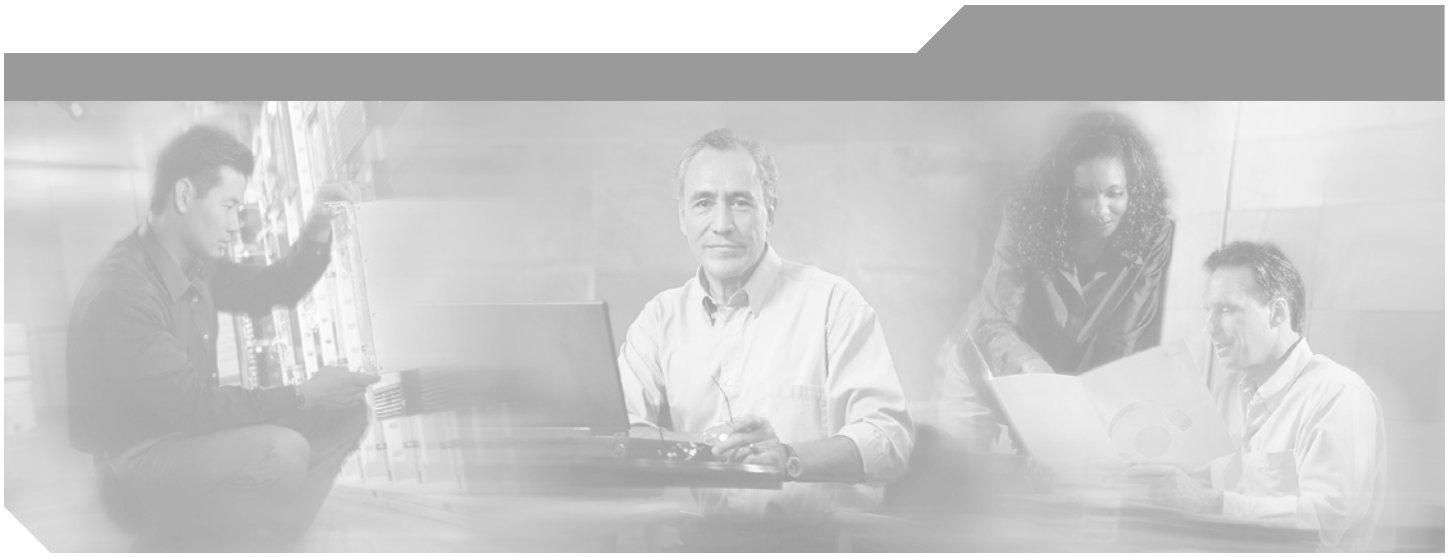

PA-FC-1G Fibre Channel Port Adapter Installation and Configuration

Product Numbers: PA-FC-1G=
Platforms Supported: Cisco 7200 VXR Routers and Cisco 7401ASR Routers

Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

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Preface: PA-FC-1G

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:

- Objectives, page vii
- Organization, page vii
- Related Documentation, page viii
- Obtaining Documentation, page ix
- Obtaining Technical Assistance, page x
- Obtaining Additional Publications and Information, page xi

Objectives

This document describes how to install and configure the PA-FC-1G fibre channel port adapter (PA-FC-1G=), hereafter referred to as the PA-FC-1G, which is used in the following platforms:

- Cisco 7200 VXR routers, including the 4-slot Cisco 7204VXR and the 6-slot Cisco 7206VXR

Note The PA-FC-1G is supported on the Cisco 7200 VXR routers with the NSE-1 or NPE-400 as the CPU card.

- Cisco 7401ASR router

Organization

This document contains the following chapters:

Section	Title	Description
Chapter 1	Overview: PA-FC-1G	Describes the PA-FC-1G and its LED displays, cables, and receptacles.
Chapter 2	Preparing to Install the PA-FC-1G	Describes safety considerations, tools required, and procedures you should perform before the actual installation.

Section	Title	Description
Chapter 3	Removing and Installing the PA-FC-1G	Describes the procedures for installing and removing the PA-FC-1G.
Chapter 4	Configuring the PA-FC-1G	Provides instructions for configuring the PA-FC-1G.

Related Documentation

The documentation listed below is available online, on the Documentation CD-ROM, or as printed documents.

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

- 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 Cisco IOS commands that are new for the 12.2(13)ZD release and the PA-FC-1G, see the *PA-FC-1G Fibre Channel Port Adapter* software document.
  - To check the minimum software requirements of Cisco IOS software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com: http://www.cisco.com/cgi-bin/Support/CompNav/Index.pl. You must be a registered user on Cisco.com to access this tool.

Note You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at http://www.cisco.com. Translated documentation is available at the following URL: http://www.cisco.com/public/countries_languages.shtml.

- Cisco 7200 VXR routers:
  - For port adapter hardware and memory configuration guidelines, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.
  - For hardware installation and maintenance information, refer to the *Cisco 7200 VXR Installation and Configuration Guide* or the *Cisco 7200 VXR Quick Start Guide*.
  - For hardware installation and maintenance information (including the Cisco 7206 or Cisco 7206VXR as a router shelf in a Cisco AS5800 Universal Access Server), refer to the installation and configuration guide that shipped with your Cisco 7200 series router.
  - For information on network processing engines or network services engines, refer to the *Network Processing Engine and Network Services Engine Installation and Configuration* publication.
- Cisco 7401ASR router:
  - For hardware installation and maintenance information, refer to the *Cisco 7401ASR Installation and Configuration Guide* or the *Cisco 7401ASR Quick Start Guide.*
- For international agency compliance, safety, and statutory information for WAN interfaces:
  - *Cisco AS5800 Universal Access Server Regulatory Compliance and Safety Information*

  - *Regulatory Compliance and Safety Information for Cisco 7200 Series Routers*
  - *Cisco 7400 Series Internet Router Regulatory Compliance and Safety Guide*
  - *Site Preparation and Safety Guide*
- To view Cisco documentation or obtain general information about the documentation, refer to the following sections:
  - "Obtaining Documentation" section on page ix
  - "Obtaining Technical Assistance" section on page x
  - "Obtaining Additional Publications and Information" section on page xi

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Cisco provides several ways to obtain documentation, technical assistance, and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

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

You can access the Cisco website at this URL:

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

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Cisco TAC Website

The Cisco TAC website (http://www.cisco.com/tac) provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The Cisco TAC website is available 24 hours a day, 365 days a year.

Accessing all the tools on the Cisco TAC website requires a Cisco.com user ID and password. If you have a valid service contract but do not have a login ID or password, register at this URL:

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

Opening a TAC Case

The online TAC Case Open Tool (http://www.cisco.com/tac/caseopen) is the fastest way to open P3 and P4 cases. (Your network is minimally impaired or you require product information). After you describe your situation, the TAC Case Open Tool automatically recommends resources for an immediate solution. If your issue is not resolved using these recommendations, your case will be assigned to a Cisco TAC engineer.

For P1 or P2 cases (your production network is down or severely degraded) or if you do not have Internet access, contact Cisco TAC by telephone. Cisco TAC engineers are assigned immediately to P1 and P2 cases to help keep your business operations running smoothly.

To open a case 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 listing of Cisco TAC contacts, go to this URL:

http://www.cisco.com/warp/public/687/Directory/DirTAC.shtml

TAC Case Priority Definitions

To ensure that all cases are reported in a standard format, Cisco has established case priority definitions.

Priority 1 (P1)—Your 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.

Priority 2 (P2)—Operation of an existing network is severely degraded, or significant aspects of your business operation 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.

Priority 3 (P3)—Operational performance of your network is impaired, but most business operations remain functional. You and Cisco will commit resources during normal business hours to restore service to satisfactory levels.

Priority 4 (P4)—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 Product Catalog* describes the networking products offered by Cisco Systems, as well as ordering and customer support services. Access the *Cisco Product Catalog* at this URL:

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

- Cisco Press publishes a wide range of networking publications. Cisco suggests these titles for new and experienced users: Internetworking Terms and Acronyms Dictionary, Internetworking Technology Handbook, Internetworking Troubleshooting Guide, and the Internetworking Design Guide. For current Cisco Press titles and other information, go to Cisco Press online at this URL:

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- Packet magazine is the Cisco quarterly publication that provides the latest networking trends, technology breakthroughs, and Cisco products and solutions to help industry professionals get the most from their networking investment. Included are networking deployment and troubleshooting tips, configuration examples, customer case studies, tutorials and training, certification information, and links to numerous in-depth online resources. You can access Packet magazine at this URL:

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

- iQ Magazine is the Cisco bimonthly publication that delivers the latest information about Internet business strategies for executives. You can access iQ Magazine at this URL:

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

- 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/en/US/about/ac123/ac147/about_cisco_the_internet_protocol_journal.html

- Training—Cisco offers world-class networking training. Current offerings in network training are listed at this URL:

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

Overview: PA-FC-1G

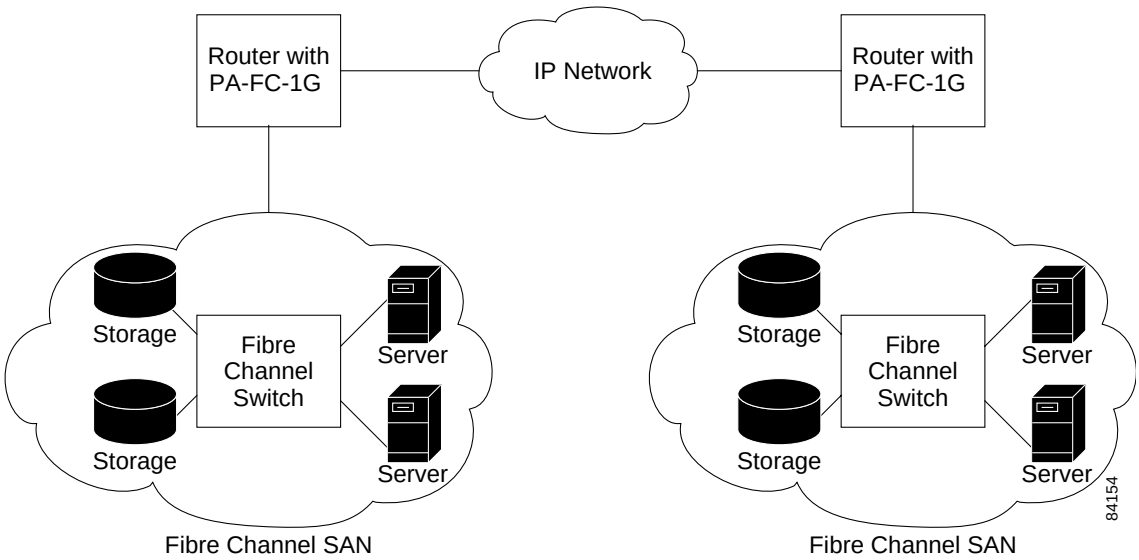
This chapter describes the PA-FC-1G and contains the following sections:

- Fibre Channel Overview, page 1-1
- PA-FC-1G Fibre Channel Port Adapter Overview, page 1-2
- LEDs, page 1-2
- Cables and Connectors, page 1-4
- PA-FC-1G Slot Locations on the Supported Platforms, page 1-5
- Identifying Interface Addresses, page 1-7

Fibre Channel Overview

The Fibre Channel over TCP/IP (FCIP) is a tunneling protocol that connects geographically distributed fibre channel storage area networks (SANs) transparently over local area networks (LANs), metropolitan area networks (MANs), and wide area networks (WANs). (See Figure 1-1.)

Figure 1-1 FC SAN Traffic Over an IP Network



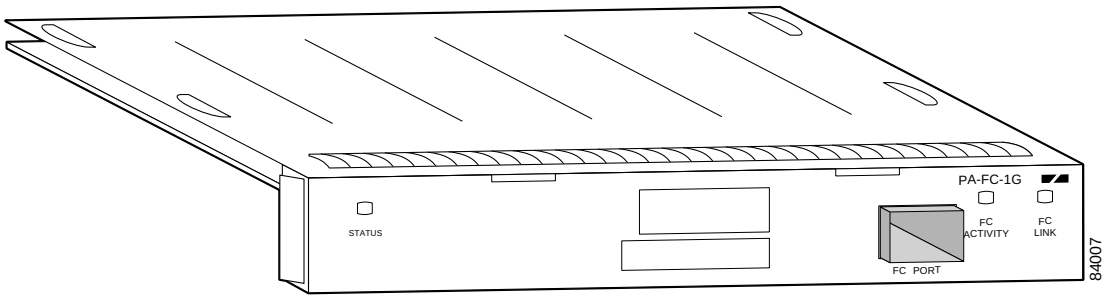
The Transmission Control Protocol (TCP) handles congestion control and congestion management, and data error recovery and data loss recovery for FCIP. TCP/IP handles transportation for FCIP, while maintaining fibre channel (FC) services.

PA-FC-1G Fibre Channel Port Adapter Overview

The PA-FC-1G is a single-width, Peripheral Component Interconnect (PCI) port adapter designed to tunnel fibre channel frames through TCP connections, guaranteeing reliable transport of SAN traffic over IP-based WANs.

The PA-FC-1G provides a one gigabit (1Gb) fibre channel interface to the external networks and a single PCI interface into 7200 VXR and 7401ASR routers. (See Figure 1-2.) It offers an alternative technology to carry SAN traffic over long distances without requiring a dedicated fibre channel network.

Figure 1-2 PA-FC-1G—Faceplate View



The PA-FC-1G complies with the environmental specifications listed in Table 1-1.

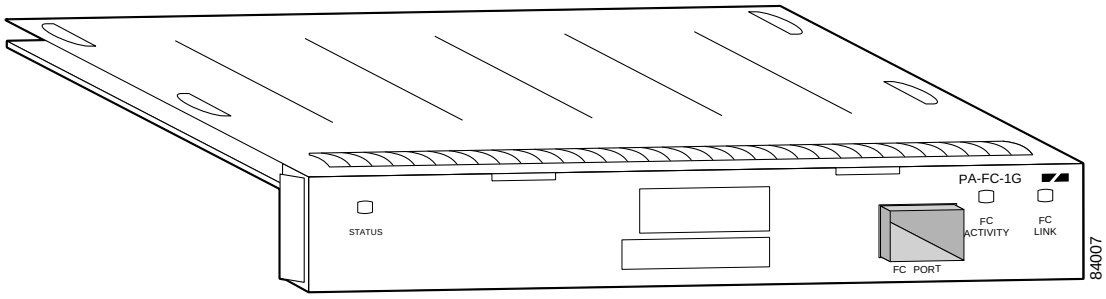
Table 1-1 PA-FC-1G Port Adapter Specifications

Environmental Specification	Description
Operating temperature	50 to 104°F (10 to 40°C)
Humidity	0 to 90%, noncondensing

LEDs

The PA-FC-1G has three LEDs to indicate port adapter status, fibre channel activity, and the status of the fibre channel link. (See Figure 1-3.)

Figure 1-3 LEDs on the PA-FC-1G



After system initialization, the Status LED goes on to indicate that the PA-FC-1G has been recognized by the system.

The following conditions must be met before the PA-FC-1G is enabled:

- The PA-FC-1G is correctly connected and is receiving power.
- A valid system software image for the PA-FC-1G has been downloaded successfully.
- The system recognizes the installed PA-FC-1G.

If any of these conditions are not met, or if the initialization fails for other reasons, the PA-FC-1G will not be operational.

Table 1-2 lists LED colors and indications.

Table 1-2 PA-FC-1G LEDs

LED Label	Color	State	Meaning
Status	Green	On	PA-FC-1G is recognized by the system.
		Off	PA-FC-1G is not recognized by the system.
FC Activity		Off	Indicates no activity on the port.
	Green	Blinking	Indicates activity on the port.
FC Link		Off	No connection, no signals are being received. Possible causes: No SFP module is present, or the fibre is not plugged in.
	Green	On	Optical signal is running through the interface, FC Link is up, and the B_port is up.
	Amber	On	Indicates that the B_port is initializing. Possible causes: SFP module is present and the fibre is connected to the port of another switch, but the FC Link is not up; the B_port is offline; fabric parameters are incompatible with the switch to which the B_port is connected.

Cables and Connectors

A small form-factor pluggable (SFP) module plugs into the FC port on the PA-FC-1G. The FC port is a 1000-Mbps optical interface in the form of an LC-type duplex port that supports IEEE 802.3z interfaces. The SFP is compliant with the 1000BASEX standard and the IEEE *Fibre Channel 2nd Generation Physical Interface* standard. The SFP (product ID SFP-FCPA-LC-1G=) ships installed in the PA-FC-1G and can be ordered as a spare.

An appropriate fibre-optic cable with an LC connector must be plugged into an SFP on the PA-FC-1G. If the SAN switch to which the PA-FC-1G is being connected has an SFP module installed, an LC-to-LC fibre-optic cable is recommended. If the SAN switch has a GBIC module, use an LC-to-SC fibre-optic cable.

Table 1-3 describes the features and operating distances of the SFP.

Table 1-3 SFP-FCPA-LC-1G Description and Operating Distance

Product ID	SFP Type	Description	Operating Distance
SFP-FCPA-LC-1G=	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 328 ft (300 m).

Table 1-4 shows the port cabling specifications of the SN-SFP-FCGEMM-LC.

Table 1-4 SFP-FCPA-LC-1G Port Cabling Specifications

Wave-length(nm)	Fiber Type	Core Size (micron)	Modal Bandwidth (MHz/km)	Maximum Cable Distance
850	MMF[1]	62.5	160	722 ft (220 m)
		62.5	200	902 ft (275 m)
		50.0	400	1640 ft (500 m)
		50.0	500	1804 ft (550 m)

1. Multimode fiber (MMF) only.

PA-FC-1G Slot Locations on the Supported Platforms

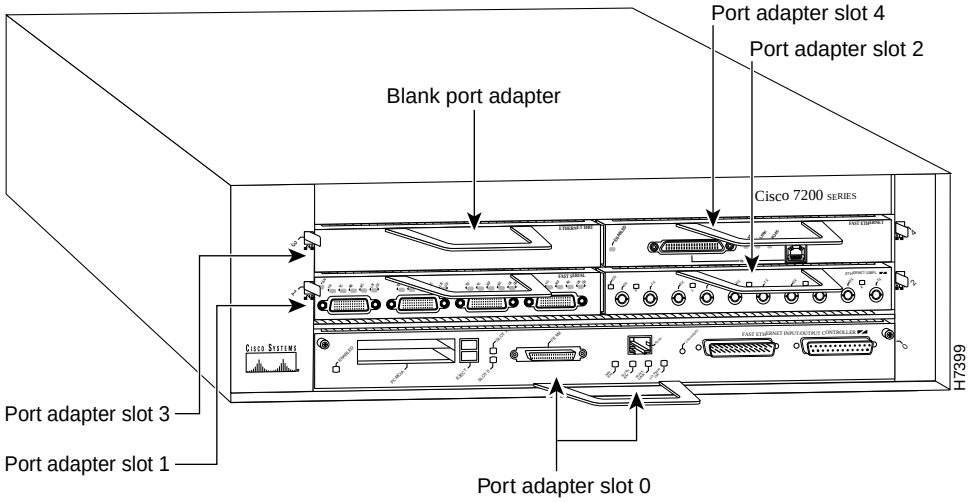
This section discusses the PA-FC-1G slot locations on the supported platforms. The illustrations that follow summarize slot location conventions on each platform:

- Cisco 7200 VXR Routers Slot Numbering, page 1-5
- Cisco 7401ASR Router Slot Numbering, page 1-6

Cisco 7200 VXR Routers Slot Numbering

The Cisco 7204VXR has four slots (slot 1 through slot 4) for port adapters. Port adapter slot 0 is reserved for an I/O controller. You can place the port adapters in any of the four available port adapter slots. (See Figure 1-4.)

