 1000BASE-CWDM GBIC, 1530 nm	Green
CWDM-GBIC-1550=	Cisco 1000BASE-CWDM GBIC, 1550 nm	Yellow
CWDM-GBIC-1570=	Cisco 1000BASE-CWDM GBIC, 1570 nm	Orange
CWDM-GBIC-1590=	Cisco 1000BASE-CWDM GBIC, 1590 nm	Red
CWDM-GBIC-1610=	Cisco 1000BASE-CWDM GBIC, 1610 nm	Brown

For more detailed information on these CWDM GBIC modules, see the *Cisco CWDM GBIC and SFP Solution Data Sheet*.

Fast Ethernet Management Port Connections

The Cisco 7304 router has an RJ-45 media port that provides 10/100-Mbps connectivity. It is not used for regular traffic. It is used to connect to a network management station and for downloading images. You should not switch to or from this port. For more information, see the online *Cisco 7304 Installation and Configuration Guide.*

To identify the Fast Ethernet cable type, hold the two ends of the cable next to each other so you can see the colored wires inside the ends. The straight-through wire type has colored wires in the same sequence at both ends. In the crossover wire type, the first colored wire at the far left is the third colored wire at the other end. The second colored wire at the far left is the sixth colored wire at the other end.

C H A P T E R 2

NSE-150 Overview

This chapter describes the NSE-150 and contains the following sections:

For NSE-150 configuration information, see Chapter 7, "Upgrading, Configuration, and Troubleshooting Tasks."

Supported Platforms

The NSE-150 is only supported on the Cisco 7304 router. The NSE-150 software support was introduced in Cisco IOS Release 12.2(31)SB2.

NSE-150 Description

The NSE-150 is a processor for the Cisco 7304 router. It contains two internal processors for forwarding network traffic: a Parallel eXpress Forwarding (PXF) processor, which accelerates the processing of IP packets for features supported in the PXF processing path, and a Route Processor (RP), which handles all non-IP packets as well as all packets that are not forwarded using the PXF processing path.

The NSE-150, which has four on-board Gigabit Ethernet interfaces, introduces additional Gigabit Ethernet ports for the Cisco 7304 router. Additional on-board memory has also been added for the NSE-150, allowing for faster processing of both PXF-processed and RP-processed traffic.

LEDs

NSE-150 LED information is in Figure 2-1.

Figure 2-1   NSE-150 LEDs
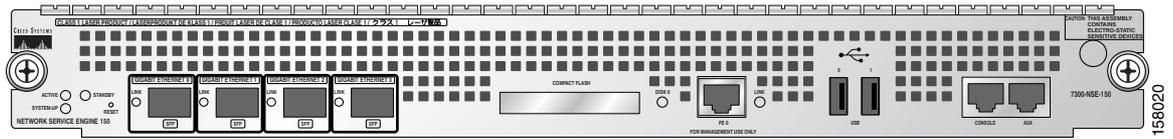
LED Label	Color	State	Function
ACTIVE	Green	On	NSE is up and running.
		Off	NSE is off. Default state on power up.
SYSTEM-UP	Green/Yellow	Green	Cisco IOS is up and running.
		Yellow	ROMmon is booting up, ROMmon detects a fatal hardware error, or ROMmon is hanging before the system completes the bootup process.
		Off	ROMmon has completed the bootup process and the system either is in the autoboot stage or is waiting for a user command at a rommon#> prompt, or the NSE is off.
STANDBY	Green	On	The NSE is the standby NSE in a High Availability configuration.
		Off	The NSE is not running or is running as the primary NSE.
GIGABIT ETHER-NET 0 LINK	Green/Yellow	Green	Gigabit Ethernet port 0 is up.
		Yellow	Gigabit Ethernet port 0 line protocol is down due to a link error or other conditions.
		Off	Default state on power up, Gigabit Ethernet port 0 has been administratively shut down, or a fatal hardware error has occurred.
GIGABIT ETHER-NET 1 LINK	Green/Yellow	Green	Gigabit Ethernet port 1 is up.
		Yellow	Gigabit Ethernet port 1 line protocol is down due to a link error or other conditions.
		Off	Default state on power up, Gigabit Ethernet port 1 has been administratively shut down, or a fatal hardware error has occurred.
GIGABIT ETHER-NET 2 LINK	Green/Yellow	Green	Gigabit Ethernet port 2 is up.
		Yellow	Gigabit Ethernet port 2 line protocol is down due to a link error or other conditions.
		Off	Default state on power up, Gigabit Ethernet port 2 has been administratively shut down, or a fatal hardware error has occurred.
GIGABIT ETHER-NET 3 LINK	Green/Yellow	Green	Gigabit Ethernet port 3 is up.
		Yellow	Gigabit Ethernet port 3 line protocol is down due to a link error or other conditions.
		Off	Default state on power up, Gigabit Ethernet port 3 has been administratively shut down, or a fatal hardware error has occurred.
DISK 0	Green/Yellow	Green	CompactFlash Disk is being accessed.
		Yellow	CompactFlash Disk access failure.
		Off	Default state on power up.
FE Management Port LINK	Green/Yellow	Green	Fast Ethernet physical link is up, line protocol is up.

LED Label	Color	State	Function
		Yellow	Line protocol is down due to a link error.
		Off	Default state on power up or has been administratively shut down.

Components

Figure 2-2   NSE-150 MotherBoard

1	ROMmon	4	Internal Flash Disk (bootdisk:)
2	DDR-SODIMMs	5	External Flash Disk (disk0:)
3	Route Processor		

⚠️

Caution   The DDR-SODIMMs on the NSE-150 motherboard are configured in a "butterfly" configuration, meaning the SODIMMs are designed to not lay flat on the motherboard like the other components. The DDR-SODIMMs should not be forced to lie flat on the board. Forcing the DDR-SODIMMs to lie flat on the board can cause damage to the SODIMM or the NSE-150 motherboard.

Figure 2-3   NSE-150 Daughter Card
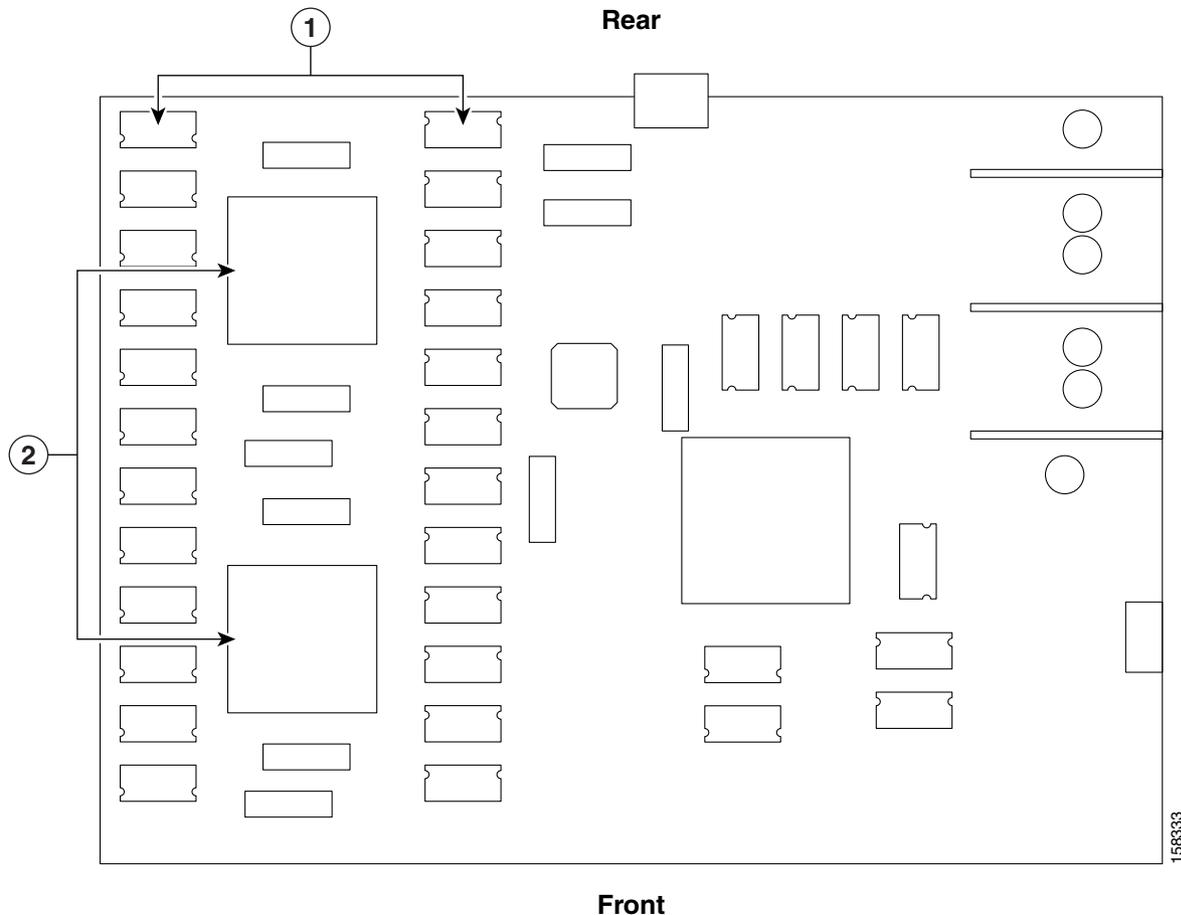
1	SDRAM	2	PXF processors

The NSE-150 consists of the following components:

- BCM-1250 processor

  The NSE-150 uses a BCM-1250 processor that operates at an internal clock speed of 800 MHz.

- Parallel eXpress Forwarding processors

  The Parallel eXpress Forwarding (PXF) processors enable parallel IP multipacket processing functions, and work with the Route Processor to provide accelerated packet switching

- Upgradeable boot ROM for storing sufficient code for booting the Cisco IOS software

- CompactFlash Disk: Stores up to 256 MB for storing images, configurations, or other files.

- NVRAM for storing the system configuration and environmental monitoring logs. NVRAM uses a lithium battery to maintain its contents when disconnected from power.
- Non-upgradeable boot ROM provides a "golden copy" of the default ROMmon image.
- Auxiliary port with full data terminal equipment (DTE) functionality
- Console port with full data communications equipment (DCE) functionality

NSE-150 Memory Information

To determine the memory configuration of your NSE-150, use the **show version** command.

The following example shows an NSE-150 installed in a Cisco 7304 router:

```
Router# show version

Cisco IOS Software, 7300 Software (C7300-JS-M), Version 12.2(31)SB
Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Thu 13-Jul-06 05:34 by wsatchel

ROM: System Bootstrap, Version 12.2(20060308:003941)

 7304-R1 uptime is 1 day, 14 hours, 58 minutes
Uptime for this control processor is 1 day, 14 hours, 58 minutes
System returned to ROM by power-on
System restarted at 23:01:36 PDT Sun Jul 16 2006
System image file is "disk0:c7300-js-mz.v122_31_sb_oib_throttle-060712"

cisco 7300 (NSE150) processor (revision 0x00) with 2064383K/32768K bytes of memory.
Processor board ID SMQ0908N06Z
SB-1 CPU at 800Mhz, Implementation 0x401, Rev 0.2, 512KB L2 Cache
4 slot midplane, Version 67.49

Last reset from power-on
PXF processor tmc0 'system:pxf/ucode1' is running ( v1.0 ).
PXF processor tmc1 'system:pxf/ucode1' is running ( v1.0 ).
5 FastEthernet interfaces
5 Gigabit Ethernet interfaces
5 Packet over SONET interfaces
2045K bytes of non-volatile configuration memory.

62592K bytes of ATA compact flash in bootdisk (Sector size 512 bytes).
125184K bytes of ATA compact flash in disk0 (Sector size 512 bytes).
Configuration register is 0x0
```

Table 2-1 provides memory specifications and Table 2-2 provides user-replaceable memory configuration information for the NSE-150.

Table 2-1   NSE-150 Memory Specifications

Memory Type	Memory Size	Quantity	Description
DRAM	2 GB	2	2 1-GB SODIMMs[1]
SDRAM	2GB	1	built-in SDRAM SODIMMs
Non-upgradeable boot ROM	512 KB	1	OTP ROM for the ROM monitor (ROMmon)
Upgradeable boot ROM	2 MB	2	Programmable ROM

Table 2-1   NSE-150 Memory Specifications (continued)

Memory Type	Memory Size	Quantity	Description
NVRAM	2 MB	1	Stores the system configuration and environmental monitoring logs
Flash Disk memory (internal CompactFlash slot; bootdisk:)	256 MB	1	Stores images, configurations, or other files. 256-MB CompactFlash Disks
Flash Disk memory (external CompactFlash slot; disk0:)	256 MB	1	Stores images, configurations, or other files. 256-MB CompactFlash Disks

1. The DDR-SODIMMs on the NSE-150 motherboard are configured in a "butterfly" configuration, meaning the SODIMMs are designed to not lay flat on the motherboard like the other components. The DDR-SODIMMs should not be forced to lie flat on the board. Forcing the DDR-SODIMMs to lie flat on the board can cause damage to the SODIMM or the NSE-150 motherboard.

Table 2-2   CompactFlash Disk Configurations

Memory Size	Product Number
256 MB	7300-I/O-CFM-256MB=

Gigabit Ethernet SFP Port and Cabling Specifications

The following sections provide information about the SFP modules supported for the NSE-150:

Master List of Supported SFP Modules

The following table provides a list of SFP modules supported by the Gigabit Ethernet ports on the NSE-150 processor.

See the other SFP module sections in this document for additional information on the SFP modules supported by the NSE-150.

Table 2-3   Master List of Supported SFP Modules

Product Number	Description
CWDM-SFP-1470=	Longwave 1470 nm laser, single mode
CWDM-SFP-1490=	Longwave 1490 nm laser, single mode
CWDM-SFP-1510=	Longwave 1510 nm laser, single mode
CWDM-SFP-1530=	Longwave 1530 nm laser, single mode
CWDM-SFP-1550=	Longwave 1550 nm laser, single mode
CWDM-SFP-1570=	Longwave 1570 nm laser, single mode
CWDM-SFP-1590=	Longwave 1590 nm laser, single mode
CWDM-SFP-1610=	Longwave 1610 nm laser, single mode
GLC-BX-D	1000BASE-BX10-D downstream bidirectional single fiber; with digital optical monitoring
GLC-BX-U	1000BASE-BX10-U upstream bidirectional single fiber; with digital optical monitoring
GLC-LH-SM	1000BASE-LX/LH long wavelength/long haul; without digital optical monitoring
GLC-SX-MM	1000BASE-SX short wavelength; without digital optical monitoring
GLC-T	1000BASE-T SFP Module
GLC-ZX-SM	1000BASE-ZX extended distance; without digital optical monitoring
SFP-GE-L	1000BASE-LX/LH short wavelength; with digital optical monitoring
SFP-GE-S	1000BASE-SX short wavelength; with digital optical monitoring
SFP-GE-Z	1000BASE-ZX extended distance; with digital optical monitoring

CWDM SFP Modules

Coarse Wavelength-Division Multiplexing (CWDM) SFP modules for the NSE-150 come in eight wavelengths that range from 1470 nm to 1610 nm. Color markings on the devices identify the wavelength to which the Gigabit Ethernet channel is mapped. Table 2-4 lists the CWDM SFP modules with the wavelengths and color codes that are supported on the NSE-150.

Table 2-4   CWDM SFP Module Wavelengths and Color Coding

CWDM SFP Module Product Number	Wavelength	Color Identifier
CWDM-SFP-1470=	Longwave 1470 nm laser, single mode	Gray
CWDM-SFP-1490=	Longwave 1490 nm laser, single mode	Violet
CWDM-SFP-1510=	Longwave 1510 nm laser, single mode	Blue
CWDM-SFP-1530=	Longwave 1530 nm laser, single mode	Green
CWDM-SFP-1550=	Longwave 1550 nm laser, single mode	Yellow
CWDM-SFP-1570=	Longwave 1570 nm laser, single mode	Orange
CWDM-SFP-1590=	Longwave 1590 nm laser, single mode	Red
CWDM-SFP-1610=	Longwave 1610 nm laser, single mode	Brown

For more detailed information on these CWDM SFP modules, see the *Cisco CWDM GBIC and SFP Solution Data Sheet*.

1000BASE-T SFP Module

The NSE-150 supports the GLC-T, which is a 1000BASE-T SFP module that provides Gigabit Ethernet connectivity over existing copper network infrastructure.

For more detailed information on the GLC-T, see the *Cisco 1000BASE-T SFP Data Sheet*.

Optical Gigabit Ethernet 1000BASE-SX SFP Modules

The 1000BASE-SX SFP module, compatible with the IEEE 802.3z 1000BASE-SX standard, operates on 50 µm multimode fiber links up to 550 m and on 62.5 µm FDDI-grade multimode fibers up to 220 m.

The NSE-150 supports the following 1000BASE-SX SFP modules:

Table 2-5   1000BASE-SX SFP Module Product Numbers and Descriptions

Product Number	Product Description
SFP-GE-S	1000BASE-SX short wavelength; with digital optical monitoring
GLC-SX-MM	1000BASE-SX short wavelength; without digital optical monitoring

For more detailed information on the 1000BASE-SX SFP modules, see the *Cisco SFP Optics For Gigabit Ethernet Applications Data Sheet*.

Optical Gigabit Ethernet 1000BASE-LX/LH SFP Modules

The 1000BASE-LX/LH SFP module, compatible with the IEEE 802.3z 1000BASE-LX standard, operates on standard single-mode fiber-optic link spans of up to 10 km and up to 550 m on any multimode fibers.