Figure 1-4 Port Adapter Slots in the Cisco 7204VXR



The Cisco 7206VXR has six slots (slot 1 through slot 6) for port adapters. Port adapter slot 0 is reserved for an I/O controller. You can place the port adapters in any of the six available port adapter slots. (See Figure 1-5.)

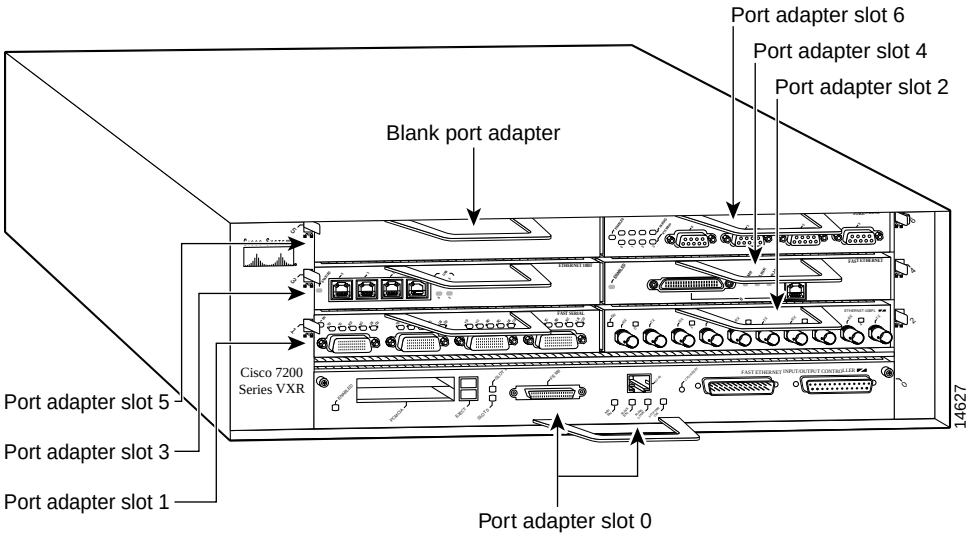
Load-Balancing Considerations

There are two PCI buses in a 7200 VXR router. Even-numbered slots are on one PCI bus and odd-numbered slots are on the other PCI bus.

If the IP connection is established using an Ethernet interface on the I/O controller, this interface shares the PCI bus of odd-numbered slots. In this case, the PA-FC-1G achieves best performance when it is installed in an even-numbered slot.

If the IP connection is established using an interface in one of the available port adapter slots, the PA-FC-1G achieves best performance when it is installed on a different PCI bus from the port adapter through which an IP connection is established. For example, if an Ethernet port adapter is installed in slot 2 (IP connection), it is best to install the PA-FC-1G in slot 1, 3, or 5 (fibre channel connection).

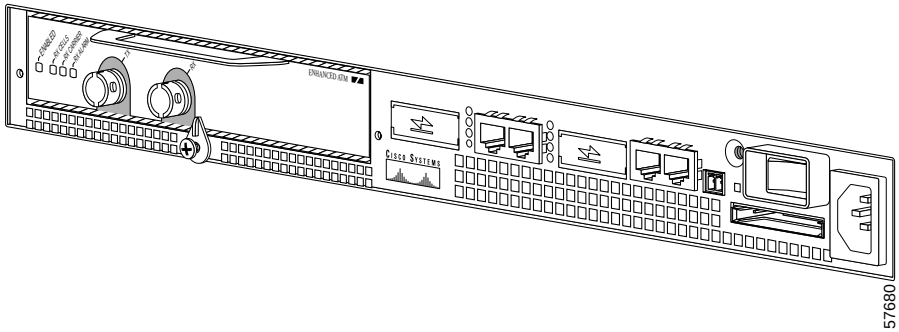
Figure 1-5 Port Adapter Slots in the Cisco 7206VXR



Cisco 7401ASR Router Slot Numbering

Figure 1-6 shows the front view of the Cisco 7401ASR router with a port adapter installed. The single slot in a 7401ASR router is located on the left side of the router.

Figure 1-6 Cisco 7401ASR Router with a Port Adapter Installed



Identifying Interface Addresses

This section describes how to identify the interface addresses for port adapters in supported platforms. Interface addresses specify the actual physical location of each interface on a router or switch.

Interfaces on the port adapter installed in a router maintain the same address regardless of whether other port adapters are installed or removed. However, when you move a port adapter to a different slot, the first number in the interface address changes to reflect the new port adapter slot number.

The following subsections describe the interface address formats for specific platforms:

- Interface Addresses of Cisco 7200 VXR Routers, page 1-7
- Interface Addresses of Cisco 7401ASR Router, page 1-7

Interface Addresses of Cisco 7200 VXR Routers

In Cisco 7200 VXR routers, slots are numbered from the lower left to the upper right, beginning with slot 1 and continuing through slot 4 for the Cisco 7204VXR, and slot 6 for the Cisco 7206VXR. (Slot 0 is reserved for the I/O controller.)

The interface address is composed of a two-part number in the format *slot/port-number*. The interface addresses of a 4-port port adapter installed in slot 1 would be 1/0 through 1/3 (slot 1 and port 0 through port 3). If the 4-port port adapter were installed in slot 4, these same interfaces would be numbered 4/0 through 4/3 (slot 4 and port 0 through port 3).

Interface Addresses of Cisco 7401ASR Router

There is only one slot on the Cisco 7401ASR router that accepts port adapters and it is numbered as slot 1. The interface address is composed of a two-part number in the format *slot/port-number*. For example, if a single-port port adapter is installed on a Cisco 7401ASR router, the interface address would be 1/0.

Preparing to Install the PA-FC-1G

This chapter describes the general equipment, safety, and site preparation requirements for installing modules. This chapter contains the following sections:

- Required Tools and Equipment, page 2-1
- Minimum Software and Hardware Requirements, page 2-1
- Checking Hardware and Software Compatibility, page 2-2
- Safety Guidelines, page 2-2
- Laser/LED Safety, page 2-8
- FCC Class A Compliance, page 2-9

Required Tools and Equipment

You need the following tools and parts to install port adapters. If you need additional equipment, contact a service representative for ordering information.

- PA-FC-1G fibre channel port adapter
- Appropriate fibre-optic cable for the PA-FC-1G
- Number 1 Phillips and a 3/16-inch flat-blade screwdriver
- Number 2 Phillips screwdriver
- Your own electrostatic discharge (ESD)-prevention equipment or the disposable grounding wrist strap included with all upgrade kits, field-replaceable units (FRUs), and spares
- Antistatic mat
- Antistatic container

Minimum Software and Hardware Requirements

This section indicates the recommended minimum Cisco IOS software release required to use the module in supported platforms. For the latest releases supporting the module, refer to the "Checking Hardware and Software Compatibility" section on page 2-2.

Refer to the following sections for supported platforms:

- Cisco 7200 VXR Routers Minimum Software Requirements, page 2-2
- Cisco 7401ASR Router Minimum Software Requirements, page 2-2

Cisco 7200 VXR Routers Minimum Software Requirements

The PA-FC-1G is a high-bandwidth port adapter and must conform to the system configuration guidelines for Cisco 7200 VXR routers. Cisco 7200 VXR routers have certain data-carrying capacity, or bandwidth, restrictions that affect the number of port adapters you can install. Refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines* for more information on port adapter installation restrictions.

Your Cisco 7200 VXR router must have an installed NPE-400 or NSE-1 to support the PA-FC-1G.

The minimum Cisco IOS software release that supports the PA-FC-1G on the Cisco 7204VXR and the Cisco 7206VXR is Cisco IOS Release 12.2(13)ZD. For the latest Cisco IOS release that supports the PA-FC-1G on Cisco 7200 VXR routers, refer to the "Checking Hardware and Software Compatibility" section on page 2-2.

Cisco 7401ASR Router Minimum Software Requirements

The PA-FC-1G can be installed in the single port adapter slot of the Cisco 7401ASR router.

The minimum Cisco IOS software release that supports the PA-FC-1G on the Cisco 7401ASR router is Cisco IOS Release 12.2(13)ZD. For the latest Cisco IOS release that supports the PA-FC-1G on the Cisco 7401ASR router, refer to the "Checking Hardware and Software Compatibility" section on page 2-2.

Checking Hardware and Software Compatibility

To check the minimum software requirements of Cisco IOS software with the hardware installed on your router, Cisco maintains the Software Advisor tool on Cisco.com. This tool does not verify whether modules within a system are compatible, but it does provide the minimum IOS requirements for individual hardware modules or components.

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

To access Software Advisor, click **Login** at Cisco.com and go to **Technical Support Help—Cisco TAC**: **Tool Index**: **Software Advisor**. You can also access the tool by pointing your browser directly to http://www.cisco.com/cgi-bin/support/CompNav/Index.pl.

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

Safety Guidelines

This section provides safety guidelines that you should follow when working with any equipment that connects to electrical power or telephone wiring.

Safety Warnings

Safety warnings appear throughout this publication in procedures that, if performed incorrectly, might harm you. A warning symbol precedes each warning statement.

Warning Definition

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. Use the statement number provided at the end of each warning to locate its translation in the translated safety warnings that accompanied this device. Statement 1071

SAVE THESE INSTRUCTIONS

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. Gebruik het nummer van de verklaring onderaan de waarschuwing als u een vertaling van de waarschuwing die bij het apparaat wordt geleverd, wilt raadplegen.