The NSE-150 supports the following 1000BASE-LX/LH SFP modules:

Table 2-6   1000BASE-LX/LH SFP Product Numbers and Descriptions

Product Number	Product Description
SFP-GE-L	1000BASE-LX/LH short wavelength; with digital optical monitoring
GLC-LH-SM	1000BASE-LX/LH long-wavelength/long haul; without digital optical monitoring

Note that a mode conditioning patch cord is often used with 1000BASE-LX/LH SFP modules to ensure reliable transmission. For information on mode conditioning patch cords, see the "Mode-Conditioning Patch Cord Description" section on page 1-11.

For more detailed information on the 1000BASE-LX/LH SFP modules, see the *Cisco SFP Optics For Gigabit Ethernet Applications Data Sheet*.

Optical Gigabit Ethernet 1000BASE-ZX SFP Modules

The 1000BASE-ZX SFP module operates on standard single-mode fiber-optic link spans of up to approximately 70 km in length. The SFP provides an optical link budget of 23 dB, but the precise link span length depends on multiple factors such as fiber quality, number of splices, and connectors.

The NSE-150 supports the following 1000BASE-ZX SFP modules:

Table 2-7   1000BASE-ZX SFP Module Product Numbers and Descriptions

Product Number	Product Description
SFP-GE-Z	1000BASE-ZX; with digital optical monitoring
GLC-ZX-SM	1000BASE-ZX extended distance; without digital optical monitoring

For more detailed information on the 1000BASE-ZX SFP modules, see the *Cisco SFP Optics For Gigabit Ethernet Applications Data Sheet*.

Optical Gigabit Ethernet 1000BASE-BX SFP Modules

The 1000BASE-BX-D and 1000BASE-BX-U SFP modules, compatible with the IEEE 802.3ah 1000BASE-BX10-D and 1000BASE-BX10-U standards, operate on a single strand of standard single-mode fiber.

A 1000BASE-BX10-D device is always connected to a 1000BASE-BX10-U device with a single strand of standard single-mode fiber with an operating transmission range up to 10 km.

The NSE-150 supports the following 1000BASE-BX SFP modules:

Table 2-8   1000BASE-BX SFP Product Numbers and Descriptions

Product Number	Product Description
GLC-BX-D	1000BASE-BX10-D downstream bidirectional single fiber; with digital optical monitoring (DOM)
GLC-BX-U	1000BASE-BX10-U upstream bidirectional single fiber; with digital optical monitoring (DOM)

For more detailed information on the 1000BASE-BX SFP modules, see the *Cisco SFP Optics For Gigabit Ethernet Applications Data Sheet*.

USB Interface

The NSE-150 USB interface is not usable at this time. Cisco Systems plans on making the USB interface available in a later Cisco IOS release as part of a future enhancement.

Fast Ethernet Management Port Connections

The NSE-150 has an RJ-45 media port that provides 10/100-Mbps connectivity. It is not used for regular traffic. It is used to connect to a network management station and for downloading images. You should not switch to or from this port.

To identify the Fast Ethernet cable type, hold the two ends of the cable next to each other so you can see the colored wires inside the ends. The straight-through wire type has colored wires in the same sequence at both ends. In the crossover wire type, the first colored wire at the far left is the third colored wire at the other end. The second colored wire at the far left is the sixth colored wire at the other end.

The Fast Ethernet cable pinouts used for the NSE-100 are identical to the Fast Ethernet cable pinouts for the Ethernet cable used on the NSE-150 Fast Ethernet Management Port. For information about these pinouts, see the "NSE-100 Fast Ethernet RJ-45 Pinouts" section of the *Cisco 7304 Installation and Configuration Guide*.

Console and Auxiliary Ports

The NSE-150 has a DCE-mode console port for connecting a console terminal, and a DTE-mode auxiliary port for connecting a modem or other DCE device (such as a CSU/DSU or other router) to your router. The NSE-150 uses RJ-45 ports for both the auxiliary and console ports. Both the console and the auxiliary ports are asynchronous serial ports; any devices connected to these ports must be capable of asynchronous transmission. (Asynchronous is the most common type of serial device; for example, most modems are asynchronous devices.)

Before connecting a terminal to the console port, configure the terminal to match the router console port as follows: 9600 baud, 8 data bits, no parity, 2 stop bits (9600 8N2). After you establish normal router operation, you can disconnect the terminal.

The following tables show the console and auxiliary port signals:

Table 2-9   Console Port Signals

Pin	Signal	Direction	Description
1	CTS	Out	Clear To Send (RTS is tied directly to CTS)
2	DSR	Out	Data Set Ready (always on)
3	RXD	Out	Transmit Data
4	GND	—	Signal Ground
5	GND	—	Signal Ground
6	TXD	In	Receive Data
7	DTR	In	Data Terminal Ready (always on)
8	RTS	In	Ready To Send (RTS is tied directly to CTS)

Table 2-10   Auxiliary Port Signals

Pin	Signal	Direction	Description
1	RTS	Out	Ready To Send (tracks CTS)
2	DTR	Out	Data Terminal Ready
3	TXD	Out	Receive Data
4	GND	—	Signal Ground
5	GND	—	Signal Ground
6	RXD	In	Transmit Data
7	DSR	In	Data Set Ready (always on)
8	CTS	In	Clear To Send

For additional information on using the console and auxiliary ports, see *Connecting Console and Auxiliary Ports*.

C H A P T E R **3**

Preparation for Installation

This section provides a list of parts and tools you need to remove and replace the network services engine (NSE-100 or NSE-150) in a Cisco 7304 router. This section also includes safety and ESD-prevention guidelines to help you avoid injury to yourself and damage to the equipment. The following sections are found in this chapter:

- Required Tools and Equipment, page 3-1
- Software Requirements, page 3-1
- Bandwidth Oversubscription, page 3-2
- Safety Guidelines, page 3-2

Required Tools and Equipment

You need the following parts and tools to remove and replace an NSE in a Cisco 7304 router:

- An NSE-100 or NSE-150
- Number 2 Phillips screwdriver and a 3/16-inch flat-blade screwdriver
- 1/8-inch flat-blade screwdriver for DC power supply connections
- Your own ESD-prevention equipment or the disposable grounding wrist strap included with all field-replaceable units (FRUs)
- An antistatic mat or surface, or static-shielding bag

If your router is mounted in a rack, make sure you have at least one other person available to assist you with removing the chassis from the rack.

Software Requirements

NSE-100

Most Cisco IOS releases, including Cisco IOS Release 12.1EX, 12.2S, 12.2SBC, and 12.2SB, used to run the Cisco 7304 router can be used while running an NSE-100.

NSE-150

The NSE-150 was introduced in Cisco IOS Release 12.2(31)SB.

Software Advisor

See Software Advisor for a list of all software releases supporting the Cisco 7304 router.

Note Access to this tool is limited to users with Cisco.com login accounts.

To access Software Advisor, click **Login** at Cisco.com, type "Software Advisor" in the SEARCH box, and click **GO**. Click the link for the Software Advisor tool.

Choose a product family or enter a specific product number to search for the minimum supported software release needed for your hardware.

Bandwidth Oversubscription

For information on bandwidth oversubscription for the NSEs, see *Bandwidth Information for Cisco 7304 Routers*.

Safety Guidelines

Following are safety guidelines that you should follow when working with any equipment that connects to electrical power or telephone wiring.

Warning **Only trained and qualified personnel should be allowed to install, replace, or service this equipment.**

Waarschuwing **Deze apparatuur mag alleen worden geïnstalleerd, vervangen of hersteld door bevoegd geschoold personeel.**

Varoitus **Tämän laitteen saa asentaa, vaihtaa tai huoltaa ainoastaan koulutettu ja laitteen tunteva henkilökunta.**

Attention **Il est vivement recommandé de confier l'installation, le remplacement et la maintenance de ces équipements à des personnels qualifiés et expérimentés.**

Warnung **Das Installieren, Ersetzen oder Bedienen dieser Ausrüstung sollte nur geschultem, qualifiziertem Personal gestattet werden.**

Avvertenza **Questo apparato può essere installato, sostituito o mantenuto unicamente da un personale competente.**

Advarsel **Bare opplært og kvalifisert personell skal foreta installasjoner, utskiftninger eller service på dette utstyret.**

Aviso **Apenas pessoal treinado e qualificado deve ser autorizado a instalar, substituir ou fazer a revisão deste equipamento.**

¡Advertencia!	**Solamente el personal calificado debe instalar, reemplazar o utilizar este equipo.**
Varning!	**Endast utbildad och kvalificerad personal bör få tillåtelse att installera, byta ut eller reparera denna utrustning.**

Safety Warnings

Warning	**IMPORTANT SAFETY INSTRUCTIONS**
	This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the translated safety warnings that accompanied this device.
	Note: SAVE THESE INSTRUCTIONS
	Note: This documentation is to be used in conjunction with the specific product installation guide that shipped with the product. Please refer to the Installation Guide, Configuration Guide, or other enclosed additional documentation for further details.
Waarschuwing	**BELANGRIJKE VEILIGHEIDSINSTRUCTIES**
	Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Voor een vertaling van de waarschuwingen die in deze publicatie verschijnen, dient u de vertaalde veiligheidswaarschuwingen te raadplegen die bij dit apparaat worden geleverd.
	Opmerking BEWAAR DEZE INSTRUCTIES.
	Opmerking Deze documentatie dient gebruikt te worden in combinatie met de installatiehandleiding voor het specifieke product die bij het product wordt geleverd. Raadpleeg de installatiehandleiding, configuratiehandleiding of andere verdere ingesloten documentatie voor meer informatie.
Varoitus	**TÄRKEITÄ TURVALLISUUTEEN LIITTYVIÄ OHJEITA**
	Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä asiakirjassa esitettyjen varoitusten käännökset löydät laitteen mukana toimitetuista ohjeista.
	Huomautus SÄILYTÄ NÄMÄ OHJEET
	Huomautus Tämä asiakirja on tarkoitettu käytettäväksi yhdessä tuotteen mukana tulleen asennusoppaan kanssa. Katso lisätietoja asennusoppaasta, kokoonpano-oppaasta ja muista mukana toimitetuista asiakirjoista.

Attention   **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant causer des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers posés par les circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions d'avertissements figurant dans cette publication, consultez les consignes de sécurité traduites qui accompagnent cet appareil.

Remarque CONSERVEZ CES INFORMATIONS

Remarque Cette documentation doit être utilisée avec le guide spécifique d'installation du produit qui accompagne ce dernier. Veuillez vous reporter au Guide d'installation, au Guide de configuration, ou à toute autre documentation jointe pour de plus amples renseignements.

Warnung   **WICHTIGE SICHERHEITSANWEISUNGEN**

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen Stromkreisen verbundenen Gefahren und der Standardpraktiken zur Vermeidung von Unfällen bewusst. Übersetzungen der in dieser Veröffentlichung enthaltenen Warnhinweise sind im Lieferumfang des Geräts enthalten.

Hinweis BEWAHREN SIE DIESE SICHERHEITSANWEISUNGEN AUF

Hinweis Dieses Handbuch ist zum Gebrauch in Verbindung mit dem Installationshandbuch für Ihr Gerät bestimmt, das dem Gerät beiliegt. Entnehmen Sie bitte alle weiteren Informationen dem Handbuch (Installations- oder Konfigurationshandbuch o. Ä.) für Ihr spezifisches Gerät.

Figyelem!   **FONTOS BIZTONSÁGI ELÕÍRÁSOK**

Ez a figyelmezetõ jel veszélyre utal. Sérülésveszélyt rejtõ helyzetben van. Mielõtt bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplõ figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található.

Megjegyzés ÕRIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Megjegyzés Ezt a dokumentációt a készülékhez mellékelt üzembe helyezési útmutatóval együtt kell használni. További tudnivalók a mellékelt Üzembe helyezési útmutatóban (Installation Guide), Konfigurációs útmutatóban (Configuration Guide) vagy más dokumentumban találhatók.

Avvertenza   **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

Questo simbolo di avvertenza indica un pericolo. La situazione potrebbe causare infortuni alle persone. Prima di intervenire su qualsiasi apparecchiatura, occorre essere al corrente dei pericoli relativi ai circuiti elettrici e conoscere le procedure standard per la prevenzione di incidenti. Per le traduzioni delle avvertenze riportate in questo documento, vedere le avvertenze di sicurezza che accompagnano questo dispositivo.

Nota CONSERVARE QUESTE ISTRUZIONI

Nota La presente documentazione va usata congiuntamente alla guida di installazione specifica spedita con il prodotto. Per maggiori informazioni, consultare la Guida all'installazione, la Guida alla configurazione o altra documentazione acclusa.

Advarsel   **VIKTIGE SIKKERHETSINSTRUKSJONER**

Dette varselssymbolet betyr fare. Du befinner deg i en situasjon som kan forårsake personskade. Før du utfører arbeid med utstyret, bør du være oppmerksom på farene som er forbundet med elektriske kretssystemer, og du bør være kjent med vanlig praksis for å unngå ulykker. For å se oversettelser av advarslene i denne publikasjonen, se de oversatte sikkerhetsvarslene som følger med denne enheten.

Merk TA VARE PÅ DISSE INSTRUKSJONENE

Merk Denne dokumentasjonen skal brukes i forbindelse med den spesifikke installasjonsveiledningen som fulgte med produktet. Vennligst se installasjonsveiledningen, konfigureringsveiledningen eller annen vedlagt tilleggsdokumentasjon for detaljer.

Aviso   **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. O utilizador encontra-se numa situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha em atenção os perigos envolvidos no manuseamento de circuitos eléctricos e familiarize-se com as práticas habituais de prevenção de acidentes. Para ver traduções dos avisos incluídos nesta publicação, consulte os avisos de segurança traduzidos que acompanham este dispositivo.

Nota GUARDE ESTAS INSTRUÇÕES

Nota Esta documentação destina-se a ser utilizada em conjunto com o manual de instalação incluído com o produto específico. Consulte o manual de instalação, o manual de configuração ou outra documentação adicional inclusa, para obter mais informações.

¡Advertencia!   **INSTRUCCIONES IMPORTANTES DE SEGURIDAD**

Este símbolo de aviso indica peligro. Existe riesgo para su integridad física. Antes de manipular cualquier equipo, considere los riesgos de la corriente eléctrica y familiarícese con los procedimientos estándar de prevención de accidentes. Vea las traducciones de las advertencias que acompañan a este dispositivo.

Nota GUARDE ESTAS INSTRUCCIONES

Nota Esta documentación está pensada para ser utilizada con la guía de instalación del producto que lo acompaña. Si necesita más detalles, consulte la Guía de instalación, la Guía de configuración o cualquier documentación adicional adjunta.

Varning!   **VIKTIGA SÄKERHETSANVISNINGAR**

Denna varningssignal signalerar fara. Du befinner dig i en situation som kan leda till personskada. Innan du utför arbete på någon utrustning måste du vara medveten om farorna med elkretsar och känna till vanliga förfaranden för att förebygga olyckor. Se översättningarna av de varningsmeddelanden som finns i denna publikation, och se de översatta säkerhetsvarningarna som medföljer denna anordning.

OBS! SPARA DESSA ANVISNINGAR

OBS! Denna dokumentation ska användas i samband med den specifika produktinstallationshandbok som medföljde produkten. Se installationshandboken, konfigurationshandboken eller annan bifogad ytterligare dokumentation för närmare detaljer.

Предупреждение ВАЖНЫЕ СВЕДЕНИЯ ПО БЕЗОПАСНОСТИ

Этот символ предупреждает о наличии опасности. При неправильных действиях возможно получение травм. Перед началом работы с любым оборудованием необходимо ознакомиться с ситуациями, в которых возможно поражение электротоком, и со стандартными действиями для предотвращения несчастных случаев. Переведенный текст предупреждений содержится в соответствующем документе, поставляемом вместе с устройством.

Примечание   СОХРАНЯЙТЕ ЭТУ ИНСТРУКЦИЮ

Примечание   Эта инструкция должна использоваться вместе с руководством по установке конкретного изделия, входящим в комплект поставки. Дополнительные сведения см. в руководстве по установке, руководстве по настройке и другой документации, поставляемой с изделием.

警告 有关安全的重要说明

这个警告符号指有危险。您所处的环境可能使身体受伤。操作设备前必须意识到电流的危险性，务必熟悉操作标准，以防发生事故。如果需要了解本说明中出现的警告符号的译文，请参阅本装置所附之安全警告译文。

注意   保存这些说明

注意   本文件应与本产品附带的具体安装说明一并阅读。如欲了解详情，请参阅《安装说明》、《配置说明》或所附的其他文件。

警告 安全上の重要な注意事項

「危険」の意味です。人身事故を予防するための注意事項が記述されています。装置の取り扱い作業を行うときは、電気回路の危険性に注意し、一般的な事故防止対策に留意してください。このマニュアルに記載されている警告の各国語版は、装置に付属の「Translated Safety Warnings」を参照してください。

注   これらの注意事項を保管しておいてください。

注   この資料は、製品に付属のインストレーション ガイドと併用してください。詳細は、インストレーション ガイド、コンフィギュレーション ガイド、または添付されているその他のマニュアルを参照してください。

Class 1 and Class 1M Laser Warning

Warning Class I (21 CFR 1040.10 and 1040.11) and Class 1M (IEC 60825-1 2001-01) laser products.

Waarschuwing Laserproducten van Klasse I (21 CFR 1040.10 en 1040.11) en Klasse 1M (IEC 60825-1 2001-01).

Varoitus Luokan I (21 CFR 1040.10 ja 1040.11) ja luokan 1M (IEC 60825-1 2001-01) lasertuotteita.

Attention Produits laser catégorie I (21 CFR 1040.10 et 1040.11) et catégorie 1M (IEC 60825-1 2001-01).

Warnung	Laserprodukte der Klasse I (21 CFR 1040.10 und 1040.11) und Klasse 1M (IEC 60825-1 2001-01).
Avvertenza	Prodotti laser di Classe I (21 CFR 1040.10 e 1040.11) e Classe 1M (IEC 60825-1 2001-01).
Advarsel	Klasse I (21 CFR 1040.10 og 1040.11) og klasse 1M (IEC 60825-1 2001-01) laserprodukter.
Aviso	Produtos laser Classe I (21 CFR 1040.10 e 1040.11) e Classe 1M (IEC 60825-1 2001-01).
¡Advertencia!	Productos láser de Clase I (21 CFR 1040.10 y 1040.11) y Clase 1M (IEC 60825-1 2001-01).
Varning!	Laserprodukter av Klass I (21 CFR 1040.10 och 1040.11) och Klass 1M (IEC 60825-1 2001-01).

Backplane Voltage Warning

Warning	Voltage is present on the backplane when the system is operating. To reduce risk of an electric shock, keep hands and fingers out of the power supply bays and backplane areas.
Waarschuwing	Er is spanning aanwezig op de achterplaat wanneer het systeem bediend wordt. Om mogelijke elektrische schokken te vermijden, dient u uw handen en vingers uit de buurt van de stroomtoevoercompartimenten en het gebied rondom de achterplaat te houden.
Varoitus	Taustalevyssä on jännitettä laitteen ollessa toiminnassa. Sähköiskun välttämiseksi on sormet ja kädet pidettävä poissa virtalähdetelineistä ja taustalevyn alueelta.
Attention	Lorsque le système est en fonctionnement, des tensions électriques circulent sur le fond de panier. Pour éviter tout risque de choc électrique, ne touchez pas aux baies des blocs d'alimentation ni au fond de panier.
Warnung	Wenn das System in Betrieb ist, herrscht Spannung auf der Rückwandplatine. Um das Risiko eines elektrischen Schlags zu verringern, dürfen Hände und Finger nicht in die Anschlußstellen der Stromversorgung und in den Bereich der Rückwandplatine gesteckt werden.
Avvertenza	Quando il sistema è in funzione, il pannello posteriore è sotto tensione. Onde evitare il rischio di scosse elettriche, tenere le mani e le dita lontano dalle parti sotto tensione e dall'area del pannello posteriore.
Advarsel	Spenning er til stede på bakpanelet når systemet kjøres. Hold hender og fingre borte fra strømforsyningsåpningene og bakpanelområdet.
Aviso	Existem tensões na placa traseira quando o sistema está a operar. Para reduzir o risco de choque eléctrico, mantenha as mãos e os dedos fora das baías das fontes de energia e das áreas da placa traseira.

¡Advertencia! **Cuando el sistema está en funcionamiento el voltaje está presente en el plano trasero. Para reducir el riesgo de choque eléctrico mantenga las manos y los dedos fuera de los puertos de alimentación eléctrica y de las áreas del plano trasero.**

Varning! **Spänning föreligger på bakplattan när systemet körs. Minska risken för elektriska stötar genom att hålla händer och fingrar borta från områdena kring strömförsörjningsenhetens fack och bakplattan.**

Faceplates and Cover Panel Requirement

Warning **Blank faceplates and cover panels serve three important functions: they prevent exposure to hazardous voltages and currents inside the chassis; they contain electromagnetic interference (EMI) that might disrupt other equipment; and they direct the flow of cooling air through the chassis. Do not operate the system unless all cards, faceplates, front covers, and rear covers are in place.**

Waarschuwing **Lege vlakplaten en afdekpanelen vervullen drie belangrijke functies: ze voorkomen blootstelling aan gevaarlijke voltages en stroom binnenin het frame, ze bevatten elektromagnetische storing (EMI) hetgeen andere apparaten kan verstoren en ze leiden de stroom van koellucht door het frame. Het systeem niet bedienen tenzij alle kaarten, vlakplaten en afdekkingen aan de voor- en achterkant zich op hun plaats bevinden.**

Varoitus **Tyhjillä tasolaikoilla ja suojapaneeleilla on kolme tärkeää käyttötarkoitusta: Ne suojaavat asennuspohjan sisäisille vaarallisille jännitteille ja sähkövirralle altistumiselta; ne pitävät sisällään elektromagneettisen häiriön (EMI), joka voi häiritä muita laitteita; ja ne suuntaavat tuuletusilman asennuspohjan läpi. Järjestelmää ei saa käyttää, elleivät kaikki tasolaikat, etukannet ja takakannet ole kunnolla paikoillaan.**

Attention **Ne jamais faire fonctionner le système sans que l'intégralité des cartes, des plaques métalliques et des panneaux avant et arrière ne soient fixés à leur emplacement. Ceux-ci remplissent trois fonctions essentielles : ils évitent tout risque de contact avec des tensions et des courants dangereux à l'intérieur du châssis, ils évitent toute diffusion d'interférences électromagnétiques qui pourraient perturber le fonctionnement des autres équipements, et ils canalisent le flux d'air de refroidissement dans le châssis.**

Warnung **Blanke Faceplates und Abdeckungen haben drei wichtige Funktionen: (1) Sie schützen vor gefährlichen Spannungen und Strom innerhalb des Chassis; (2) sie halten elektromagnetische Interferenzen (EMI) zurück, die andere Geräte stören könnten; (3) sie lenken den kühlenden Luftstrom durch das Chassis. Das System darf nur betrieben werden, wenn alle Karten, Faceplates, Voder- und Rückabdeckungen an Ort und Stelle sind.**

Avvertenza **Le piattaforme bianche e i panelli di protezione hanno tre funzioni importanti: Evitano l'esposizione a voltaggi e correnti elettriche pericolose nello chassis, trattengono le interferenze elettromagnetiche (EMI) che potrebbero scombussolare altri apparati e dirigono il flusso di aria per il raffreddamento attraverso lo chassis. Non mettete in funzione il sistema se le schede, le piattaforme, i panelli frontali e posteriori non sono in posizione.**

Advarsel   **Blanke ytterplater og deksler sørger for tre viktige funksjoner: de forhindrer utsettelse for farlig spenning og strøm inni kabinettet; de inneholder elektromagnetisk forstyrrelse (EMI) som kan avbryte annet utstyr, og de dirigerer luftavkjølingsstrømmen gjennom kabinettet. Betjen ikke systemet med mindre alle kort, ytterplater, frontdeksler og bakdeksler sitter på plass.**

Aviso   **As faces furadas e os painéis de protecção desempenham três importantes funções: previnem contra uma exposição perigosa a voltagens e correntes existentes no interior do chassis; previnem contra interferência electromagnética (EMI) que poderá danificar outro equipamento; e canalizam o fluxo do ar de refrigeração através do chassis. Não deverá operar o sistema sem que todas as placas, faces, protecções anteriores e posteriores estejam nos seus lugares.**

¡Advertencia! **Las placas frontales y los paneles de relleno cumplen tres funciones importantes: evitan la exposición a niveles peligrosos de voltaje y corriente dentro del chasis; reducen la interferencia electromagnética (EMI) que podría perturbar la operación de otros equipos y dirigen el flujo de aire de enfriamiento a través del chasis. No haga funcionar el sistema a menos que todas las tarjetas, placas frontales, cubiertas frontales y cubiertas traseras estén en su lugar.**

Varning!   **Tomma framplattor och skyddspaneler har tre viktiga funktioner: de förhindrar att personer utsätts för farlig spänning och ström som finns inuti chassit; de innehåller elektromagnetisk interferens (EMI) som kan störa annan utrustning; och de styr riktningen på kylluftsflödet genom chassit. Använd inte systemet om inte alla kort, framplattor, fram- och bakskydd är på plats.**

Lightning Activity Warning

Warning   **Do not work on the system or connect or disconnect cables during periods of lightning activity.**

Waarschuwing **Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.**

Varoitus   **Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosilmalla.**

Attention   **Ne pas travailler sur le système ni brancher ou débrancher les câbles pendant un orage.**

Warnung   **Arbeiten Sie nicht am System und schließen Sie keine Kabel an bzw. trennen Sie keine ab, wenn es gewittert.**

Figyelem!   **Villámlás közben ne dolgozzon a rendszeren, valamint ne csatlakoztasson és ne húzzon ki kábeleket!**

Avvertenza   **Non lavorare sul sistema o collegare oppure scollegare i cavi durante un temporale con fulmini.**

Advarsel   **Utfør aldri arbeid på systemet, eller koble kabler til eller fra systemet når det tordner eller lyner.**

Aviso   **Não trabalhe no sistema ou ligue e desligue cabos durante períodos de mau tempo (trovoada).**

¡Advertencia!   **No operar el sistema ni conectar o desconectar cables durante el transcurso de descargas eléctricas en la atmósfera.**

Varning!   **Vid åska skall du aldrig utföra arbete på systemet eller ansluta eller koppla loss kablar.**

Предупреждение   Не следует работать с устройством, а также подключать или отключать кабели во время грозы.

警告   请勿在发生雷电时操作系统，也不要在此期间连接或断开电缆。

警告   雷が発生しているときは、システムに手を加えたり、ケーブルの接続や取り外しを行わないでください。

Radiation from Open Port Aperture

Warning   **Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.**

Waarschuwing   **Aangezien onzichtbare straling vanuit de opening van de poort kan komen als er geen fiberkabel aangesloten is, dient blootstelling aan straling en het kijken in open openingen vermeden te worden.**

Varoitus   **Koska portin aukosta voi emittoitua näkymätöntä säteilyä, kun kuitukaapelia ei ole kytkettynä, vältä säteilylle altistumista äläkä katso avoimiin aukkoihin.**

Attention   **Des radiations invisibles à l'åil nu pouvant traverser l'ouverture du port lorsqu'aucun câble en fibre optique n'y est connecté, il est recommandé de ne pas regarder fixement l'intérieur de ces ouvertures.**

Warnung   **Warnung: Aus der Port-Öffnung können unsichtbare Strahlen emittieren, wenn kein Glasfaserkabel angeschlossen ist. Vermeiden Sie es, sich den Strahlungen auszusetzen, und starren Sie nicht in die Öffnungen!**

Avvertenza   **Quando i cavi in fibra non sono inseriti, radiazioni invisibili possono essere emesse attraverso l'apertura della porta. Evitate di esporvi alle radiazioni e non guardate direttamente nelle aperture.**

Advarsel   **Unngå utsettelse for stråling, og stirr ikke inn i åpninger som er åpne, fordi usynlig stråling kan emiteres fra portens åpning når det ikke er tilkoblet en fiberkabel.**

Aviso   **Dada a possibilidade de emissão de radiação invisível através do orifício da via de acesso, quando esta não tiver nenhum cabo de fibra conectado, deverá evitar a exposição à radiação e não deverá olhar fixamente para orifícios que se encontrarem a descoberto.**

¡Advertencia!   **Debido a que la apertura del puerto puede emitir radiación invisible cuando no existe un cable de fibra conectado, evite mirar directamente a las aperturas para no exponerse a la radiación.**

Varning!   **Osynlig strålning kan avges från en portöppning utan ansluten fiberkabel och du bör därför undvika att bli utsatt för strålning genom att inte stirra in i oskyddade öppningar.**

Battery Handling Warning

Warning   **There is the danger of explosion if the battery is replaced incorrectly. Replace the battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.**

Waarschuwing   **Er is ontploffingsgevaar als de batterij verkeerd vervangen wordt. Vervang de batterij slechts met hetzelfde of een equivalent type dat door de fabrikant aanbevolen is. Gebruikte batterijen dienen overeenkomstig fabrieksvoorschriften weggeworpen te worden.**

Varoitus   **Räjähdyksen vaara, jos akku on vaihdettu väärään akkuun. Käytä vaihtamiseen ainoastaan saman- tai vastaavantyyppistä akkua, joka on valmistajan suosittelema. Hävitä käytetyt akut valmistajan ohjeiden mukaan.**

Attention   **Danger d'explosion si la pile n'est pas remplacée correctement. Ne la remplacer que par une pile de type semblable ou équivalent, recommandée par le fabricant. Jeter les piles usagées conformément aux instructions du fabricant.**

Warnung   **Bei Einsetzen einer falschen Batterie besteht Explosionsgefahr. Ersetzen Sie die Batterie nur durch den gleichen oder vom Hersteller empfohlenen Batterietyp. Entsorgen Sie die benutzten Batterien nach den Anweisungen des Herstellers.**

Avvertenza   **Pericolo di esplosione se la batteria non è installata correttamente. Sostituire solo con una di tipo uguale o equivalente, consigliata dal produttore. Eliminare le batterie usate secondo le istruzioni del produttore.**

Advarsel   **Det kan være fare for eksplosjon hvis batteriet skiftes på feil måte. Skift kun med samme eller tilsvarende type som er anbefalt av produsenten. Kasser brukte batterier i henhold til produsentens instruksjoner.**

Aviso   **Existe perigo de explosão se a bateria for substituída incorrectamente. Substitua a bateria por uma bateria igual ou de um tipo equivalente recomendado pelo fabricante. Destrua as baterias usadas conforme as instruções do fabricante.**

¡Advertencia!   **Existe peligro de explosión si la batería se reemplaza de manera incorrecta. Reemplazar la batería exclusivamente con el mismo tipo o el equivalente recomendado por el fabricante. Desechar las baterías gastadas según las instrucciones del fabricante.**

Varning!   **Explosionsfara vid felaktigt batteribyte. Ersätt endast batteriet med samma batterityp som rekommenderas av tillverkaren eller motsvarande. Följ tillverkarens anvisningar vid kassering av använda batterier.**

Electrical Equipment Guidelines

Follow these basic guidelines when working with any electrical equipment:

- Before beginning any procedures requiring access to the chassis interior, locate the emergency power-off switch for the room in which you are working.
- Disconnect all power and external cables before moving a chassis.
- Do not work alone when potentially hazardous conditions exist.
- Never assume that power has been disconnected from a circuit; always check.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.
- Carefully examine your work area for possible hazards such as moist floors, ungrounded power extension cables, and missing safety grounds.

Telephone Wiring Guidelines

Use the following guidelines when working with any equipment that is connected to telephone wiring or to other network cabling:

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.

Electrostatic Discharge Prevention

Electrostatic discharge (ESD) damages equipment and impairs electrical circuitry. ESD occurs when printed circuit boards are improperly handled and results in complete or intermittent failures.

The network services engine consists of printed circuit boards that are fixed in a metal carrier. Electromagnetic interference (EMI) shielding, connectors, and a handle are integral components of the carrier. Handle the network services engine by its carrier edges and handles; never touch the printed circuit board or connector pins.

Figure 3-1 shows the location of a printed circuit board in a network services engine. Do not touch the printed circuit board when handling any of the components.

Figure 3-1   *Handling a Network Services Engine—Side View*
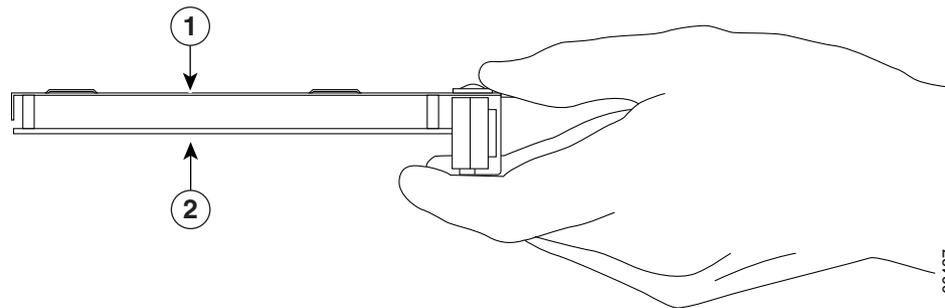
1	Metal carrier	2	Printed circuit board

Although the metal carrier helps to protect the printed circuit boards from ESD, wear a preventive antistatic strap whenever handling a network services engine. Ensure that the strap makes good skin contact and connect the strap's clip to an unpainted chassis surface to channel unwanted ESD voltages safely to ground.

If no wrist strap is available, ground yourself by touching the metal part of the chassis.

⚠️
Caution   Make sure to tighten the captive installation screws on the network services engine (use a number 2 Phillips or a 3/16-inch flat-blade screwdriver). These screws prevent accidental removal, provide proper grounding for the router, and help to ensure that the network services engine is properly seated in the router midplane.

Following are guidelines for preventing ESD damage:

*   Always use an ESD wrist strap or ankle strap when installing or replacing the network services engine. Ensure that the ESD strap makes contact with your skin.

*   Handle the network services engine by its metal carrier edges and handles only; avoid touching the printed circuit board components or any connector pins.

*   When removing the network services engine, place it on an antistatic surface with the printed circuit board components facing upward, or in a static shielding bag. If you are returning a network services engine to the factory, immediately place it in a static shielding bag.

⚠️
Caution   Periodically check the resistance value of the antistatic strap. The measurement should be within the range of 1 to 10 megohms (Mohms).

Removing and Installing the NSE

This chapter describes how to remove a network services engine from a Cisco 7304 router and also how to install a replacement network services engine. This chapter contains the following sections:

Ensuring Easy Access to the Router

If your Cisco 7304 router is installed in a standard 19-inch, 4-post or 2-post rack, cables from other equipment in the rack might obstruct access to the front of the router. Also, rack power strips or other permanent fixtures may obstruct access to the router. Review the following guidelines to ensure easy access to the front of the router when it is installed in a rack. If the router is not installed in a rack, or if you already have clear access to the front of the router, proceed to the "Powering Down the Router and Disconnecting Input Power" section on page 4-2.