BEWAAR DEZE INSTRUCTIES

Varoitus **TÄRKEITÄ TURVALLISUUSOHJEITA**

Tämä varoitusmerkki merkitsee vaaraa. Tilanne voi aiheuttaa ruumiillisia vammoja. Ennen kuin käsittelet laitteistoa, huomioi sähköpiirien käsittelemiseen liittyvät riskit ja tutustu onnettomuuksien yleisiin ehkäisytapoihin. Turvallisuusvaroitusten käännökset löytyvät laitteen mukana toimitettujen käännettyjen turvallisuusvaroitusten joukosta varoitusten lopussa näkyvien lausuntonumeroiden avulla.

SÄILYTÄ NÄMÄ OHJEET

Attention **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

Ce symbole d'avertissement indique un danger. Vous vous trouvez dans une situation pouvant entraîner des blessures ou des dommages corporels. Avant de travailler sur un équipement, soyez conscient des dangers liés aux circuits électriques et familiarisez-vous avec les procédures couramment utilisées pour éviter les accidents. Pour prendre connaissance des traductions des avertissements figurant dans les consignes de sécurité traduites qui accompagnent cet appareil, référez-vous au numéro de l'instruction situé à la fin de chaque avertissement.

CONSERVEZ CES INFORMATIONS

Warnung **WICHTIGE SICHERHEITSHINWEISE**

Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer Situation, die zu Verletzungen führen kann. Machen Sie sich vor der Arbeit mit Geräten mit den Gefahren elektrischer Schaltungen und den üblichen Verfahren zur Vorbeugung vor Unfällen vertraut. Suchen Sie mit der am Ende jeder Warnung angegebenen Anweisungsnummer nach der jeweiligen Übersetzung in den übersetzten Sicherheitshinweisen, die zusammen mit diesem Gerät ausgeliefert wurden.

BEWAHREN SIE DIESE HINWEISE GUT AUF.

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. Utilizzare il numero di istruzione presente alla fine di ciascuna avvertenza per individuare le traduzioni delle avvertenze riportate in questo documento.

CONSERVARE QUESTE ISTRUZIONI

Advarsel **VIKTIGE SIKKERHETSINSTRUKSJONER**

Dette advarselssymbolet betyr fare. Du er i en situasjon som kan føre til skade på person. Før du begynner å arbeide med noe av utstyret, må du være oppmerksom på farene forbundet med elektriske kretser, og kjenne til standardprosedyrer for å forhindre ulykker. Bruk nummeret i slutten av hver advarsel for å finne oversettelsen i de oversatte sikkerhetsadvarslene som fulgte med denne enheten.

TA VARE PÅ DISSE INSTRUKSJONENE

Aviso **INSTRUÇÕES IMPORTANTES DE SEGURANÇA**

Este símbolo de aviso significa perigo. Você está em uma situação que poderá ser causadora de lesões corporais. Antes de iniciar a utilização de qualquer equipamento, tenha conhecimento dos perigos envolvidos no manuseio de circuitos elétricos e familiarize-se com as práticas habituais de prevenção de acidentes. Utilize o número da instrução fornecido ao final de cada aviso para localizar sua tradução nos avisos de segurança traduzidos que acompanham este dispositivo.

GUARDE ESTAS INSTRUÇÕES

¡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. Al final de cada advertencia encontrará el número que le ayudará a encontrar el texto traducido en el apartado de traducciones que acompaña a este dispositivo.

GUARDE ESTAS INSTRUCCIONES

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. Använd det nummer som finns i slutet av varje varning för att hitta dess översättning i de översatta säkerhetsvarningar som medföljer denna anordning.

SPARA DESSA ANVISNINGAR

Figyelem **FONTOS BIZTONSÁGI ELOÍRÁSOK**

Ez a figyelmezeto jel veszélyre utal. Sérülésveszélyt rejto helyzetben van. Mielott bármely berendezésen munkát végezte, legyen figyelemmel az elektromos áramkörök okozta kockázatokra, és ismerkedjen meg a szokásos balesetvédelmi eljárásokkal. A kiadványban szereplo figyelmeztetések fordítása a készülékhez mellékelt biztonsági figyelmeztetések között található; a fordítás az egyes figyelmeztetések végén látható szám alapján keresheto meg.

ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение **ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ**

Этот символ предупреждения обозначает опасность. То есть имеет место ситуация, в которой следует опасаться телесных повреждений. Перед эксплуатацией оборудования выясните, каким опасностям может подвергаться пользователь при использовании электрических цепей, и ознакомьтесь с правилами техники безопасности для предотвращения возможных несчастных случаев. Воспользуйтесь номером заявления, приведенным в конце каждого предупреждения, чтобы найти его переведенный вариант в переводе предупреждений по безопасности, прилагаемом к данному устройству.

СОХРАНИТЕ ЭТИ ИНСТРУКЦИИ

警告 重要的安全性说明

此警告符号代表危险。您正处于可能受到严重伤害的工作环境中。在您使用设备开始工作之前，必须充分意识到触电的危险，并熟练掌握防止事故发生的标准工作程序。请根据每项警告结尾提供的声明号码来找到此设备的安全性警告说明的翻译文本。

请保存这些安全性说明

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、一般的な事故防止策に留意してください。警告の各国語版は、各注意事項の番号を基に、装置に付属の「Translated Safety Warnings」を参照してください。

これらの注意事項を保管しておいてください。

Figyelem

FONTOS BIZTONSÁGI ELOÍRÁSOK

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ORIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

Предупреждение

ВАЖНЫЕ ИНСТРУКЦИИ ПО СОБЛЮДЕНИЮ ТЕХНИКИ БЕЗОПАСНОСТИ

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これらの注意事項を保管しておいてください。

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.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) damage, which can occur when electronic cards or components are improperly handled, results in complete or intermittent failures. Port adapters and processor modules comprise printed circuit boards that are fixed in metal carriers. Electromagnetic interference (EMI) shielding and connectors are integral components of the carrier. Although the metal carrier helps to protect the board from ESD, use a preventive antistatic strap during handling.

Following are guidelines for preventing ESD damage:

- Always use an ESD wrist or ankle strap and ensure that it makes good skin contact.
- Connect the equipment end of the strap to an unfinished chassis surface.
- When installing a component, use any available ejector levers or captive installation screws to properly seat the bus connectors in the backplane or midplane. These devices prevent accidental removal, provide proper grounding for the system, and help to ensure that bus connectors are properly seated.
- When removing a component, use any available ejector levers or captive installation screws to release the bus connectors from the backplane or midplane.
- Handle carriers by available handles or edges only; avoid touching the printed circuit boards or connectors.

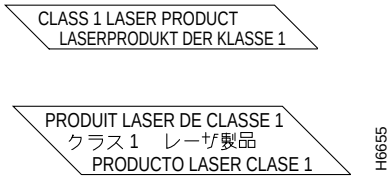
- Place a removed board component-side-up on an antistatic surface or in a static shielding container. If you plan to return the component to the factory, immediately place it in a static shielding container.
- Avoid contact between the printed circuit boards and clothing. The wrist strap only protects components from ESD voltages on the body; ESD voltages on clothing can still cause damage.
- Never attempt to remove the printed circuit board from the metal carrier.

Caution For safety, periodically check the resistance value of the antistatic strap. The measurement should be between 1 and 10 megohms (Mohms).

Laser/LED Safety

The single-mode transmitter in the module uses a small laser to transmit the light signal to the network ring. Keep the transmit port covered whenever a cable is not connected to it. Although multimode transceivers typically use LEDs for transmission, it is good practice to keep open ports covered and avoid staring into open ports or apertures. The single-mode aperture port contains a laser warning label, as shown in Figure 2-1.

Figure 2-1 Laser Warning Labels for Single-Mode Port



Warning **Invisible laser radiation may be emitted from the aperture ports of the single-mode products when no fibre cable is connected. *Avoid exposure and do not stare into open apertures.***

Warning **Class 1 laser product.**

The multimode aperture contains a Class 1 LED warning label, as shown in Figure 2-2.

Figure 2-2 Class 1 LED Warning Label for Multimode Port

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

Warning **Class 1 LED product.**

FCC Class A Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case users will be required to correct the interference at their own expense.

You can determine whether your equipment is causing interference by turning it off. If the interference stops, it was probably caused by the Cisco equipment or one of its peripheral devices. If the equipment causes interference to radio or television reception, try to correct the interference by using one or more of the following measures:

- Turn the television or radio antenna until the interference stops.
- Move the equipment to one side or the other of the television or radio.
- Move the equipment farther away from the television or radio.
- Plug the equipment into an outlet that is on a different circuit from the television or radio. (That is, make certain the equipment and the television or radio are on circuits controlled by different circuit breakers or fuses.)

Warning **This product has been designed to meet these requirements. Modifications to this product that are not authorized by Cisco Systems, Inc. could void the various approvals and negate your authority to operate the product.**

Removing and Installing the PA-FC-1G

This chapter describes how to remove the PA-FC-1G from supported platforms and also how to install new or replacement port adapters. This chapter contains the following sections:

- Handling Port Adapters, page 3-1
- Online Insertion and Removal, page 3-2
- Warnings and Cautions, page 3-3
- PA-FC-1G Removal and Installation, page 3-3
- SFP Removal and Installation, page 3-6

Each PA-FC-1G circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage. Before you begin installation, read Chapter 2, "Preparing to Install the PA-FC-1G," for a list of parts and tools required for installation.