Use the following guidelines to ensure easy access to the front of the router when it is installed in a rack:

- Ensure that you have at least 3 to 4 feet (.9 to 1.2 meters) of working space at the front of the router.
- If cables from other equipment in the rack fall in front of the router, carefully gather the cables (using care not to strain them) and use cable ties to anchor them away from the front of the router.

- If access to the front of the router is partially blocked by a power strip or some other permanent rack fixture, detach the router from the rack and carefully slide it forward until there is enough clearance to remove the network services engine from the router. Detailed steps for detaching the router from the rack are contained in the "Removing the Network Services Engine" section on page 4-4.

Powering Down the Router and Disconnecting Input Power

The following sections describe how to remove power from an AC-input power supply and a DC-input power supply:

- Powering Down an AC-Input Power Supply, page 4-2
- Powering Down a DC-Input Power Supply and Removing the DC-Input Leads, page 4-3

Note If you have two NSEs in the Cisco 7304 router in a high availability configuration and want to remove one, do not power down the router. Simply remove the NSE and insert a new one, because high availability provides for the other NSE to take on the processing tasks for the router.

Powering Down an AC-Input Power Supply

Note Before powering down the router, use the **copy running-config startup-config** command to save the router's running configuration to nonvolatile random-access memory (NVRAM) or another file system.

The Cisco 7304 power supply switches have a standby symbol (a broken circle with a line through it) and an on symbol (I) on the power switch. If only one power supply is installed in the router, the standby symbol means off, as there is no other power supply to take over its function. If two power supplies are installed, one is turned on, and the other power supply switch is set to the standby position, as it will be activated automatically if the primary power supply fails.

To power down the AC-input power supply to the Cisco 7304 router, complete the following steps:

Step 1 Place the power switch to the standby position (broken circle with a line through it).

Step 2 Observe the following items:
- The green INPUT OK LED and FAN OK LED on the power supply turn off.
- The fans in the power supply stop operating.
- All LEDs turn off.

Step 3 Remove the cable from the AC-input power receptacle.

Note When powering off the router, wait 30 seconds before powering it on again.

This completes the procedure for powering down an AC-input power supply on a Cisco 7304 router.

Powering Down a DC-Input Power Supply and Removing the DC-Input Leads

Warning   **Before completing any of the following steps, and to prevent short-circuit or shock hazards, ensure that power is removed from the DC circuit. To ensure that all power to the power supply is OFF, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the switch handle of the circuit breaker in the OFF position. Note that the power to the power supply should be off, not necessarily all power to the router. A DC-Input power supply can be running when another power supply or fan module is being removed or replaced.**

Warning   **When installing the unit, the ground connection must always be made first and disconnected last.**

Note   Before powering down the router, use the **copy running-config startup-config** command to save the router's running configuration to NVRAM or another file system.

The Cisco 7304 power supply switches have a standby symbol (a broken circle with a line through it) and an on symbol (|) on the power switch. If only one power supply is installed in the router, the standby symbol means off, as there is no other power supply to take over its function. If two power supplies are installed, one is turned on, and the other power supply switch is set to the standby position, as it will be activated automatically if the primary power supply fails.

To power down the DC-input power supply to the Cisco 7304 router and remove the DC-input power leads from the DC-input power supply, complete the following steps:

Step 1   Place the standby switch on the DC-input power supply in the standby position.

Step 2   Ensure that power is removed from the DC circuit by turning off the circuit breaker or switch providing power to the DC-input power supply.

Step 3   If necessary, remove the cable tie that secures the DC-input power line input leads and ground lead to the power supply faceplate. Save the cable tie.

Step 4   Using a 1/8-inch flat-blade screwdriver, loosen the screw above the –DC power line input lead receptacle and pull the lead from the connector. Repeat this step for the +DC power line input lead and the ground lead.

Note   The color coding of the DC-input power supply leads depends on the color coding of the DC power source at your site. Typically, green or green/yellow is used for ground. Make certain the lead color coding you choose for the DC-input power supply matches lead color coding used at the DC power source.

This completes the procedure for disconnecting DC-input power and removing the DC-input power leads from the DC-input power supply.

Removing the Network Services Engine

⚠️
Caution Two NSE-100s, two NSE-150s, or two NPE-G100 configurations are supported on the Cisco 7304 router. You cannot use different processors in the same Cisco 7304 router at the same time.

To remove an NSE from a Cisco 7304 router, complete the following steps:

Step 1 Power down the router and disconnect the input power cable. (Refer to the "Powering Down the Router and Disconnecting Input Power" section on page 4-2.)

Step 2 Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

Step 3 Remove any GBIC module, SFP module, Fast Ethernet Console port, auxiliary port, or any other cables.

Figure 4-1 *Cisco 7304 NSE-100 Captive Installation Screws and Levers*
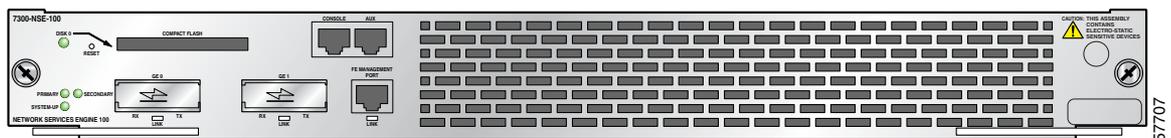
Step 4 Using a number 2 Phillips or a 3/16-inch flat-blade screwdriver, loosen the two captive installation screws on the faceplate of the network services engine. (See Figure 4-1.)

If the router is not installed in a standard 19-inch, 4-post or 2-post rack, skip to Step 8. If the router is installed in a rack, determine if any permanent rack fixtures, such as a power strip, are obstructing access to the front of the router. If a rack fixture is obstructing access to the router, proceed with Step 5.

Step 5 Using a 3/16-inch flat-blade screwdriver, loosen the screws that secure the router to the front mounting strips of the rack.

Step 6 Position at least one person in front of the rack to support the front underside of the router.

Step 7 From the front of the rack, carefully push the front of the router out of the rack until there is enough clearance to remove the network services engine.

✏️
Note If you have difficulty removing or installing a processor in the lowest slot of a Cisco 7304 router that is rack-mounted, remove the line cards, port adapter carrier cards, and processor from the chassis and reinstall them. Install a processor engine in the lowest slot first, then populate the slots above it, in a bottom-to-top order.

Step 8 Pull the network services engine locking levers outwards and carefully pull the network services engine from its chassis slot.

⚠️
Caution Handle the network services engine by the carrier edges only; never touch the printed circuit board components or connector pins.

Step 9 Place the NSE on an antistatic surface with its printed circuit board components facing upward, or in a static shielding bag. If you are returning the network services engine to the factory, immediately place it in a static shielding bag.

This completes the procedure for removing an installed NSE. For instructions on installing the NSE, go to the "Inserting the Network Services Engine" section on page 4-7.

- To prepare the chassis for installing a second network services engine, go to the "Removing the Slot Divider for a Redundant Configuration" section on page 4-5.
- To replace a single network services engine, go to the "Inserting the Network Services Engine" section on page 4-7.

Removing the Slot Divider for a Redundant Configuration

You must remove the slot divider in slot 2 in order to install a second network services engine in a Cisco 7304 router. See Figure 4-2.

Figure 4-2   Cisco 7304 Slot Designation
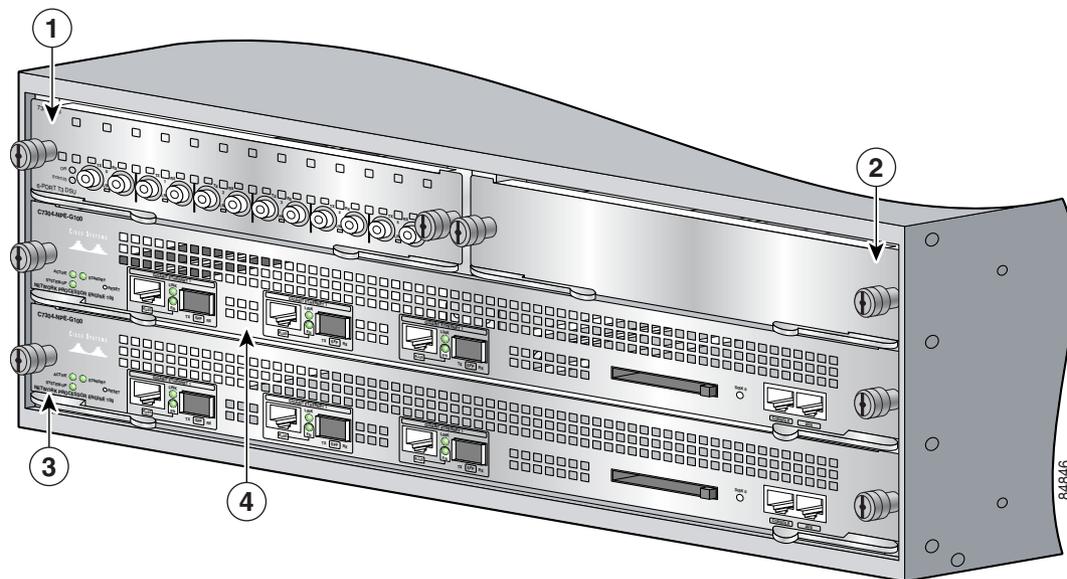
1	Slot 4	**3**	Slot 0
2	Slot 5	**4**	Slot 2

Figure 4-3   Slot Divider Retaining Mechanism
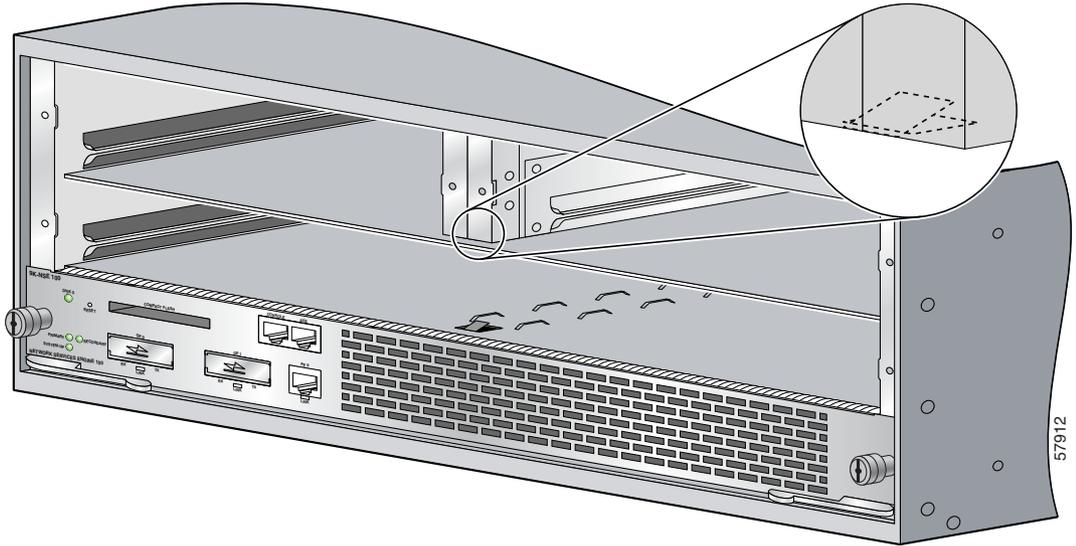
To remove the slot divider from the router, complete the following steps:

Step 1   Grasp the slot divider and lift upwards (see Figure 4-3).

Figure 4-4   Removing the Slot Divider
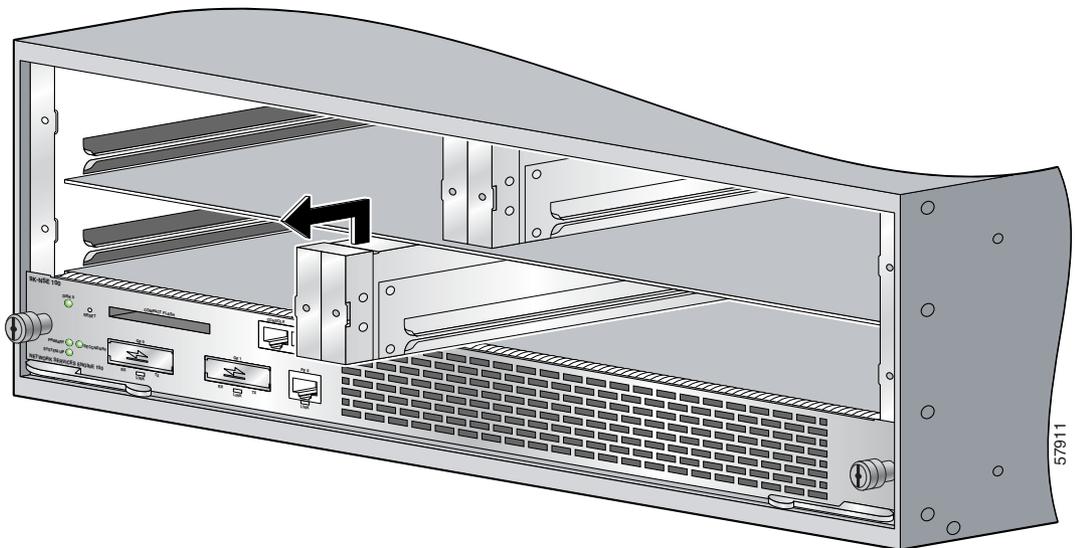
Step 2   Slide the slot divider from the router (Figure 4-4).

This completes the procedure for removing a slot divider from a Cisco 7304 router.

To install the slot divider, slide the slot divider into the router until it clicks into the slot divider retaining mechanism.

Inserting the Network Services Engine

The NSE-100 or NSE-150 should be installed in slot 0. For high availability, install a second NSE-100 or NSE-150 in slot 2.

Online insertion and removal (OIR) of the standby NSE is supported. If two NSEs are installed, and one fails, whether primary or secondary, the failed NSE can be removed without powering off the router, and a new NSE can be installed.

⚠

Caution   Two NSE-100s, two NSE-150s, or two NPE-G100 configurations are supported on the Cisco 7304 router. You cannot use different processors in the same Cisco 7304 router at the same time.

To install an NSE in the router, complete the following steps:

Step 1   Ensure that the router is powered down and the input power cable is disconnected from the router and the power source. See the "Powering Down the Router and Disconnecting Input Power" section on page 4-2.

Step 2   Attach an ESD-preventive wrist strap between you and an unfinished chassis surface.

Step 3   Remove the new network services engine from its static shielding bag.

⚠

Caution   Handle the network services engine by the carrier edges and handle only; never touch the printed circuit board components or connector pins.

Figure 4-5   Aligning the NSE in the Slot Guides in a Cisco 7304 Router
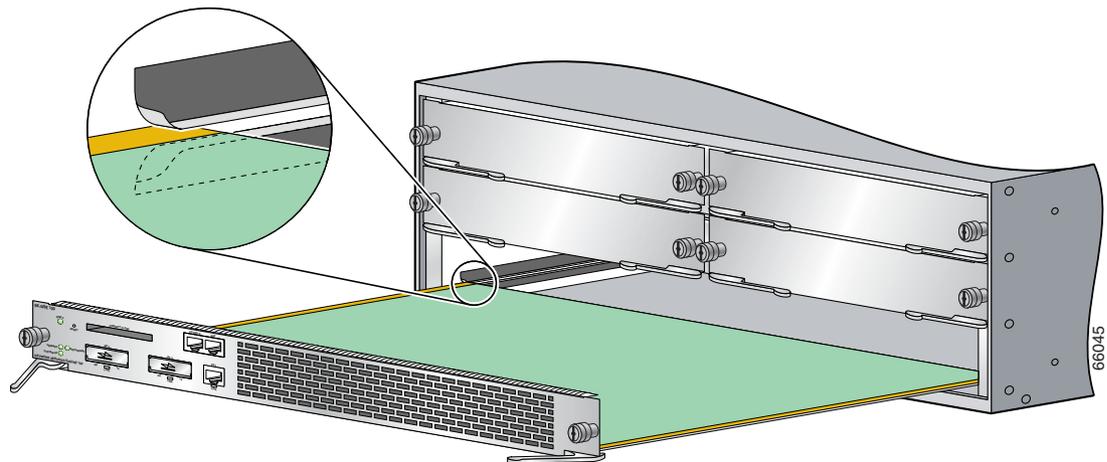
Step 4   Position the locking levers at a 45-degree angle *before* installing the network services engine (see Figure 4-5).

✎

Note   If you have difficulty installing a processor in the lowest slot of a Cisco 7304 router that is rack-mounted, remove the line cards, port adapter carrier cards, and processor from the chassis and reinstall them. Install a processor in the lowest slot first, then populate the slots above it, in a bottom-to-top order.

Step 5   Align the network services engine in the slot guides (see Figure 4-5).

Step 6   Gently slide the network services engine all the way into its chassis slot until you feel the connectors seat with the router midplane. Push the locking levers to lock the network services engine in place.

Step 7   Seat the network services engine in the router midplane by tightening its captive installation screws with a number 2 Phillips or a 3/16-inch flat-blade screwdriver.

> **Note**   The network services engine is not fully seated in the router midplane until you tighten its captive installation screws.

Step 8   If you removed power supplies from the router, replace the power supplies. (See the "Reconnecting Input Power and Powering Up the Router" section on page 4-19 when replacing a power supply in a Cisco 7304 router.)

Step 9   If you slid the front of the router out of the rack, slowly guide the router back into the rack.

Step 10   Use a 3/16-inch flat-blade screwdriver to tighten the screws that secure the router to the front mounting strips of the rack.

This completes the procedure for inserting the network services engine in a Cisco 7304 router.

For information on reconnecting the cables, go to the "Attaching Multimode and Single-Mode Optical Fiber Cables" section on page 4-15, the "Attaching the Mode-Conditioning Patch Cord" section on page 4-17, and the "Reconnecting AC-Input Power" section on page 4-19 or the "Reconnecting DC-Input Power" section on page 4-20.

Removing and Replacing the SDRAM SODIMM

This section explains how to remove and replace the SDRAM SODIMM main memory modules on the network services engine. Other than the CompactFlash Disk, the SDRAM SODIMM is the only physically replaceable memory type on the NSE-100.

> **Caution**   The DDR-SODIMMs on the NSE-150 motherboard are configured in a "butterfly" configuration, meaning the SODIMMs are designed to not lay flat on the motherboard like the other components. The DDR-SODIMMs should not be forced to lie flat on the board. Forcing the DDR-SODIMMs to lie flat on the board can cause damage to the SODIMM or the NSE-150 motherboard.
> These NSE-150 SODIMMs are also not field-replaceable.

The SDRAM SODIMM is the main memory module for the Route Processor on the NSE-100. The SDRAM SODIMM stores the configuration and routing tables for non-IP traffic. Cisco IOS software executes from main memory, and the Route Processor is responsible for forwarding all non-IP traffic and analyzing routing protocols. The advantage of upgrading the SDRAM SODIMM is to allow the NSE-100 to establish more sessions with communicating devices. The SDRAM SODIMM might also need to be replaced to correct a problem being caused by the SODIMM.

> **Note**   Use only Cisco-supported SDRAM SODIMMs.

Removing a SDRAM SODIMM on the NSE-100

This section provides a procedure for removing the SDRAM SODIMM on the NSE-100.

Caution The DDR-SODIMMs on the NSE-150 motherboard are configured in a "butterfly" configuration, meaning the SODIMMs are designed to not lay flat on the motherboard like the other components. The DDR-SODIMMs should not be forced to lie flat on the board. Forcing the DDR-SODIMMs to lie flat on the board can cause damage to the SODIMM or the NSE-150 motherboard.
These NSE-150 SODIMMs are also not field-replaceable.

Follow these steps to remove the existing SDRAM SODIMM:

Step 1 Power down the router and disconnect input power, if it hasn't already been done.
See the "Powering Down the Router and Disconnecting Input Power" section on page 4-2 and follow the directions for powering down the router and disconnecting input power.

Step 2 Remove the NSE-100, if it hasn't already been removed.
Go to the "Removing the Network Services Engine" section on page 4-4 and follow the instructions for removing the NSE-100. Then return to this section.

Step 3 Place the NSE-100 on an antistatic mat or pad and ensure that you are wearing an antistatic device, such as a wrist strap.

Step 4 Locate the SODIMM. See Figure 4-6.

Step 5 Release the spring latches from the SODIMM, and release the SODIMM from the socket (see Figure 4-6).

Caution To prevent ESD damage, handle the SODIMM by the card edges only (see Figure 4-7). Place the removed SODIMM on an antistatic mat and store it in an antistatic container.

Figure 4-6   Releasing the SODIMM Spring Latches
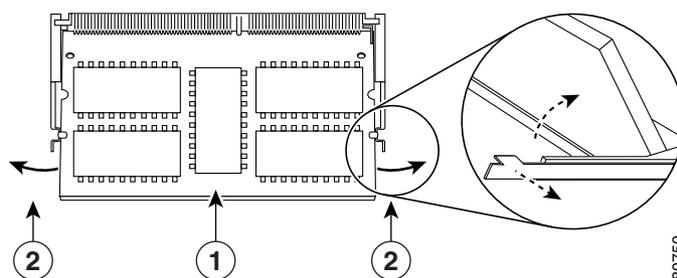
| 1 | SDRAM SODIMM | 2 | Spring latches |

Step 6 When both ends of the SODIMM are released from the socket, grasp the ends of the SODIMM with your thumb and forefinger and pull the SODIMM completely out of the socket. Handle the edges of the SODIMM only; avoid touching the memory module, pins, or traces (the metal *fingers* along the connector edge of the SODIMM).

Step 7 Place the SODIMM in an antistatic container to protect it from ESD damage.

This completes the SODIMM removal procedure. Proceed to the next section to install the new SODIMM.

Inserting a SDRAM SODIMM on the NSE-100

This section provides a procedure for inserting the SODIMM on the NSE-100.

The synchronous dynamic random-access memory (SDRAM) on the NSE-100 is contained in one small outline dual in-line memory module (SODIMM) (see Figure 4-6).

⚠

Caution   SODIMMs are sensitive components that are susceptible to ESD damage. Always wear an antistatic wrist strap when working with SODIMMs.

Figure 4-7   *Handling a SODIMM*
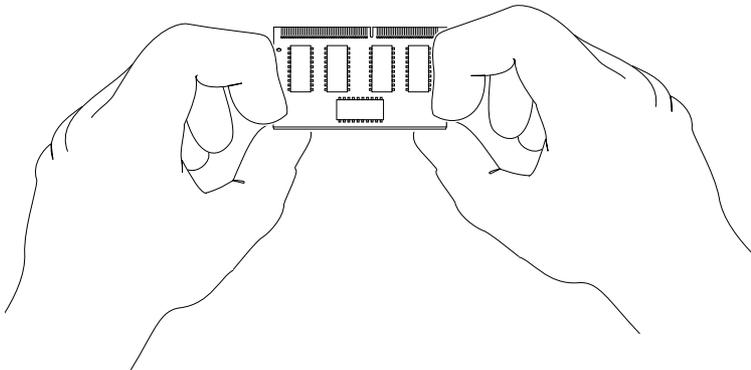
Follow these steps to install the new SODIMM:

Step 1   Remove a new SODIMM from the antistatic container.

Step 2   Hold the SODIMM with the connector edge (the metal *fingers*) away from you. Wear an antistatic wrist strap and handle SODIMMs by the edges only; avoid touching the memory modules, pins, or traces (the metal *fingers* along the connector edge of the SODIMM). (See Figure 4-7.) Ensure that the metal fingers of the SODIMM align properly with the SODIMM receptacle.

Step 3   Hold the sides of the SODIMM between your thumb and index finger (see Figure 4-7).

Step 4   Tilt the SODIMM to approximately the same angle as the receptacle, and insert the pin edge into the connector.

⚠

Caution   Note that these instructions are for the NSE-100.
The DDR-SODIMMs on the NSE-150 motherboard are configured in a "butterfly" configuration, meaning the SODIMMs are designed to not lay flat on the motherboard like the other components. The DDR-SODIMMs should not be forced to lie flat on the board. Forcing the DDR-SODIMMs to lie flat on the board can cause damage to the SODIMM or the NSE-150 motherboard.
Furthermore, the DDR-SODIMMs on the NSE-150 are not field-replaceable, so they should not be removed from the NSE-150 motherboard.

⚠

Caution   When inserting the SODIMM, use firm but not excessive pressure. If you damage a socket, you will have to return the NSE-100 to the factory for repair.

Step 5   Press the SODIMM down until it is secured by the spring latches.

Step 6   When the SODIMM is installed, check both alignment holes on the SODIMM and ensure that the spring latch is visible. If it is not, the SODIMM is not seated properly. If the SODIMM appears misaligned, carefully remove it and reseat it in the socket. Push the SODIMM firmly back into the socket until the spring latches snap into place.

This completes the SDRAM SODIMM installation procedure. To reinstall the NSE-100 in the chassis, see the "Inserting the Network Services Engine" section on page 4-7.

Installing and Using the CompactFlash Disk

This section provides instructions for installing, removing, and using CompactFlash Disks in the Cisco 7304 router.

On the NSE-100 and NSE-150, CompactFlash Disks provide storage space for your configuration files, Cisco IOS software images, and so forth.

This section includes the following subsections:

Product Description

CompactFlash Disks are Flash memory-based devices that conform to the PC Card (formerly PCMCIA) standard, and that present an AT Attachment (ATA) interface to the system. This interface complies with the ANSI ATA Interface Document X3T13.1153 D Rev. 9 specification.

The CompactFlash Disk is more flexible than linear Flash memory because the CompactFlash Disk has controller circuitry that allows it to emulate a hard disk and that automatically maps out bad blocks and performs automatic block erasure. Further, the CompactFlash Disk provides the capability to allocate noncontiguous sectors, which eliminates the need for the **squeeze** command (previously required with linear Flash memory cards).

The CompactFlash Disk is a Type-2 PC Card device. The CompactFlash Disk provides increased Flash-based memory space for storage of system configuration files, Cisco IOS software images, and other types of system-related files. Table 1-3 provides memory information for the CompactFlash Disk.

The Cisco IOS File System feature provides a single interface to all file systems your system uses:

- Flash memory file systems—CompactFlash Disks, onboard Flash memory, linear Flash memory cards
- Network file systems—File Transfer Protocol (FTP), Remote Copy Protocol (rcp), and TFTP
- Any other endpoint for reading or writing data—NVRAM, the running configuration, ROM, raw system memory, system-bundled microcode, Xmodem, Flash load helper log, modems, and BRI MUX interfaces

A complete discussion of the Cisco IOS File System feature is beyond the scope of this publication. For information about this feature, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide* and *Cisco IOS Configuration Fundamentals Command Reference* publications for Cisco IOS Release 12.*x*. These publications are available through Cisco.com. (For information on how to access Cisco.com, see the "Obtaining Documentation" section on page v.)

For information on using a CompactFlash Disk, see Chapter 6, "Working with a CompactFlash Disk."

Installing and Removing the CompactFlash Disk

Use the following procedure to install and eject the CompactFlash Disk.

Figure 4-8   Installing and Ejecting a CompactFlash Disk
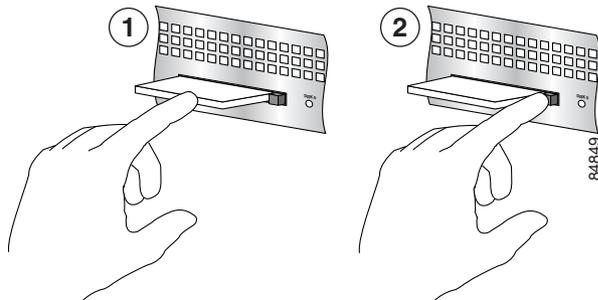
1	Inserting a CompactFlash Disk (disk0:)	**2**	Ejecting a CompactFlash Disk (disk0:)

Step 1   Face the front panel of the network services engine and locate the CompactFlash Disk slot, as shown in Figure 4-8.

Step 2   Hold the CompactFlash Disk with its connector end toward the CompactFlash Disk slot and its front label facing up.

The CompactFlash Disk is keyed and cannot be seated the wrong way. The ejector button does not pop out if the CompactFlash Disk is not completely inserted.

Step 3   Insert the CompactFlash Disk into the CompactFlash Disk slot until the CompactFlash Disk completely seats in the connector at the rear of the slot, and the ejector button pops out toward you.
(See Figure 4-8.)

To eject a CompactFlash Disk, press the ejector button—located to the right of the slot— until the Compact Flash Disk is free of the connector at the rear of the CompactFlash Disk slot.
(See Figure 4-8.)

Step 4   Remove the CompactFlash Disk from the slot and place it in an antistatic bag.

This completes the procedure for installing and removing a CompactFlash Disk. Proceed to the "Reconnecting Input Power and Powering Up the Router" section on page 4-19.

About GBIC Modules (NSE-100)

Before powering up the router, install any GBIC modules and cables.

For information on the GBIC modules supported by the NSE-100, see the "Gigabit Ethernet GBIC Port and Cabling Specifications" section on page 1-10.

Note   The NSE-150 uses SFPs while the NSE-100 uses GBICs.

⚠

Caution   If you plan to use a GBIC-LX/LH or WS-G5486 at distances greater than 984.25 feet (300 meters) over 50/125-micron or 62.5/125-micron multimode fiber, you must use the mode-conditioning patch cord to prevent data transmission problems.

⚠

Warning   **Because invisible laser radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to laser radiation and do not stare into open apertures.**

⚠

Warning   **Class 1 laser product.**

⚠

Warning   **Class 1 LED product.**

⚠

Warning   **When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the card. Some platforms have an ESD connector for attaching the wrist strap. Do not directly touch the system board with your hand or any metal tool, or you could shock yourself.**

Installing and Removing the GBIC Modules and Cables

Figure 4-9   Inserting a GBIC
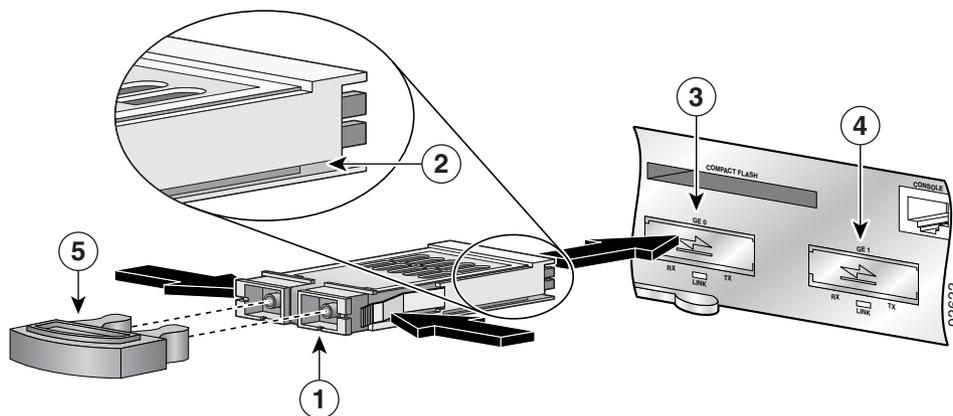
1	GBIC module	**4**	Gigabit Ethernet port1
2	Alignment groove	**5**	Plug
3	Gigabit Ethernet port 0		

Use the following procedure to remove and install a GBIC module:

Step 1   Attach an ESD-preventive wrist strap between you and an unpainted chassis surface.

Step 2   Remove the GBIC module optical cables.

Step 3   Pull the GBIC module from the GBIC slot. If you are keeping the GBIC module, install the plug to protect the optical bores.

Step 4   Find the replacement GBIC module.

Step 5   Locate the label on the GBIC module and turn the GBIC module so the label is on top and the alignment groove is down.

> **Note**   The GBIC module is keyed so that it cannot be inserted incorrectly.

Step 6   Insert the Gigabit Ethernet GBIC module into Gigabit Ethernet slot 0 or slot 1. The GBIC module snaps into place when you have completely and properly inserted it.

Step 7   Repeat these steps if you are inserting a second GBIC module.

> **Note**   Do not remove the plug from the GBIC module optical bores until you are ready to install the network interface optical fiber cable. Save the plug for future use.

This completes the GBIC module installation procedure.

Attaching Multimode and Single-Mode Optical Fiber Cables

> **Warning**   **To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.**

> **Caution**   If you plan to use a GBIC-LX/LH or WS-G5486 at distances greater than 984.25 feet (300 meters) over 50/125-micron or 62.5/125-micron multimode fiber, you must use a mode-conditioning patch cord to prevent data transmission problems.

> **Note**   Optical fiber cables are commercially available; they are not available from Cisco Systems.

For cabling specifications, including specific cable maximum distances, see the "Gigabit Ethernet GBIC Port and Cabling Specifications" section on page 1-10.

> **Warning**   **Class 1 laser product.**

> **Warning**   **Class 1 LED product.**

Figure 4-10   GBIC Port Connections
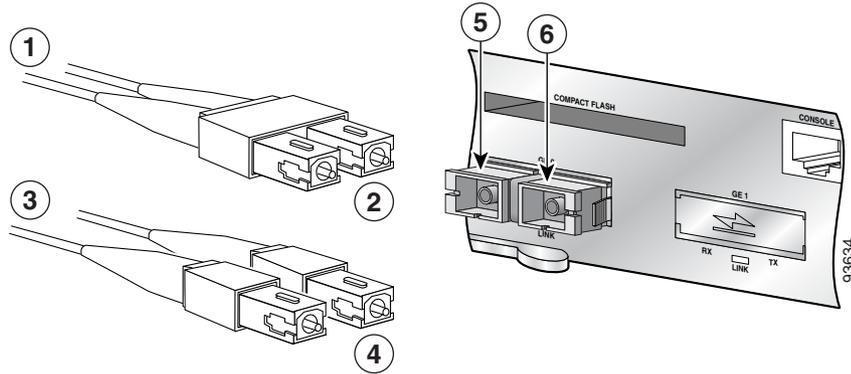
1	To external 1000BASEX network	4	Simplex connectors (TX and RX)
2	Duplex connector (TX and RX)	5	TX (Gigabit Ethernet GBIC port 0)
3	To external 1000BASEX network	6	RX (Gigabit Ethernet GBIC port 0)

Step 1   Remove the plug from the GBIC module so that you can insert the cables. Keep the plug for use should you ever disconnect the optical fiber cables.

Warning   **Because invisible laser radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to laser radiation and do not stare into open apertures.**

Step 2   Attach the appropriate optical fiber cable directly to the GBIC module. You can use either simplex or duplex connectors for most devices. (Figure 4-10 shows a GBIC module installed in Gigabit Ethernet slot 0.)

- For simplex connectors, two cables are required, one cable for transmit (TX) and a second cable for receive (RX).