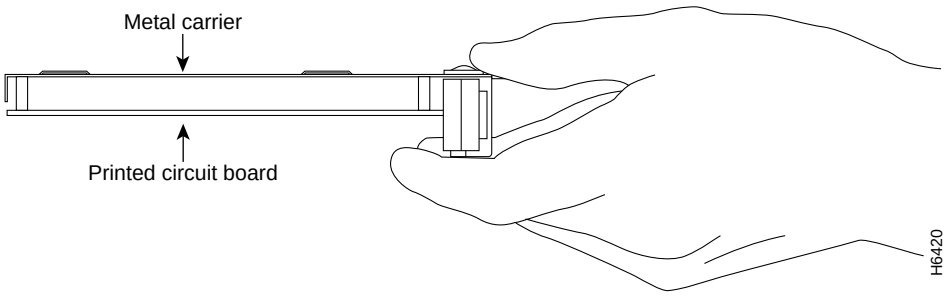
Note When a slot is not in use, a blank must fill the empty slot to allow the router or switch to conform to electromagnetic interference (EMI) emissions requirements and to allow proper airflow across the installed port adapters. If you plan to install a new port adapter in a slot that is not in use, you must first remove the blank.

Caution When powering off the router, wait a minimum of 30 seconds before powering it on again.

Handling Port Adapters

Always handle the port adapter by the carrier edges and handle; never touch the port adapter components or connector pins. (See Figure 3-1.)

Figure 3-1 Handling a Port Adapter



Online Insertion and Removal

The Cisco 7200 VXR routers and the Cisco 7404ASR router support the online insertion and removal (OIR) of all port adapter types. Therefore, you do not have to power down routers when removing and replacing port adapters in these chassis. However, it is wise to gracefully shut down the system before removing a port adapter that has active traffic moving through it. Removing a port adapter while traffic is flowing through the ports can cause system disruption. Once the port adapter is inserted, the ports can be brought back up.

Note As you disengage the port adapter from the router or switch, online insertion and removal (OIR) administratively shuts down all active interfaces in the port adapter.

OIR allows you to install and replace port adapters and service adapters while the router is operating; you do not need to notify the software or shut down the system power, although you should not run traffic through the port adapter you are removing while it is being removed. OIR is a method that is seamless to end users on the network, maintains all routing information, and preserves sessions.

The following is a functional description of OIR for background information only; for specific procedures for installing and replacing a PA-FC-1G in a supported platform, refer to the "PA-FC-1G Removal and Installation" section on page 3-3.

Each PA-FC-1G has a PCI bus connector that connects it to the router. The PCI bus connector has a set of tiered pins in three lengths that send specific signals to the system as they make contact with the port adapter. The system assesses the signals it receives and the order in which it receives them to determine if a port adapter is being removed from or introduced to the system. From these signals, the system determines whether to reinitialize a new interface or to shut down a disconnected interface.

Specifically, when you insert a port adapter, the longest pins make contact with the port adapter first, and the shortest pins make contact last. The system recognizes the signals and the sequence in which it receives them.

When you remove or insert a port adapter, the pins send signals to notify the system of changes. The router then performs the following procedure:

1. Rapidly scans the system for configuration changes.
2. Initializes newly inserted port adapters or administratively shuts down any vacant interfaces.

3. Brings all previously configured interfaces on the port adapter back to their previously installed state. Any newly inserted interface is put in the administratively shutdown state, as if it was present (but not configured) at boot time. If a similar port adapter type is reinserted into a slot, its ports are configured and brought online up to the port count of the originally installed port adapter of that type.

Warnings and Cautions

Observe the following warnings and cautions when installing or removing port adapters:

- Do not slide a port adapter all the way into the slot until you have connected all required cables. Trying to do so disrupts normal operation of the router or switch.
- If a port adapter lever or other retaining mechanism does not move to the locked position, the port adapter is not completely seated in the midplane. Carefully pull the port adapter halfway out of the slot, reinsert it, and move the port adapter lever or other mechanism to the locked position.
- To prevent jamming the carrier between the upper and the lower edges of the port adapter slot, and to ensure that the edge connector at the rear of the port adapter mates with the connection at the rear of the port adapter slot, make certain that the carrier is positioned correctly, as shown in the cutaway in the following illustrations.

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 midplane or backplane with your hand or any metal tool, or you could shock yourself.**

PA-FC-1G Removal and Installation

In this section, the illustrations that follow give step-by-step instructions on how to remove and install port adapters. Although the procedures might refer to a particular type of port adapter, the steps are the same for installing and removing all types of port adapters. This section contains the following illustrations:

- Cisco 7200 VXR Routers—Removing and Installing a Port Adapter, page 3-4
- Cisco 7401ASR Router—Removing and Installing a Port Adapter, page 3-5

Cisco 7200 VXR Routers—Removing and Installing a Port Adapter

Step 1

To remove the port adapter, place the port adapter lever in the unlocked position. (See A.) The port adapter lever remains in the unlocked position.

Step 2

Grasp the handle of the port adapter and pull the port adapter from the router, about halfway out of its slot. If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

Step 3

With the port adapter halfway out of the slot, disconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter from its chassis slot.

Step 4

To insert the port adapter, carefully align the port adapter carrier between the upper and the lower edges of the port adapter slot. (See B.)

Step 5

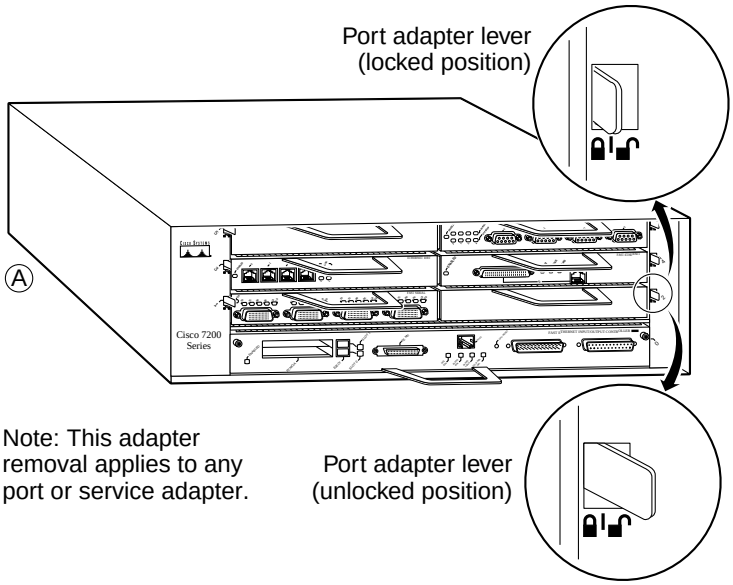
Carefully slide the new port adapter halfway into the port adapter slot. (See B.)

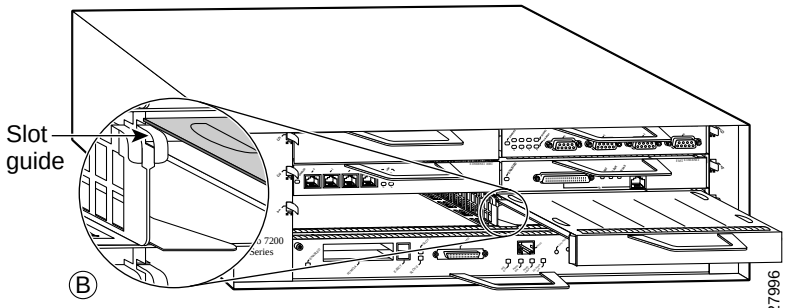
Step 6

With the port adapter halfway into the slot, connect all required cables to the port adapter. After connecting all required cables, carefully slide the port adapter all the way into the slot until the port adapter is seated in the router midplane.

Step 7

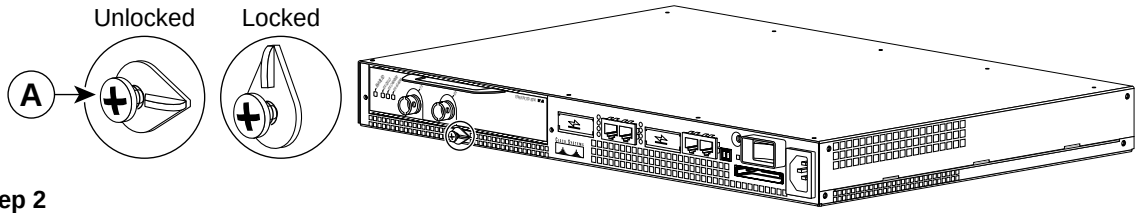
After the port adapter is properly seated, lock the port adapter lever. (See A.)





Cisco 7401ASR Router—Removing and Installing a Port Adapter

Step 1
To remove the port adapter, use a number 2 Phillips screwdriver to loosen the screw on the port adapter latch. Rotate the port adapter latch until it clears the faceplate of the port adapter. (See A.) The latch can rotate 360˚.

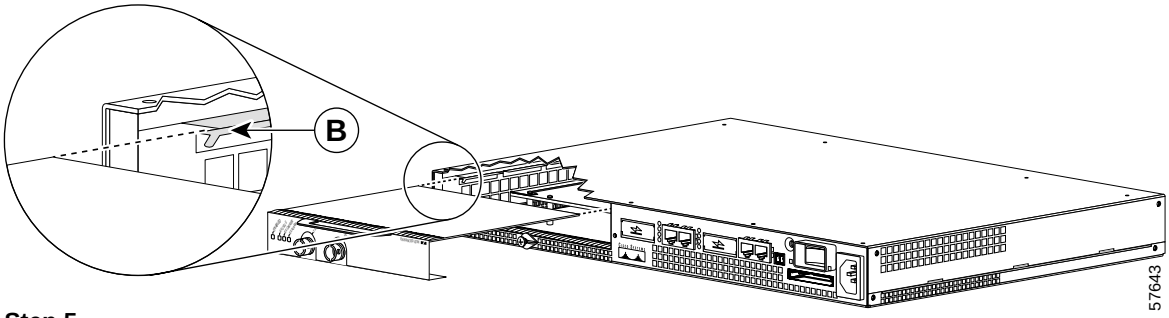


Step 2
Pull the port adapter from the router, about halfway out of its slot. (If you remove a blank port adapter, keep the blank port adapter for use in the router if you should ever remove the port adapter. The port adapter slot must always be filled.)