- For duplex connectors, only one cable that has both TX and RX connectors is required.

Attaching the Mode-Conditioning Patch Cord

Figure 4-11   Mode-Conditioning Patch Cord
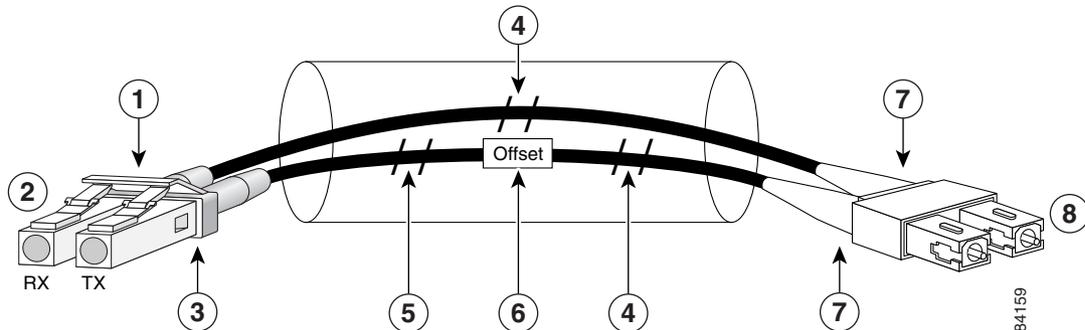
1	Gray color identifier	5	Single-mode bar
2	To GE interface	6	Offset
3	Blue color identifier	7	Beige color identifier
4	Multimode bar	8	To cable plant

Note Figure 4-11 shows one type of mode-conditioning patch cord. For specifications, see the "Mode-Conditioning Patch Cord Description" section on page 1-11.

To use a mode-conditioning patch cord, follow these steps:

Step 1 Attach a patch cord to the GBIC module. (See Figure 4-11.)

Step 2 Attach the network ends of your patch cord to the appropriate 1000BASEX equipment in your building cable plant.

Ensure that you connect the TX and RX ports on one end of the patch cord to the RX and TX ports (respectively) on the other end. Connect TX to RX and RX to TX.

Installing and Removing SFP Modules (NSE-150)

The NSE-150 uses SFP modules to connect to copper and fiber-optic media types.

Before powering up the router, ensure all SFP module cabling is installed.

To see the SFP modules supported on the NSE-150, see the "Gigabit Ethernet SFP Port and Cabling Specifications" section on page 2-6.

For instructions on installing and removing SFPs, see the *Cisco Small Form-Factor Pluggable Modules Installation Notes*.

Installing and Removing the CWDM GBIC and SFP Modules

For the CWDM GBIC modules supported on the NSE-100, see the "CWDM GBIC Modules" section on page 1-12.

For the CWDM SFP modules supported on the NSE-150, see the "CWDM SFP Modules" section on page 2-7.

For information on installing and removing CWDM GBIC modules, see the *Cisco CWDM GBIC and CWDM SFP Installation Note*.

Connecting the Fast Ethernet 10/100 Cable to the Fast Ethernet Management Port

The Fast Ethernet management port supports IEEE 802.3 (Ethernet), and IEEE 802.3u (Fast Ethernet) interfaces compliant with 10BASET and 100BASETX specifications.

The Fast Ethernet port supports standard straight-through and crossover Category 5 unshielded twisted-pair (UTP) cables with RJ-45 connectors. Cisco Systems does not supply Category 5 UTP cables; these cables are available commercially.

Figure 4-12   Attaching the Fast Ethernet Management Port 10/100 Cable
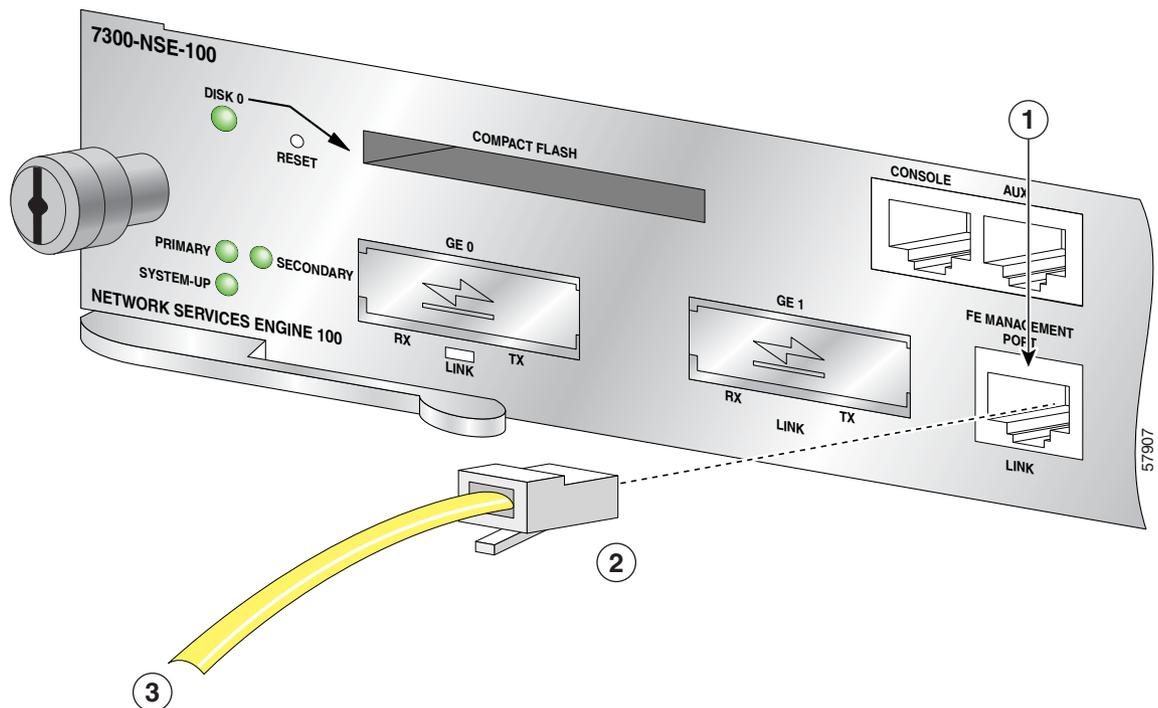
1	Fast Ethernet port with RJ-45 connector	3	Fast Ethernet cable
2	RJ-45 connector		

Attach a Fast Ethernet 10/100 cable to the Fast Ethernet management port.

Warning   **To avoid electric shock, do not connect safety extra-low voltage (SELV) circuits to telephone-network voltage (TNV) circuits. LAN ports contain SELV circuits, and WAN ports contain TNV circuits. Some LAN and WAN ports both use RJ-45 connectors. Use caution when connecting cables.**

Intra-Building Lightning Protection

Shielded cables, which are grounded at both ends, are required to be used on the 10/100/1000 Ethernet/Fast Ethernet/Gigabit Ethernet (RJ-45) port in order to be in compliance with requirement R4-11 in GR-1089-Core for a Central Office environment. This is not a requirement for customer premise installations.

Attaching the Console Port and Auxiliary Port Cables

If you have removed the console port and auxiliary port cables, reconnect them to the appropriate port.

Note   On the NSEs, the auxiliary port should be connected using straight-through cables and the console port should be connected using rollover cables.

This completes the procedures for connecting the console and auxiliary port cables.

Reconnecting Input Power and Powering Up the Router

The following procedures explain how to reconnect input power to a Cisco 7304 router, power up the router, and verify a successful system boot.

Warning   **Read the installation instructions before you connect the system to its power source.**

Reconnecting AC-Input Power

To reconnect AC-input power to a Cisco 7304 router, complete the following steps:

Step 1   Plug the power cable into the AC connector on the router.

Step 2   Plug the AC power supply cable into the AC power source.

Step 3   Turn the power switch on.

Note   For the Cisco 7304 router, each AC-input power supply operating at 120 VAC requires a minimum of 5A service.

Step 4   Repeat this procedure if a second power supply is installed.

This completes the steps for reconnecting AC-input power to a Cisco 7304. Proceed to the "Powering Up the Router" section on page 4-22.

Reconnecting DC-Input Power

Figure 4-13   Connecting DC-Input Power to a Cisco 7304 Router
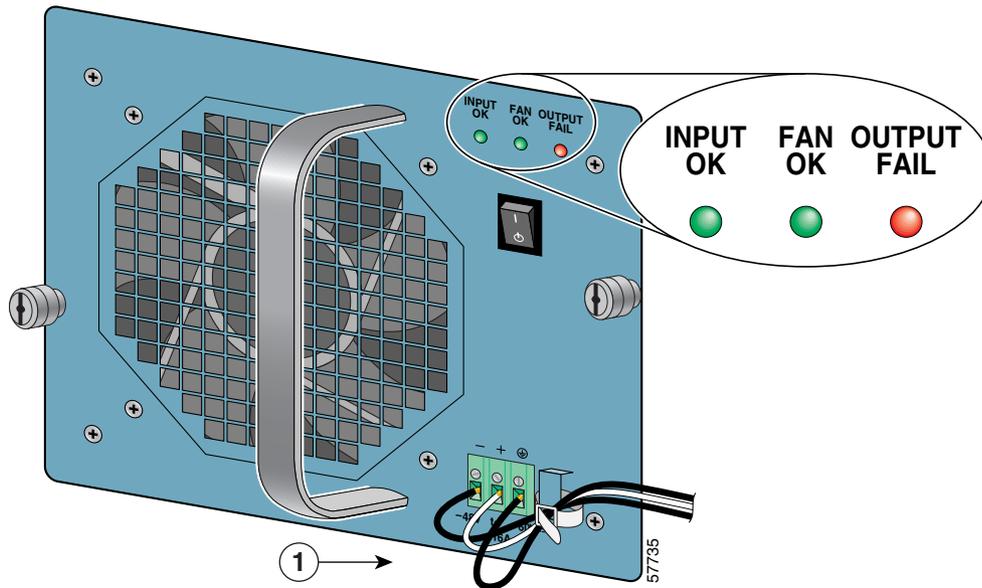
1	DC power line input leads		

Note   The color coding of the DC-input power supply leads depends on the color coding of the DC power source at your site. Typically, green or green/yellow is used for ground. Make certain that the lead color coding you choose for the DC-input power supply matches the lead color coding used at the DC power source.

Warning   **Before completing any of the following steps, and to prevent short-circuit or shock hazards, ensure that power is removed from the DC circuit. To ensure that all power is OFF, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the switch handle of the circuit breaker in the OFF position.**

Warning   **When installing the unit, the ground connection must always be made first and disconnected last.**

> **Note** This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a listed and certified fuse or circuit breaker, 35A minimum 60 VDC, is used on all current-carrying conductors.

To reconnect DC-input power to a Cisco 7304 router, complete the following steps:

Step 1 Ensure that the DC power line input leads are disconnected from the power source.

Step 2 If necessary, use a wire stripper to strip approximately 0.55 inch (14 mm) from the DC power line input and ground leads.

> **Note** Do not consolidate the strands by soft soldering. Use 12 AWG (2.5mm) copper wire only.

Step 3 Insert the stripped end of the ground lead all the way into the ground lead receptacle on the DC-input power supply and tighten the receptacle screw using a 1/8-inch flat-blade screwdriver. (See Figure 4-13.)

Step 4 Insert the stripped end of the +DC lead all the way into the lead receptacle and tighten the receptacle screw using the same 1/8-inch flat-blade screwdriver. Repeat this step for the –DC lead.

> **Note** Make sure that the entire stripped end of each lead is inserted all the way into its receptacle. If any exposed wire at the stripped end of a lead is visible after inserting the lead into its receptacle, remove the lead from the receptacle, use the wire stripper to cut the stripped end of the lead, and repeat Step 2 through Step 5.

Step 5 After tightening the receptacle screw for the ground and DC power line input leads, secure the leads to the power supply faceplate. Use a cable tie to secure the three leads.

> **Note** When securing the ground and DC power line input leads to the power supply faceplate, leave a small service loop in the ground lead to ensure that it is the last lead to disconnect from the power supply if a great deal of strain is placed on all three leads. (See Figure 4-13.)

Step 6 Connect the ground and DC power line input leads to the power source.

Step 7 Repeat Step 1 through Step 6 if a second power supply is installed.

This completes the steps for reconnecting DC-input power to a Cisco 7304 router. Proceed to the following section, "Powering Up the Router."

Powering Up the Router

To power up a Cisco 7304 router complete the following steps:

Step 1 Check for the following:

- Each line card is inserted in its slot, its respective line card levers are in the locked position, and the locking thumbscrews are tightened.
- Empty line card slots have a blank line card installed for cooling and correct airflow.
- All network interface cables are connected to the Gigabit Ethernet GBIC module cables.
- All network interface cables are connected to the line cards.
- A CompactFlash Disk is installed.
- Each DC lead is connected and secured to the power supply faceplate with a cable tie.
- Each DC lead is connected and secured to the power source (DC-input power supplies only).
- Ensure that the tape (that you applied earlier) is removed from the circuit breaker switch handle, and power is restored by moving the circuit breaker handle to the on (|) position (DC-input power supplies only).
- The console terminal is turned on.

Step 2 Plug the AC power supply cable in to the AC power source. Turn the power switch on. Repeat if a second power supply is installed.

Step 3 Listen for the fans; you should immediately hear them operating.

Step 4 During the boot process, observe the system LEDs.

Note If the system detects a corrupted FPGA image, you will be prompted to download a golden FPGA image from ROM 0. The system will then reset automatically and will restart the boot process. The download is necessary to continue the boot process.

Step 5 Observe the initialization process. When the system boot is complete (a few seconds), the network services engine begins to initialize the line cards. During this initialization, the LEDs on each line card behave differently (most flash on and off). The STATUS LED on each line card goes on when initialization is completed, and the console screen displays a script and system banner similar to the following:

```
Cisco Internetwork Operating System Software
IOS (tm) 7300 Software (C7300-JS-M), Version 12.1(9) RELEASED, CISCO
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Fri 20-Apr-01 01:53 by biff
```

This completes the procedures for connecting input power and powering up the router. This also completes the procedure for installing the network services engine in a Cisco 7304 router.

Verifying a Successful Boot

The router boots at the point when both the NSE and the power supply are properly installed. If the following steps occur, you have verified that a successful boot process has occurred.

Step 1   Verify that the green INPUT OK LED on the power supply turns on.

Step 2   Listen for the fans; you should immediately hear them operating.

Step 3   During the boot process, observe the system LEDs. The LEDs on most of the line cards and the NSE should go on and off in irregular sequence. Some may go on, go out, and go on again for a short time.

Step 4   Observe the initialization process. When the system boot is complete (a few seconds), the network services engine begins to initialize the line cards. During this initialization, the LEDs on each line card behave differently. The STATUS LED on each line card goes on when initialization is completed, and the console screen displays a script and system banner.

If the system fails to boot properly, or if the console terminal displays a checksum or memory error, check the following:

- Check the NSE by making sure it is properly seated in the midplane. If the NSE is not properly installed, reinstall the NSE and reboot the system for an installation check.

- Check the power supply. If the power supply is not properly installed, reinstall it, and reboot the system for an installation check.

- Check the SODIMM by looking straight down on it and then at eye level. If a SODIMM appears to stick out or rest in the socket at an odd angle, remove the SODIMM and reinsert it. Then replace the network services engine and reboot the system for another installation check.

If after several attempts the system fails to restart properly, contact a service representative for assistance. Before you call, note any error messages, unusual LED states, or other indications that might help solve the problem.

C H A P T E R **5**

High Availability NSE Redundancy

⚠️
Caution   Two NSE-100s, two NSE-150s, or two NPE-G100 configurations are supported on the Cisco 7304 router. You cannot use different processors in the same Cisco 7304 router at the same time.

This chapter contains the following sections:

Route processing redundancy is a feature currently available on the Cisco 7304 router. With two NSEs installed in a router, the feature provides the most basic level of increased system availability through a "partial bootup" feature on the standby NSE. A "partial bootup" means that when the active NSE fails or a fatal error is detected on the NSE, the standby NSE will complete booting and take control of the line cards. This minimizes the time that the router is in a failed state, thereby increasing system availability. Switchover takes approximately one minute.

Configuration syncing of startup configuration (only) and ROMmon environmental variables are supported.

✎
Note   During a failover, the entire system will lose all functionality for the duration of the restoration; line cards will be reset, and all traffic flowing through the router at the time of failure will be lost.

After a failover, you should replace the failed NSE to maintain high availability.

High Availability System Requirements

To configure high availability (HA) operation with the Cisco 7304, you need two network services engines that are the same model, and the same Cisco IOS release running on both network services engines.

Note It is recommended that both NSEs run the same version of Cisco IOS. It is also recommended that both NSEs have the same physical configuration for optimum availability; memory and CompactFlash Disk configuration should be the same on the active and standby NSEs.

High Availability Commands

The **show redundancy** command is issued on the active NSE and shows redundancy-related information for the active and standby NSEs.

```
Router# show redundancy
Slot 0 NSE (This NSE)   : Active
Slot 2 NSE              : Standby

Redundancy state is REDUNDANCY_PEERSTANDBY_INITED

Standby NSE information:
Standby is up.
Standby has 132096K bytes of memory.
Standby BOOT variable = disk0:c7300-js-mz.ha-031202,1
Standby CONFIG_FILE variable =
Standby BOOTLDR variable = bootdisk:c7300-boot-mz.ha-031202
Standby Configuration register is 0x2002

Standby version:
Cisco Internetwork Operating System Software
IOS (tm) 7300 Software (C7300-JS-M), Released Version 12.1(20020306:160533)]
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Tue 12-Mar-02 18:27 by biff
```

You can also use the **show c7300** command to show the status of the two NSEs. In this example, two NSE-100s are installed in the Cisco 7304 router.

```
Router# show c7300
Slot      Card Type       Status       Insertion time
----      ---------       ------       --------------
0,1       NSE-100         Active       1d20h ago
2,3       NSE-100         Standby      1d20h ago
4         4OC3-POS        Active       1d20h ago
5         1OC48-POS       Active       1d20h ago

System is compliant with hardware configuration guidelines.

All the FPGAs in the system are up-to-date

Network IO Interrupt Throttling:
 throttle count=11370, timer count=11370
 active=0, configured=1
 netint usec=3999, netint mask usec=200
```

To force a manual switchover to the standby NSE, use the **redundancy force-switchover** command:

```
Router# redundancy force-switchover

System configuration has been modified. Save? [yes/no]:y
Proceed with switchover to standby NSE? [confirm]n
```

To cause the standby NSE to be reset, use the **hw-module standby** {**reset** | **reload**} command:

```
Router# hw-module standby reset
```

```
Proceed with reset of standby NSE? [confirm]n
```

FPGA Upgrades and Failover

If the FPGA versions of the NSE do not match and the router fails over to the standby NSE, you may be required to upgrade the FPGAs on the standby NSE.

For further information on upgrading FPGA, see the *Cisco 7304 FPGA Bundling and Update* document.

GBIC Module, SFP Module, and FE Management Port Addressing

Four Gigabit Ethernet ports are available from the active NSE-100. The slot 0 NSE-100 GBIC ports are 0/0 and 0/1; slot 2 GBIC ports are 2/0 and 2/1.

Four Gigabit Ethernet ports are available for NSE-150. The slot 0 NSE-150 SFP ports are 0, 1, 2, and 3; slot 2 SFP ports are 2/0, 2/1, 2/2, and 2/3.

In an HA-enabled system, the FE management port is 0.

CompactFlash Disk Commands

The following commands are available as part of the remote file system support which causes the file systems on the standby NSE to be visible on the active NSE. In an HA-enabled Cisco 7304 router, the CompactFlash Disks on the standby NSE can be accessed with the following commands (use **copy**, **dir** or other commands before **standby-disk0:**, **standby-bootdisk:**, **or standby-nvram:**).

copy tftp standby-disk0:

copy tftp standby-bootdisk:

copy standby-disk0: tftp

copy standby-bootdisk: tftp

dir standby-bootdisk:

dir standby-disk0:

dir standby-nvram:

Any file system command that takes disk0: or bootdisk: as parameters can also take standby-disk0: and bootdisk: as parameters.

Working with a CompactFlash Disk

This chapter provides basic instructions for working with a CompactFlash Disk in your system. Detailed descriptions of more complex CompactFlash Disk options and the Cisco IOS File System feature are beyond the scope of this publication and can be found in the following Cisco IOS Release 12.*x* publications:

- *Cisco IOS Configuration Fundamentals Configuration Guide*, in the chapter "File Management"
- *Cisco IOS Configuration Fundamentals Command Reference*, in the chapter "File Management Commands"

Note These and all publications are available on Cisco.com. For information on how to access Cisco.com, see the "Obtaining Documentation" section on page v.

This chapter includes the following subsections:

Software Command Overview

This section lists some of the basic software commands you can use with the CompactFlash Disk. Examples of these commands are included in the sections that follow.

The CompactFlash Disk and other memory devices and locations in your system are defined as *file systems*, which are locations where you can store, use, or retrieve files and software images.

Table 6-1 lists the software commands that you can use with the CompactFlash Disk.

Note You can use other arguments with some of the commands listed in Table 6-1; however, in Table 6-1 and throughout this document, command arguments are limited to those that apply to the CompactFlash Disk and related file systems.

For a discussion of additional command arguments, refer to the *Cisco IOS Configuration Fundamentals Command Reference* document, in the chapter "File Management Commands."

Table 6-1   *CompactFlash Disk-Related Software Commands*

Command and Arguments	Description
cd [**disk0:** | **bootdisk:**] *directory-name*	Changes current directory. Allows you to move between directories on a CompactFlash Disk, where *directory-name* is the directory to which you want to move.
copy [**disk0:** | **bootdisk:**] *source-filename* [**disk0:** | **bootdisk:**] *destination-filename*	Copies from one file to another. Allows you to make a copy of a file (*source-filename*) located on a source file system (**disk0:**, **bootdisk:**) and place it with either the same filename or a different filename (*destination-filename*) on a destination file system. Along with **disk0:** and **bootdisk:**, the source and destination file system arguments include, but are not limited to: • **nvram:** (onboard nonvolatile random-access memory) • **running-config** (the running system configuration file) • **startup-config** (the startup system configuration file) • **tftp:** (a TFTP server to which you have access) **Note** Note that any file system command that takes **disk0:** or **bootdisk:** as parameters can also take the **standby-disk0:** and **bootdisk:** as parameters.
delete [**disk0:** | **bootdisk:**] *filename*	Deletes a file. Allows you to delete any file you designate, where *filename* designates the name of the file.
dir [**/all** | **disk0:** | **bootdisk:**]	Lists files on a file system. Allows you to list the contents of the CompactFlash Disk in **disk0:**. The **/all** argument lists all files on all file systems in your system.
format [**flash:** | **bootflash:** | **disk0:** | **bootdisk:**]	Formats a file system. Allows you to format a new CompactFlash Disk (**disk0:** or **bootdisk:**). This command also allows you to reformat a CompactFlash Disk that was formatted on another type of system. **Note** This command destroys all data currently in Flash memory; therefore, we strongly recommend that you use the **format** command with caution to prevent irretrievable loss of data. **Note** flash: maps to **disk0**:
mkdir [**disk0:** | **bootdisk:**] *directory-name*	Creates a new directory. Allows you to create directories on a CompactFlash Disk, where *directory-name* is the name you assign to this directory.
pwd	Displays current working directory. Allows you to display the name of the CompactFlash Disk directory in which you are currently working.
rename [**disk0:** | **bootdisk:**] *filename* [**disk0:** | **bootdisk:**] *filename*	Renames a file. Allows you to rename a file that is located on one CompactFlash Disk and assign to that file another (or the same) file system path and filename. The first group of arguments defines the source (current) file system path and filename, and the second set of arguments defines the destination file system path and filename.

Table 6-1   CompactFlash Disk-Related Software Commands (continued)

Command and Arguments	Description
rmdir [**disk0:** | **bootdisk:**] *directory-name*	Removes an existing directory. Allows you to remove a directory that currently exists on a CompactFlash Disk, where *directory-name* is the name of the directory you want to remove.
show [**disk0:** | **bootdisk:**]	Lists information about CompactFlash Disk format and geometry.

Using Software Commands

This section provides examples of some of the basic software commands you can use with the CompactFlash Disk. See Table 6-1 for optional arguments you can use with some of the following commands:

Using the show Command

To display information about CompactFlash Disk format and geometry, use the **show** [**disk0:** |**bootdisk:**] command. The following example shows output from the **show disk0:** command:

```
System# show disk0:
******** ATA Flash Card Geometry/Format Info ********

ATA CARD GEOMETRY
   Number of Heads:      16
   Number of Cylinders   840
   Sectors per Cylinder  32
   Sector Size           512
   Total Sectors         430080

ATA CARD FORMAT
   Number of FAT Sectors 105
   Sectors Per Cluster   16
   Number of Clusters    26822
   Number of Data Sectors 429536
   Base Root Sector      338
   Base FAT Sector       128
   Base Data Sector      370

Router#
```

In this example:

- Number of Heads is the number of heads on the CompactFlash Disk.

- Number of Cylinders is the number of cylinders on the CompactFlash Disk.

- Sectors per Cylinder is the number of sectors in each cylinder.

- Sector Size is the number of bytes in each sector.

- Total Sectors is the total number of sectors on the CompactFlash Disk.

- Number of FAT Sectors is the number of sectors used to track allocation of clusters to files.

- Sectors Per Cluster is the number of sectors contained in each cluster. (Files grow by a minimum of one cluster.)

- Number of Clusters is the total number of clusters available for use by files.

- Number of Data Sectors is the number of sectors available for files.

- Base Root Sector is the logical address of the first sector of the root directory.

- Base FAT Sector is the first sector in the File Allocation Table (FAT).

- Base Data Sector is the first sector available for use by files.

Using the pwd Command

To determine the CompactFlash Disk slot you are accessing, use the **pwd** command:

```
System# pwd
disk0:/
System#
```

The preceding example indicates that you are currently in the working directory called *disk0:*, which is the CompactFlash Disk.

Using the cd Command

To move back and forth between installed CompactFlash Disks, use the **cd** command by defining a specific path name. Then to verify your working directory, use the **pwd** command:

```
System# cd disk0:
System# pwd
disk0:/
```

You can also move up (or back) one level in the CompactFlash Disk directory hierarchy by using the **cd ..** command, and then verify your working directory with the **pwd** command:

```
System# pwd
disk0:daily_dir/
System# cd ..
System# pwd
disk0:/
System#
```

Using the dir Command

To list the directory structure and contents of the CompactFlash Disk from which you are currently working, use the **dir** command with no arguments:

```
System# dir
Directory of disk0:/

  1 drw-           0   Jul 25 1998 10:23:11   daily_dir
  2 drw-           0   Jul 25 1998 10:28:37   access_lists

48755200 bytes total (48742912 bytes free)
System#
```

Note that the size of the CompactFlash Disk is shown in the output of the **dir** command. (A 48-MB CompactFlash Disk is shown in this example.) You can also view the contents of other directories and file systems using specific optional arguments with the **dir** command. (See Table 6-1.)

Using the format Command

To format a new CompactFlash Disk, use the **format** [**disk0:** | **bootdisk:**] command.

Note   You must format a new CompactFlash Disk before you can use it.

Caution   The formatting procedure erases all information on the CompactFlash Disk. To prevent the loss of important data that might be stored on a CompactFlash Disk, proceed carefully. If you want to save data that is currently on your CompactFlash Disk, copy the data to a TFTP server or to another CompactFlash Disk *before* you format the new CompactFlash Disk. A CompactFlash Disk that was shipped as part of a configured system contains a CompactFlash Disk-compatible Cisco IOS software image; therefore, you do not need to format it to use it in the system in which it was shipped.

Note   A spare CompactFlash Disk is shipped blank; therefore, you must format it before you can use it.

Use the following procedure to format a new CompactFlash Disk in disk0: using the **format** command. (The procedure assumes you have already booted your system.)

Step 1   Insert the CompactFlash Disk using the procedures in the "Installing and Using the CompactFlash Disk" section on page 4-11.

Step 2   Use the **format disk0:** command to format the CompactFlash Disk as follows:

```
System# format disk0:
Format operation may take a while. Continue? [confirm]
Format operation will destroy all data in 'disk0:'.  Continue? [confirm]
Format:Drive communication & 1st Sector Write OK...
Writing Monlib
sectors...............................................................
......................
Monlib write complete

Format:All system sectors written. OK...

Format:Total sectors in formatted partition:81760
Format:Total bytes in formatted partition:49861120
Format:Operation completed successfully.

Format of disk0:complete
```

The new CompactFlash Disk is now formatted and ready to use in the system on which you formatted it.

Using the copy Command

To copy an image from a CompactFlash Disk to another file system or from another file system to the CompactFlash Disk, use the **copy** command:

copy [**tftp:** | **bootflash:** | **disk0:**] *source-filename* [**tftp:** | **bootflash:** | **disk0:**] *destination-filename*

In this example:

- The file you want to copy is located in a file system (**tftp:**, **bootflash:**, and all of the other options).
- The variable *source-filename* is the name of the file you want to copy to another file system (**tftp:**, **bootflash:**).
- The variable *destination-filename* is the name you want to apply to this file after it is copied.

    You do not need to change the filename; this is an option.

The following assumptions are made for this command:

- You have a system processor with a CompactFlash Disk-compatible Cisco IOS software image in the onboard Flash memory—called *boot flash memory*—so you can start the system.
- Your system is running Cisco IOS Release 12.1(10)EX2 or later releases of 12.1EX, Cisco IOS Release 12.2YZ, or Cisco IOS Release 12.2SZ or later. See Software Advisor for any future releases.
- The bootable image you want to copy to the CompactFlash Disk exists in another file system or on a TFTP server to which you have access (meaning you know its name and have connectivity to it), and at least one interface is available over which you can access this server through Telnet. To ensure access to a TFTP server, you need to configure at least one interface. To configure an interface, you can use the **setup** command or use the configuration editor.

    An Ethernet interface is used in the examples that follow.

- You know the filename of the image you want to copy to the CompactFlash Disk.

Note   You might need to copy a new image to a CompactFlash Disk whenever a new Cisco IOS software release or a new Cisco IOS software maintenance release becomes available. You can use the **copy** command for this purpose.

Use the following procedure to copy a file (called *new.image* in this example) located on a CompactFlash Disk—called *disk0*:—to the CompactFlash Disk—called *bootdisk*:

Step 1   If the CompactFlash Disk is unformatted or has been formatted on another possibly incompatible system, format it now using the procedure in the , as appropriate.

Step 2   To copy the image *new.image* to CompactFlash Disk *disk0:*, use the following series of commands:

```
System> enable
Password:
System# copy disk0:new.image bootdisk:new.image
3393 bytes copied in 0.548 secs#
System#
```

In the preceding example, the 3393-byte file *new.image* was copied to the CompactFlash Disk in approximately one-half second.

Step 3   Verify that the file *new.image* is now on the CompactFlash Disk:

```
System# pwd
disk0:/
System# dir
Directory of disk0:/

  1  -rw-       3393   Jul 26 1998 17:44:47 new.image

48755200 bytes total (48747008 bytes free)
System#
```

Using the mkdir Command

To create a directory on the CompactFlash Disk, use the **mkdir** command. The following example shows how to create a directory called *daily_dir* on the CompactFlash Disk, and then verify that it was created:

```
System# mkdir disk0:daily_dir
Created dir disk0:daily_dir
System# dir
Directory of disk0:/

  1  drw-          0   Jul 25 1998 10:15:43  daily_dir

48755200 bytes total (48751104 bytes free)
System#
```

Note   If you create a directory and place a file in it that you plan to access or use later, be sure to define the entire directory path to the file as you enter the appropriate software commands.

For example, if you placed the file *itsa.file* into the directory *daily_dir* on the CompactFlash Disk in disk0:, you must designate the entire directory path as follows: *disk0:daily_dir/itsa.file*. Otherwise, the system might not be able to locate this file.

Using the rmdir Command

To remove a directory from the CompactFlash Disk, use the **rmdir** command. The following example shows how to remove the directory *daily_dir* from the CompactFlash Disk in disk0:, and then verify that it was removed:

```
System# rmdir disk0:daily_dir
Delete disk0:daily_dir? [confirm] y
Removed dir disk0:daily_dir
System# dir
Directory of disk0:/

  No files in directory.

48755200 bytes total (48751104 bytes free)
System#
```

Using the delete Command

To delete a file from a CompactFlash Disk, use the **delete** command. Use the **dir** command to find the file you want to delete, and then use the **delete** command to delete it.

The following example shows how to find a file (called *fun1)* on the CompactFlash Disk, delete the file, and then verify that it is deleted:

Step 1   Find the file you want to delete:

```
System# dir
Directory of disk0:/

  1  drw-          0   May 10 1998 09:54:53 fun1

48755200 bytes total (48742912 bytes free)
```

Step 2   Delete the file *fun1*:

```
System# delete disk0:fun1
```

Step 3   Verify that the file *fun1* is deleted:

```
System# dir
Directory of disk0:/

  No files in directory.

48755200 bytes total (48742912 bytes free)
System#
```

Enabling Booting from a CompactFlash Disk

This section explains how to enable booting from a CompactFlash Disk.

To enable booting from a CompactFlash Disk, set configuration register bits 3, 2, 1, and 0 to a value between 2 and 15 in conjunction with the **boot system** [**disk0:**] *filename* configuration command. This section includes only descriptions of **boot** commands specific to the CompactFlash Disk. (You can use either the **slotn:** argument or the **diskn:** argument for **boot** commands.)

Following are definitions of the various CompactFlash Disk-related **boot** commands:

- **boot system flash disk0:** —Boots the first file in the CompactFlash Disk.
- **boot system flash bootdisk:** —Boots the first file in the CompactFlash Disk.
- **boot system flash disk0:***herfile*—Boots the file named *herfile* from the CompactFlash Disk.
- **boot system flash bootdisk:***hisfile*—Boots the file named *hisfile* from the CompactFlash Disk.

> **Note** As you enter **boot** commands, pay attention to how you use the Spacebar, which influences the way your system interprets the commands. Also, ensure that you define the entire path to a file as you enter the **boot** commands; otherwise, the system might not be able to find the file.

For example, notice the difference in the following correct and incorrect commands:

```
System(config)# boot system flash disk0:myfile
```

Based on the preceding correct command, the system boots the file specified (*myfile*).

```
System(config)# boot system flash disk0: myfile
```

Based on the preceding incorrect command, the system finds the *filename* field blank because there is a space after **disk0:**. In this case, the system ignores the filename argument and boots the first file on the CompactFlash Disk, which might not be the file called *myfile*.