Step 3
With the port adapter halfway out of the slot, disconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter completely out of the chassis slot.

Step 4
To insert the port adapter, locate the port adapter slot guides inside the Cisco 7401ASR router. They are near the top, and are recessed about 1/2 inch. (See B.)

Caution
The port adapter must slide into the slot guides under the chassis lid. Do not allow the port adapter components to come in contact with the system board, or the port adapter could be damaged.



Step 5
Insert the port adapter in the slot guides halfway, and then reconnect the port adapter cables.

Step 6
After the cables are connected, carefully slide the port adpater all the way into the slot until the port adapter is seated in the router midplane. When installed, the port adapter input/output panel should be flush with the face of the router.

Step 7
After the port adapter is properly seated, rotate the port adapter latch to the upright locked position and use a number 2 Phillips screwdriver to tighten the latch screw. If needed, loosen the latch screw to rotate the latch over the port adapter. Finish the installation by tightening the latch screw.

SFP Removal and Installation

A small form-factor pluggable (SFP) module plugs into the FC port on the PA-FC-1G. A fibre-optic cable connects the PA-FC-1G through the SFP to a fibre channel switch.

The SFP ships installed in the PA-FC-1G and supports online insertion and removal (OIR).

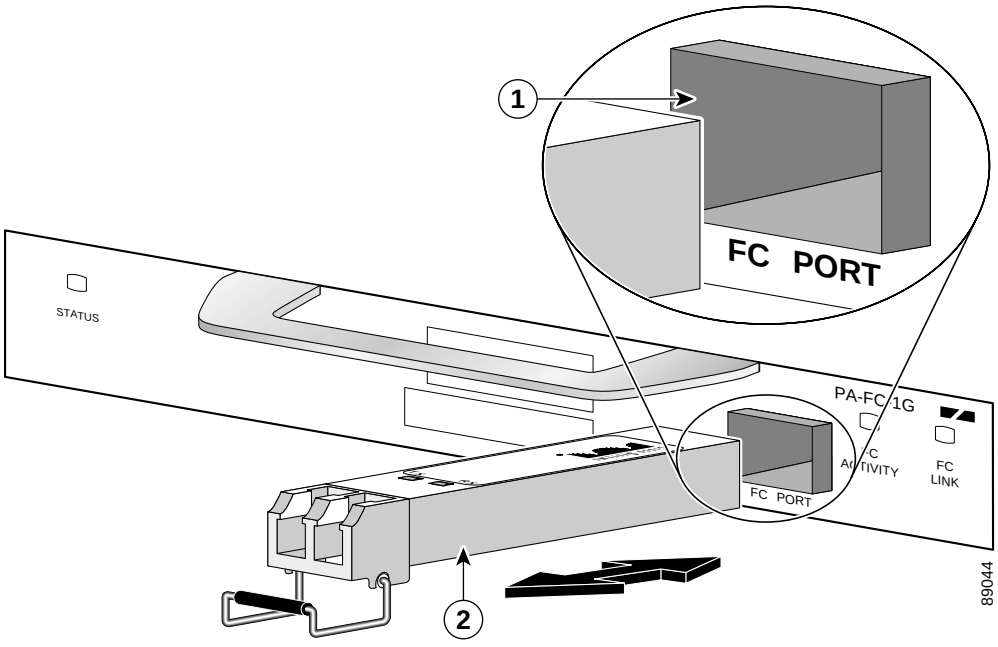
Warning **Because invisible laser radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to laser radiation and do not stare into open apertures.**

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.**

Figure 3-2 Removing and Installing an SFP



1	FC Port	**2**	SFP

To replace an SFP, do the following:

Step 1 To remove an SFP, disconnect the fibre optic cable from the SFP.

Step 2 Pull the swing latch outward. This releases the SFP from the PA-FC-1G and allows you to remove the SFP.

Step 3 To install an SFP, turn the SFP so the latch is on the bottom, as shown in Figure 3-2. The SFP is keyed so that it cannot be inserted incorrectly.

Step 4 Push the SFP in the FC Port of the PA-FC-1G. Lift the swing latch up and over the top of the SFP. The SFP snaps into place when you have completely and properly inserted it.

Step 5 Attach the fibre optic cable to the SFP.

Configuring the PA-FC-1G

To continue your port adapter installation, you must configure the fibre channel interface. The instructions that follow apply to all supported platforms.

This chapter contains the following sections:

- Using the EXEC Command Interpreter, page 4-1
- Configuring the Interfaces, page 4-2
- Closing or Removing a TCP Tunnel, page 4-11
- Checking the Configuration, page 4-13
- Troubleshooting, page 4-21

Using the EXEC Command Interpreter

You modify the configuration of your router through the software command interpreter called the EXEC (also called enable mode). You must enter the privileged level of the EXEC command interpreter with the **enable** command before you can use the **configure** command to configure a new interface or change the existing configuration of an interface. The system prompts you for a password if one has been set.

The system prompt for the privileged level ends with a pound sign (#) instead of an angle bracket (>). At the console terminal, use the following procedure to enter the privileged level:

Step 1 At the user-level EXEC prompt, enter the **enable** command. The EXEC prompts you for a privileged-level password as follows:

```
Router> enable

Password:
```

Step 2 Enter the password (the password is case sensitive). For security purposes, the password is not displayed.

When you enter the correct password, the system displays the privileged-level system prompt (#):

```
Router#
```

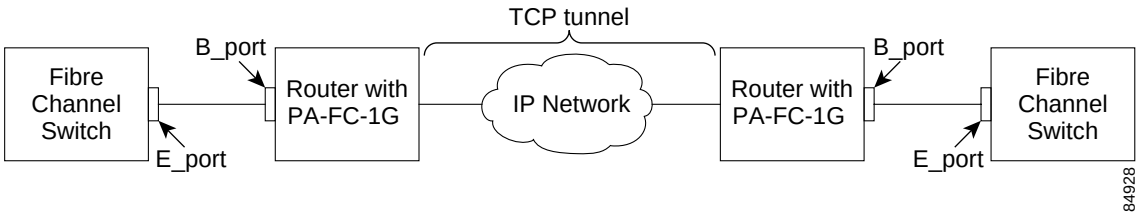
To configure the new fibre channel interface, proceed to the "Configuring the Interfaces" section on page 4-2.

Configuring the Interfaces

Because a PA-FC-1G interface is one of many components in a fibre channel fabric, configuring a PA-FC-1G requires more than assigning an IP address to the PA-FC-1G. Figure 4-1 indicates the logical connections among the main components in a fibre channel fabric. (For the purposes of this section, only the fibre channel switch component of the fibre channel SAN is shown.)

Figure 4-1 shows the TCP tunnel that connects routers in a fibre channel over IP configuration. It also shows the B_port to E_port fibre channel connection between the routers and fibre channel switches.

Figure 4-1 Fibre Channel Fabric Logical Connections



To configure a PA-FC-1G, you must complete a series of tasks in a particular order. The following tasks are presented in the order in which you perform them:

- Connecting a PA-FC-1G to a Fibre Channel Switch, page 4-2
- Enabling a PA-FC-1G, page 4-3
- Setting Fibre Channel Fabric Timeout Values, page 4-5
- Creating and Configuring a TCP Tunnel, page 4-5
- Verifying TCP Tunnel Connectivity, page 4-7
- Verifying PA-FC-1G to Fibre Channel Switch Connectivity, page 4-10
- Verifying End-to-End Fabric Connectivity, page 4-11

Connecting a PA-FC-1G to a Fibre Channel Switch

The first task in configuring a PA-FC-1G is to establish a physical connection between the PA-FC-1G and the fibre channel switch that connects the PA-FC-1G to a fibre channel SAN. Perform this task for *each* PA-FC-1G in the fibre channel fabric.

To connect a PA-FC-1G to a fibre channel switch, do the following:

Step 1 Verify that the Status LED on the front of the PA-FC-1G is on. This indicates the PA-FC-1G is installed correctly.

Step 2 Using a fibre optic cable with an LC connector, connect the PA-FC-1G to the fibre channel switch by inserting one end of the cable into the SFP of the PA-FC-1G and inserting the other end of the cable into a port on the switch. (If the fibre channel switch has a GBIC module, use an LC-to-SC fibre optic cable.)

Enabling a PA-FC-1G

After verifying a physical connection between a PA-FC-1G and a fibre channel switch, you must assign an IP address to the PA-FC-1G and then enable it. Perform this task for *each* PA-FC-1G in the fibre channel fabric.

To enable a PA-FC-1G, do the following:

Step 1 Enter the privileged level of the EXEC command interpreter (also called enable mode). (See the "Using the EXEC Command Interpreter" section on page 4-1 for instructions.)

Step 2 At the privileged-level prompt, enter configuration mode and specify that the console terminal is the source of the configuration commands.

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

Step 3 Specify the interface to be enabled using the **interface** command followed by the interface type and address. The address consists of the slot number of the router and the port number on the PA-FC-1G. (Because the PA-FC-1G has only one port, the port number is always 0.)

```
Router(config)# interface fcpa 2/0
Router(config-if)#
```

Step 4 You are now in interface configuration mode. Assign an IP address and subnet mask to the PA-FC-1G using the **ip address** command.

```
Router(config-if)# ip address 10.1.1.1 255.255.255.0
```

Step 5 Enable the PA-FC-1G using the **no shutdown** command.

```
Router(config-if)# no shutdown
```

Step 6 Exit interface configuration mode and then configuration mode by pressing **Ctrl-Z**—hold down the **Control** key while you press **Z**—or entering **end** or **exit** to return to the EXEC command interpreter.

```
Router(config-if)# exit
Router(config)# exit
Router#
```

Step 7 Write the new configuration to NVRAM.

```
Router# copy running-config startup-config
[OK]
Router#
```

The system displays an OK message when the configuration has been stored in NVRAM.