Use the following procedure to enable booting the file *myfile* from a CompactFlash Disk:

Step 1 Enter configuration mode and specify an image filename in disk0: from which to boot by using the **configure terminal** command, as follows:

```
System# configure terminal
Enter configuration commands, one per line. End with CTRL-Z.
System(config)# boot system flash disk0:myfile
```

Step 2 Enable the **boot system flash disk0:***myfile* command using the **config-register** command with the hexadecimal value shown in the following example:

```
System(config)# config-reg 0x2102
```

This command, with the hexadecimal value 0x2102, results in the following:

- Enables the system to boot the default boot ROM software if the CompactFlash Disk-based image fails to boot—hexadecimal value 0x2000
- Disables Break—hexadecimal value 0x0100
- Enables the image *myfile* as the default boot image—hexadecimal value 0x0002

Step 3 Press **Ctrl-Z** to exit configuration mode:

```
System(config)#
```

Cisco 7304 Network Service Engine Installation and Configuration

```
Crtl-Z
System#
```

Step 4   Save the new configuration to NVRAM by using the **copy system:running-config nvram:startup-config** command as follows:

```
System# copy system:running-config nvram:startup-config
```

Boot Environment Variables

The contents of the boot environment variables, which are stored in the configuration file in NVRAM, determine the actions your system takes on bootup. To see the current settings of these variables, use the **show bootvar** command as follows:

```
Router> show bootvar
BOOT variable =
CONFIG_FILE variable =
Current CONFIG_FILE variable =
BOOTLDR variable does not exist
Configuration register is 0x100
```

Following are explanations for each of these boot environment variables:

- BOOT variable—Points to the Cisco IOS software image that you want to boot; you set it in configuration mode. The default software image is the CISCO*xxx* image (where *xxx* is a filename assigned by the system, if you do not enter a specific filename). The system then looks for the first image on the CompactFlash Disk in disk0:.

    Enter configuration mode and specify a filename and CompactFlash Disk slot from which to boot using the **configure terminal** and **boot system** commands as follows:

    ```
    Router# configure terminal
    Enter configuration commands, one per line. End with CTRL-Z.
    System(config)# boot system flash disk0:image
    ```

    The result of this configuration file entry is that the BOOT variable is disk0:c7300-js-mz.

- CONFIG_FILE (configuration file) variable—Determines where the configuration is read from on bootup; you set it in configuration mode as follows:

    ```
    Router# configure terminal
    Enter configuration commands, one per line. End with CTRL-Z.
    System(config)# boot config disk0:image
    ```

    The result of this configuration file entry is that the CONFIG_FILE variable is disk0:configfile.

- BOOTLDR (boot loader) variable—Determines which image is used as the boot helper; you set it in configuration mode as follows:

    ```
    Router# configure terminal
    Enter configuration commands, one per line. End with CTRL-Z.
    System(config)# boot bootldr disk0:image
    ```

- Configuration register variable—Instructs the system where to look for a bootable Cisco IOS software image; you set it as a hexadecimal value in configuration mode as follows:

    ```
    Router# configure terminal
    Enter configuration commands, one per line. End with CTRL-Z.
    System(config)# config-register 0x102
    ```

The result of this configuration file entry is that the configuration register is set to hexadecimal 0x102. For more information on the configuration register, see the *Cisco IOS Configuration Fundamentals* manual.

If there is no **boot system** command in the configuration file, the router will try to load the default file image from the CompactFlash Disk. For more information, see "Rebooting the Router" in the *Cisco IOS Configuration Fundamentals* manual.

Making a CompactFlash Disk-Based Software Image the Bootable Software Image

This section explains how to make a CompactFlash Disk-based Cisco IOS software image a bootable image.

After you copy a software image to the CompactFlash Disk, use the following series of commands to make the image bootable (the file named *new.image* in this example). The software image in this example is located on the CompactFlash Disk. Note that the **config-register** command is also a part of this command sequence because you must set the configuration register to 0x2102 to enable loading an image from the CompactFlash Disk.

```
System# config terminal
System(config)# no boot system
System(config)# boot system flash disk0:new.image
System(config)# config-register 0x2102
Ctrl-Z
System# copy system:running-config nvram:startup-config
System# reload
```

When the system reloads, it boots the image *new.image* from the CompactFlash Disk.

C H A P T E R 7

Upgrading, Configuration, and Troubleshooting Tasks

This chapter provides configuration and troubleshooting information. Troubleshooting information includes general **show** commands, **show** and **debug** commands specific to the NSE, and the like. The following topics are covered in this chapter:

Configuration Tasks

The PXF processors are turned on by default. If they are ever disabled, you must enable them to take advantage of IP packet switching and feature acceleration.

Note Before enabling the PXF processors, you must have IP routing and IP CEF switching turned on.

To manually disable or enable the PXF processors, use the global command:

```
hostname (config)# [no] ip pxf
```

For additional information on PXF processing, including a list of features supported in the PXF processing path, see *PXF Information for the Cisco 7304 Router*.

Upgrading FPGA

The instructions for upgrading FPGA on the Cisco 7304 router can be found in *Cisco 7304 FPGA Bundling and Update*.

FPGA Recovery Upgrade on the NSE-150

Minimal boot mode is entered on the NSE-150 if an in-progress FPGA upgrade is abruptly stopped (due to various factors such as a power outage, router crash, hardware OIR, or other reason).

In minimal boot mode, the Fast Ethernet management port (**interface fastethernet 0**) is the only working port on the NSE-150.

If minimal boot mode is entered when using a Cisco 7304 with an NSE-150 because an FPGA upgrade was interrupted, simply retry the upgrade in minimal boot mode using the **upgrade fpga all** command.

After upgrading the FPGA, the router can be booted using a Cisco IOS image on one of the Flash file systems on the router or from another source.

Upgrading ROMmon

Upgrading the rewriteable ROM monitor (ROMmon) allows you to download a new ROMmon image instead of having to replace hardware (NSE) to get a new image.

There are three ROMmon images: one "golden"—always there (ROM 0—one-time programmable) and two others that you can configure the system to point to (ROM 1 and ROM 2). At bootup, the system starts with the golden image and then jumps to the one to which you have pointed the system. If a new ROMmon image you are pointing to fails to boot up Cisco IOS for the first time, then the router marks this ROMmon image as invalid and will revert to the golden image after a subsequent reset or power cycling.

After you have downloaded a new ROMmon image to the rewriteable ROMmon, you need to do a reload of Cisco IOS (recommended) for the new ROMmon to take effect. This is required only for the new ROMmon to take effect; it is not required otherwise.

The first time a new ROMmon image is loaded, you must allow the system to boot up Cisco IOS before doing any additional resets or power cycling. If the ROMmon loading process is interrupted, the system interprets this as a bootup failure of the new ROMmon image. The router reverts the ROMmon back to the golden image in ROM 0.

> **Note** Images are marked as invalid if the first Cisco IOS bootup is not completed. Do not reset the router when it is doing an initial bootup.

Using the show rom-monitor Command

Use the **show rom-monitor** command to determine which ROMmon images are available. See the following example for information shown in the output of the **show rom-monitor** command:

```
Router> show rom-monitor
ROM                                        IMAGE                    STATUS
—                          —                                       —
ROM 0 (Golden ROM)
```

```
ROM 1 (Field Upgradeable)                     APPROVED
ROM 2 (Field Upgradeable)                     APPROVED                    DEFAULT & IN USE

In ROM 0, ROMMON version is inaccessible when executing from either ROM 1 or ROM 2.

In ROM 1, ROMMON version is not available, possibly an older ROMMON.


In ROM 2, ROMMON version:
System Bootstrap, Version 12.1(12r)EX1, RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Copyright (c) 2002 by cisco Systems, Inc.
```

Using the upgrade rom-monitor Command

To program the ROM monitor, use the following command:

upgrade rom-monitor{**rom1** | **rom2**} **file** *file_id*

To set a particular ROMmon image as default, use the following command:

upgrade rom-monitor{**rom0** | **rom1** | **rom2**} **default**

The following example provides the output of a ROMmon upgrade:

```
Router> copy tftp://255.255.255.255/siff/WS_RM.srec.121-12r.EX1 disk0:
Destination filename [WS_RM.srec.121-12r.EX1]?
Accessing tftp://255.255.255.255/siff/WS_RM.srec.121-12r.EX1...
Loading siff/WS_RM.srec.121-12r.EX1 from 255.255.255.255 (via FastEthernet0)
: !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 975913 bytes]

975913 bytes copied in 20.372 secs (47905 bytes/sec)
Router# upgrade rom-monitor rom1 file disk0:WS_RM.srec.121-12r.EX1
ROM 1 update in progress
Erasing (this may take a while)...
Programming...
CC
Do you want to verify this image (may take a few minutes)? [yes/no]: y
Verifying ROM 1
  Reading from ROM 1...vDone
  Comparing with the source file...Passed

Set this ROMMON image as the default (will take effect on next reload)? [yes/no]
: y
Router# reload

System configuration has been modified. Save? [yes/no]: n
Proceed with reload? [confirm]

System Bootstrap, Version 12.1(12r)EX1, RELEASE SOFTWARE (fc1)
TAC Support: http://www.cisco.com/tac
Copyright (c) 2002 by cisco Systems, Inc.

C7300 platform with 131072 Kbytes of main memory

Currently running ROMMON from ROM 1
```

Note It is advisable to load a known good Cisco IOS image after a ROMmon upgrade.

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Troubleshooting ROMmon Upgrades

- If Cisco IOS fails to boot to the command prompt after a ROMmon upgrade, the ROMmon will reverts to the "golden" ROM—ROM 0.

- If Cisco IOS fails after a ROMmon is newly upgraded, the new ROMmon is marked as bad and may not be selected for use again. Start the upgrade procedure again from the beginning.

Additional ROMmon Upgrade Information

For NSE ROMmon release notes, see *Cisco 7300 Series Router Release Notes*.

Configuring Autoboot to Boot from the Network

To configure autoboot to boot from the network, you must have a usable network interface correctly configured. This procedure assumes your interface is configured and that a default gateway is set if the TFTP server is not local.

Follow these steps for configuring autoboot to boot from the network:

Step 1   Specify the Cisco IOS image using the **boot system** command.

Step 2   Specify the boot loader (optional).

Step 3   Ensure your configuration register is set to autoboot (0x2102).

See the following example:

```
Router> boot sysem tftp server_name://c7300-js-mz
Router> boot bootldr bootdisk:c7300-boot-mz
Router> config-reg 0x2102
Router> copy running-config startup-config
```

Configuring Autoboot to Boot from a Local Device

The procedure for booting from a local device is similar to booting from the network. However, if you are booting from a local device, specifying the bootloader image is not necessary.

See the following example:

```
Router> boot system flash disk0:c7300-js-mz
Router> config-reg 0x2102
```

Using the Bootldr Command

Use the **bootldr** command to specify an image to boot the system in the case of a system crash. You can use the **bootldr** command in Cisco IOS or in ROMmon mode.

You can use the **bootldr** command in Cisco IOS:

```
Router> enable
Router#> config
```

```
Router(config)# boot bootldr bootdisk:c7300-boot-mz-my-image
Router(config)# copy system: running-config nvram: startup-config
```

The **show bootvar** command can be used in ROMmon mode to verify that parameter settings are correct.

In cases where the system will not boot up, you can also use the **bootldr** command in ROMmon mode. First check to see if **bootldr** is set correctly:

```
ROMMON> set
```

If **bootldr** is not set correctly, set it with the correct image:

```
ROMMON> BOOTLDR="bootdisk:c7300-boot-mz-my-image"
```

⚠️
Caution   Be careful of typographical errors in ROMmon mode as there is no error checking.

You can use the ROMmon command **sync** to save the current parameters that remain after a power cycle to NVRAM.

Use the **set** command to check your configuration.

Failure to Boot After a SDRAM Upgrade or Replacement

📝
Note   Only the NSE-100 uses SDRAM SODIMMs. The NSE-150 DDR-SODIMMs are not field-upgradeable.

If, after a SDRAM upgrade or replacement, the system fails to boot properly, or if the console terminal displays a checksum or memory error, ensure that the SODIMM is installed correctly. If necessary, shut down the system and remove the network services engine. Check the SODIMM by looking straight down on it and then at eye level. If the SODIMM appears to stick out or rest in the socket at an odd angle, remove it and reinsert it. Then replace the network services engine and reboot the system for another installation check.

If after several attempts the system fails to restart properly, contact a service representative for assistance. Before you call, note any error messages, unusual LED states, or other indications that might help solve the problem.

Using the show version Command

Use the **show version** command to display the configuration of the system hardware including the NSE and the software version.

The following example of the **show version** command identifies an NSE-100 installed in a Cisco 7304 router:

```
Router# show version

Cisco Internetwork Operating System Software
IOS (tm) 7300 Software (C7300-JS-M), Released Version
12.1(20020207:195834) [biff-ha02 146]
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Fri 22-Mar-02 18:17 by biff
Image text-base:0x40008970, data-base:0x4197C000
```

```
ROM:System Bootstrap, Version 12.1(20020207:195837) [biff-ha02 104],
Released SOFTWARE
Currently running ROMMON from ROM 1

Router uptime is 0 minutes
System returned to ROM by power-on
System image file is "disk0:c7300-js-mz.NSE100CR_20020322"

cisco 7300 (NSE100) processor (revision 0x00) with 114688K/16384K bytes
of memory.
Processor board ID
R7000 CPU at 350Mhz, Implementation 39, Rev 4.0, 256KB L2, 1024KB L3 Cache
4 slot midplane, Version 65.48

Last reset from software reset or reload
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
PXF processor tmc0 running 'system:pxf/ucode1' v1.7 is active
PXF processor tmc1 running 'system:pxf/ucode1' v1.7 is active
1 FastEthernet/IEEE 802.3 interface(s)
4 Gigabit Ethernet/IEEE 802.3 interface(s)
1 Packet over SONET network interface(s)
509K bytes of non-volatile configuration memory.

31360K bytes of ATA compact flash in bootdisk (Sector size 512 bytes).
62720K bytes of ATA compact flash in disk0 (Sector size 512 bytes).
Configuration register is 0x0
```

Using the show c7300 Command

Use the **show c7300** command to obtain information about the router.

```
Router# show c7300
Network IO Interrupt Throttling:
throttle count=0, timer count=0
active=0, configured=0
netint usec=4000, netint mask usec=200

C7300 Midplane EEPROM:
Hardware revision 2.0          Board revision A0
Serial number     16061833     Part number    73-3223-05
Test history      0x0          RMA number     00-00-00
MAC=00b0.4aae.4000, MAC Size=1024
EEPROM format version 1, Model=0x6
EEPROM contents (hex):
0x20:01 06 02 00 00 F5 15 89 49 0C 97 05 00 B0 4A AE
0x30:40 00 04 00 00 00 00 00 00 01 13 50 00 00 FF 00

C7300 CPU EEPROM:
Hardware revision 1.2          Board revision A0
Serial number     15053437     Part number    73-3453-04
Test history      0x0          RMA number     00-00-00
EEPROM format version 1
EEPROM contents (hex):
0x20:01 C2 01 02 00 E5 B2 7D 49 0D 7D 04 00 00 00 00
0x30:50 00 00 00 00 01 14 00 00 00 FF FF FF FF FF FF

C7300 PE EEPROM:
Hardware Revision         :1.0
```

```
Top Assy. Part Number     :800-05272-04
Part Number               :73-4068-02
Board Revision            :A0
PCB Serial Number         :12342775
RMA History               :00
Fab Version               :02
Fab Part Number           :28-3146-02
EEPROM format version 4
EEPROM contents (hex):
0x00:04 FF 40 00 DE 41 01 00 C0 46 03 20 00 14 98 04
0x10:82 49 0F E4 02 42 41 30 C1 8B 31 32 33 34 32 37
0x20:37 35 20 20 20 04 00 02 02 85 1C 0C 4A 02 CB 84
0x30:4E 53 45 31 FF FF FF FF FF FF FF FF FF FF FF FF
0x40:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x50:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x60:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
0x70:FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

Using the show c7300 pxf accounting or show pxf Command

The following is an example of the **show c7300 pxf accounting** or **show pxf accounting** command with sample output (not all Cisco IOS releases have both commands, but both commands produce the same output):

```
Router> show c7300 pxf accounting
PXF Utilization: 0 %
PXF Packet Counters:
 Ingress from GE :            18       Egress to GE :             34
 Ingress from LCs:           329       Egress to LCs:              8
 Ingress from RP :            42       Egress to RP :            347
```

Using Debugging Commands and PXF

To enable all normal Cisco IOS packet debugging facilities, disable PXF. In configuration mode, use the **no ip pxf** command. Then use the Cisco IOS debugging commands to troubleshoot the problem.

To disable routing problems and control problems, you should not disable PXF. Only data packets pass through PXF, and by debugging problems in Cisco IOS, you are changing packet treatment.

Ethernet Pause Frames on the NSE Gigabit Ethernet Ports

NSE-150 Gigabit Ethernet ports can always receive Ethernet pause frames because any version of Cisco IOS that can be used to run the Cisco 7304 using an NSE-150 supports this functionality.

NSE-100 Gigabit Ethernet ports can receive Ethernet pause frames starting in Cisco IOS Release 12.2(31)SB2.

For the NSE Gigabit Ethernet ports, Ethernet pause frames are automatically received if sent by a neighbor device. The NSE Gigabit Ethernet ports only have the ability to receive Ethernet pause frames; they cannot send Ethernet pause frames. No user CLI is necessary to configure Ethernet pause frames for the NSE Gigabit Ethernet ports.

Ethernet pause frame counters can be viewed by entering the **show controllers gigabitethernet** command.

Troubleshooting

For troubleshooting information, see the *Cisco 7304 Internet Router Troubleshooting Documentation Roadmap*.

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