Step 8 Verify that the PA-FC-1G and line protocol are up using the **show interfaces** command followed by the interface type and address.

```
Router# show interfaces fcpa 2/0
Fcpa2/0 is up, line protocol is up
Hardware is FC over TCP/IP
```

Default Configuration Values

When an interface is enabled (taken out of shutdown mode) with no additional arguments, the default interface configuration file parameters are operational. Table 4-1 shows PA-FC-1G default configuration values. The default maximum transmission unit (MTU) is the maximum MTU allowed. Decreasing the MTU is not recommended because it will decrease throughput. IP fragmentation is not supported.

Table 4-1 PA-FC-1G Default Configuration Values

Parameter	Configuration Commands	Default Value
MTU	[**no**] **mtu** <*mtu*>	1500
IP MTU	[**no**] **ip mtu** <*ip-mtu*>	1500

Table 4-2 shows TCP tunnel default configuration values. IP TOS is used as part of the overall QoS design to prioritize traffic. For example, to give fibre channel over IP traffic a higher priority than web traffic, set the IP TOS for fibre channel over IP traffic to a number that is lower than the number assigned to IP TOS for web traffic. The lower the number, the higher the priority.

Table 4-2 TCP Tunnel Default Configuration Values

Parameter	Description	Configuration Commands	Default Value
IP TOS	Type of service for the IP layer of the TCP tunnel	[**no**] **ip tos** <*tos*>	0
TCP KAD	Keepalive timer for the TCP tunnel	[**no**] **tcp kad** <*kad*>	7200 seconds
TCP MWS	Maximum window size for the TCP tunnel	[**no**] **tcp mws** <*mws*>	32K

Maximum Window Size Recommendations

When you configure the TCP tunnel, you will need to customize the maximum window size (MWS) for the TCP connection based on the delay across the WAN connection. The larger the delay, the larger the window size needs to be.

If there is no delay across the WAN connection, set the MWS based on these guidelines:

- PA-FC-1G installed in an even-numbered slot: MWS of 32K or 64K
- PA-FC-1G installed in an odd-numbered slot: MWS of 32K
- Two PA-FC-1Gs installed in odd-numbered or even-numbered slots: MWS of 32K

If there is delay across the WAN connection, use an MWS appropriate for the delay. Performance is measured in megabytes per second. Table 4-3 shows that increasing the window size when the delay is large has a significant effect on performance.

Table 4-3 Maximum Window Size Recommendations Based on Delay

Delay (RTT)	32K MWS	64K MWS	128K MWS	256K MWS	512K MWS
2	19 MBps	40 MBps	—	—	—
4	11 MBps	24 MBps	50 MBps	—	—
10	5.5 MBps	11 MBps	22 MBps	46 MBps	—

Table 4-3 Maximum Window Size Recommendations Based on Delay (continued)

Delay (RTT)	32K MWS	64K MWS	128K MWS	256K MWS	512K MWS
20	2.9 MBps	6.0 MBps	11 MBps	24 MBps	48 MBps
50	1.2 MBps	2.4 MBps	5.0 MBps	10 MBps	20 MBps
100	—	1.2 MBps	2.5 MBps	5 MBps	10 MBps
200	—	—	1.2 MBps	2.5 MBps	5.1 MBps

Setting Fibre Channel Fabric Timeout Values

Timeout values are defined on each fibre channel switch in a fibre channel fabric. The default error detection (E_D_TOV) and resource allocation (R_A_TOV) timeout values are usually low. You might need to increase them; set the timeout values as appropriate for your SAN and applications.

Timeout values *must* be configured identically on each fibre channel switch in the fabric. While the TCP tunnel might come up if the timeout values on the switches are not configured identically, this is an exceptional case, and performance and reliability can suffer.

Failure to establish the TCP tunnel (due to mismatched timeout values or any other reason) means that the PA-FC-1G cannot communicate with any part of the fibre channel fabric.

Creating and Configuring a TCP Tunnel

After establishing a physical connection between each PA-FC-1G and a fibre channel switch and after enabling the PA-FC-1G, the next task is to create and configure a TCP tunnel between two PA-FC-1G interfaces. Creating a TCP tunnel establishes a fibre channel over IP connection between two routers.

Note A PA-FC-1G can support a maximum of one TCP tunnel.

To create and configure the TCP tunnel, do the following:

Step 1 At the privileged-level prompt, enter configuration mode and specify the interface to be configured using the **interface** command followed by the interface type and address (router slot/interface port).

```
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface fcpa 2/0
Router(config-if)#
```

Step 2 Create the TCP tunnel.

```
Router(config-if)# fc-tunnel abc
Router(config-if-fc-tunnel)#
```

Step 3 Specify the source and destination TCP tunnel IP addresses on each end of the TCP tunnel. The source TCP tunnel IP address must be a host address on the same subnet as the PA-FC-1G. The source and destination IP addresses on one end of the TCP tunnel must match the destination and source IP addresses on the other end of the TCP tunnel, respectively.

On one end of the tunnel:

```
Router(config-if-fc-tunnel)# srp-ip 10.1.1.2
Router(config-if-fc-tunnel)# dest-ip 10.2.2.2
```

On the other end of the tunnel:

```
Router(config-if-fc-tunnel)# srp-ip 10.2.2.2
Router(config-if-fc-tunnel)# dest-ip 10.1.1.2
```

Step 4 Specify the source and destination TCP tunnel ports on each end of the tunnel. The source and destination ports on one end of the TCP tunnel must match the destination and source ports on the other end of the TCP tunnel, respectively.

On one end of the tunnel:

```
Router(config-if-fc-tunnel)# src-port 2000
Router(config-if-fc-tunnel)# dest-port 3000
```

On the other end of the tunnel:

```
Router(config-if-fc-tunnel)# src-port 3000
Router(config-if-fc-tunnel)# dest-port 2000
```

Step 5 Customize the maximum window size for the TCP tunnel based on the delay across the WAN connection using the **tcp mws** command. Do this on both ends of the TCP tunnel. See the "Maximum Window Size Recommendations" section on page 4-4.

Step 6 If required for your TCP tunnel, change the type of service, or keepalive timer using the **ip tos** and **tcp kad** commands, respectively. Do this on both ends of the TCP tunnel.

Step 7 Activate the TCP tunnel using the **inservice** command.

```
Router(config-if-fc-tunnel)# inservice
```

Step 8 Exit tunnel configuration mode, interface configuration mode, and configuration mode by pressing **Ctrl-Z**—hold down the **Control** key while you press **Z**—or entering **end** or **exit** to return to the EXEC command interpreter.

```
Router(config-if-fc-tunnel)# exit
Router(config-if)# exit
Router(config)# exit
Router#
```

Step 9 Write the new configuration to NVRAM as follows:

```
Router# copy running-config startup-config
[OK]
Router#
```

Changing the TCP Tunnel Configuration

If you need to tune or modify the TCP tunnel configuration after the TCP tunnel is established, you must first take the TCP tunnel out of service using the **no inservice** command. The following example shows how to change the IP TOS value from 0 to 1 for an established tunnel.

```
Router(config-if)# fc-tunnel abc
Router(config-if-fc-tunnel)# no inservice
Router(config-if-fc-tunnel)# ip tos 1
Router(config-if-fc-tunnel)# inservice
```

Configuring for Multiple SANs

Two fibre channel SANs can be connected by establishing a TCP tunnel between two PA-FC-1G interfaces, each residing in a separate router. Additional PA-FC-1G interfaces can be installed in each router and multiple TCP tunnels can be configured, thus allowing multiple fibre channel SANs to be interconnected.

However, additional TCP tunnels must be defined using different PA-FC-1G port adapters, different IP addresses on different subnets, different source and destination TCP tunnel IP addresses, and different source and destination TCP tunnel ports.

Verifying TCP Tunnel Connectivity

Verifying TCP tunnel connectivity requires checking that the TCP tunnel is correctly configured and verifying that the TCP tunnel is working properly. To verify TCP tunnel connectivity, proceed with the following tasks:

- Checking TCP Tunnel Configuration, page 4-7
- Checking the TCP Tunnel Is Working Properly, page 4-9

Checking TCP Tunnel Configuration

Check the TCP tunnel configuration using the **show fc-tunnel** command. Verify that the values shown are those you defined. Make sure that the TCP tunnel is in service, the ARP entry is installed, the SM (session manager) state is up, and the FC Link is up.

ARP entry values	
Variable	**Description**
Installed	ARP entry is installed.
Not installed	ARP entry is not installed.
Not installed (admin state DOWN)	ARP entry is not installed and the PA-FC-1G is administratively down.
Not installed (protocol state DOWN)	ARP entry is not installed and the line protocol is down.
Waiting for adjacency update	Forwarding table has not yet been updated. (When the PA-FC-1G is administratively down or the line protocol is down, the IP adjacencies for the PA-FC-1G are removed.)

SM state values	
Variable	**Description**
SM_UP_ST	TCP connection is established and the B_port is up.
SM_NULL_ST	TCP tunnel is not in service, the PA-FC-1G is shut, or the line protocol is down.
SM_TCP_OPEN_PENDING_ST	TCP is attempting to connect to the peer.
SM_CONN_RETRY_WAIT_ST	TCP will try again to connect to the peer after 3 seconds.
SM_FC_INIT_PENDING_ST	TCP connection is established and the PA-FC-1G is being initialized.
SM_NS_UNLOCK_PENDING_ST	TCP connection is closed and the hardware connection entry is being cleared.
SM_FC_CLOSE_PENDING_ST	TCP connection is closed, the hardware connection entry is removed, and the PA-FC-1G is being put into an offline state.

```
Router# show fc-tunnel
Interface: Fcpa2/0
FC Tunnel name: abc
INSERVICE: configured ARP entry: Installed
Source IP: 10.1.1.2
Destination IP: 10.2.2.2
Source port: 2000
Destination port: 3000
TCP SACK option set
TCP MWS: 32KB
TCP KAD: 7200sec
IP TOS: 0
MTU: 1500
MSS: 1440
SM state: SM_UP_ST
FC Port Type: B_Port
FC Port WWN    : 100000E0B0FFF2CF
Switch Port WWN: 200000C0DD00C248
Switch WWN     : 100000C0DD00C248
FC BB_Credit: 128
FC RA_TOV: 120000msec
FC ED_TOV: 60000msec
FC Link state: UP
```

Checking the TCP Tunnel Is Working Properly

Check that the TCP tunnel is established using the **show fc-tunnel tcpconn** command. Make sure that t_state is indicated as TCPS_ESTABLISHED. (With the exception of t_state, the output of this command is for debugging purposes only.)

t_state values	
Variable	**Description**
TCPS_ESTABLISHED	TCP connection is established.
TCPS_CLOSED	TCP connection is closed.
TCPS_SYN_SENT	TCP connection has been initiated and a SYN has been sent.
TCPS_SYN_RECEIVED	TCP connection has been initiated, a SYN has been sent, and a SYN has been received by the peer.

```
Router# show fc-tunnel tcpconn
Interface:Fcpa2/0
TCP variables for Connection Fcpa4/0:
=====================================
snd_una: 831125, snd_nxt: 831125, snd_up: 813868, snd_wnd: 65535
snd_max: 863892, snd_cwnd: 65535, snd_retx_max: 831125, snd_ssthresh: 2176
t_unack_datasz: 0, t_flags: 612, t_state: TCPS_ESTABLISHED,
rcv_wnd: 32767, rcv_nxt: 888667, rcv_adv: 921434
 TCP Timers: REXMT=0 PERSIST=0 KEEP=7159 2MSL=0
```

Check the TCP tunnel TCP statistics for errors using the **show fc-tunnel tcp-statistics** command.

Router# **show fc-tunnel tcp-statistics**	**Description**
Interface:Fcpa2/0	
Rto Min = 500	Minimum TCP retransmission timeout in msecs
Rto Max = 60000	Maximum TCP retransmission timeout in msecs
Max Conn = 1	TCP connections PA-FC-1G can support
Active Opens = 1	TCP connections initiated
Attempt Fails = 0	TCP connections failed to initiate
Estab Resets = 1	TCP connections closed due to Reset
Curr Estab = 1	TCP connections established up to now
Out Rsts = 1	TCP Resets sent by PA-FC-1G
In Segs = 2	Segments received, including in error
Out Segs = 15324	Segments sent, excluding retransmissions
Retrans Segs = 0	Segments retransmitted
In Errs = 0	Segments received in error

Check the TCP tunnel fibre channel statistics for errors using the **show fc-tunnel fc-statistics** command.

Router# **show fc-tunnel fc-statistics**	**Description**
Interface:Fcpa2/0	
Link failure events = 0	Port link failures
Sync loss events = 1	Word Sync loss occurrences
Signal loss events = 0	Signal loss occurrences
Pseq error events = 0	Primitive error sequence occurrences
Rx inv words = 2	Invalid transmission words
rx crc error frames = 0	Fibre channel frames received with CRC errors
Delim error frames = 0	Fibre channel frames received with invalid EOF/length
Rx class2 frames = 0	Fibre channel class 2 frames received
Rx class2 octets = 0	Fibre channel class 2 bytes received
Rx class3 frames = 0	Fibre channel class 3 frames received
Rx class3 octets = 0	Fibre channel class 3 bytes received
Rx class2 frames = 0	Fibre channel class 2 frames sent
Rx class2 octets = 0	Fibre channel class 2 bytes sent
Rx class3 frames = 0	Fibre channel class 3 frames sent
Rx class3 octets =	Fibre channel class 3 bytes sent

Verifying PA-FC-1G to Fibre Channel Switch Connectivity

Check the connectivity between each PA-FC-1G and the fibre channel switch by using the **show fc-tunnel detail** command. Make sure that elp_completed is indicated as 1. This means that an exchange link parameter has been received by the router from the fibre channel switch and that the B_port on the router has been successfully initialized.

Note that in addition to the information shown in the **show fc-tunnel** command output, the **show fc-tunnel detail** command output indicates a reason why the connection between the PA-FC-1G and the fibre channel switch was closed (Last close reason) and port information.

Last close reason values

Variable	Description
REASON_CLI_CLOSED	**no inservice** command was issued by the user.
REASON_CLI_RESET	**no fc-tunnel** command was issued by the user.
REASON_PEER_CLOSED	Connection was closed by the peer.
REASON_TCP_CLOSED	Connection was closed by TCP because an error was detected.
REASON_ICMP_UNFRAG_CLOSED	Connection was closed because an ICMP unreachable packet was received with UNFRAG code.
REASON_NS_TCP_RESET	Connection was closed by hardware TCP because of multiple retransmissions.
REASON_FC_ERROR	Connection was closed because of a fibre channel protocol error.
REASON_IF_SHUT	Connection was closed because the PA-FC-1G was shut.
REASON_LINE_PROTOCOL_DOWN	Connection was closed because the line protocol is down.
REASON_CLEAR_INTERFACE_ISSUED	**clear interface** command issued by the user.
REASON_CARD_REMOVED	PA-FC-1G was removed from the router.

Router# **show fc-tunnel detail**	**Description**
Interface: Fcpa2/0	
FC Tunnel name: abc	
INSERVICE: configured ARP entry: Installed	TCP tunnel is in service, ARP entry is installed
Source IP: 10.1.1.2	Source IP address
Destination IP: 10.2.2.2	Destination IP address
Source port: 2000	Source port
Destination port: 3000	Destination port
TCP SACK option set	Selective acknowledgement set
TCP MWS: 32KB	Maximum window size
TCP KAD: 7200sec	Keepalive timer
IP TOS: 0	Type of service
MTU: 1500	Maximum transmission unit
MSS: 1440	
SM state: SM_UP_ST	TCP connection and B_port are up
FC Port Type: B_Port	Fibre channel port on the PA-FC-1G is a B_port
FC Port WWN : 100000E0B0FFF2CF	World wide name of the B_port on the PA-FC-1G
Switch Port WWN: 200000C0DD00C248	World wide name of the E_port on the fibre channel switch
Switch WWN : 100000C0DD00C248	World wide name of the fibre channel switch
FC BB_Credit: 128	Buffer-to-buffer credits of the PA-FC-1G
FC RA_TOV: 120000msec	Resource allocation timeout value (ELP)
FC ED_TOV: 60000msec	Error detection timeout value (from ELP)
FC Link state: UP	B_port is up
Last close reason: REASON_IF_SHUT	Last reason why connection between PA-FC-1G and fibre channel switch was closed
========== port info ==========	
port_type: B	Fibre channel port on the PA-FC-1G is a B_por
FC Link: UP	B_port is up
Negotiation: Forced	1 Gbps speed forced on the switch E_port
link_status: 0x00000081	Fibre channel link status from hardware (active)
op_state: 0x00000008	Fibre channel port status from software (link reset complete)
elp_completed: 1	Exchange link parameter received from the fibre channel switch
CPU credits: 29 (remaining off of 32)	Credits remaining for packets from the CPU to NS TCP
ELS ECHO: Enabled	B_port to B_port TCP keepalive
no_of_tcp_ssn: 1	
sm_prt_op: 0x82DB	History of fibre channel events
Our BB_CRDT: 128	Buffer-to-buffer credits of the PA-FC-1G
Our RA_TOV: 20000	Resource allocation timeout value (same as in ELP)
Our ED_TOV: 10000	Error detection timeout value (same as in ELP)
Peer BB_crdt: 27	Fibre channel switch E_port buffer-to-buffer credits
Peer RA_TOV: 20000	Fibre channel switch E_port resource allocation timeout value
Peer ED_TOV: 10000	Fibre channel switch E_port error detection timeout value

Verifying End-to-End Fabric Connectivity

Check that the fibre channel fabric is complete by making sure any fibre channel switch can see all other switches in the fibre channel fabric. On most fibre channel switches, this can be done using a type of **show** command. For example, on the Cisco SN 5428, use the **show fcswitch fabric brief** command. On an MDS 9000 fibre channel switch, use the **show fspf database** and **show fcdomain** commands.

Closing or Removing a TCP Tunnel

Table 4-4 summarizes the commands you can use to close or remove a TCP tunnel.

Table 4-4 Commands for Closing or Removing a TCP Tunnel

Command	Closes a TCP Tunnel	Removes a TCP Tunnel	Shuts the PA-FC-1G Interface	Resets the PA-FC-1G Interface
clear interface fcpa <*slot/port*>	Closes the tunnel; opens a new tunnel.	no	Shuts the interface; brings up the interface	yes
no fc-tunnel	yes	yes	no	no
no inservice	yes	no	no	no
shut	yes	no	yes	yes

Command examples are based on the following configuration for a TCP tunnel called abc:

```
Router# show runn int fcpa 2/0
Building configuration...
Current configuration : 262 bytes
!
interface Fcpa2/0
mtu 1500
ip address 10.1.1.1 255.255.255.0
no ip route-cache
no ip mroute-cache
fc-tunnel abc
src-ip 10.1.1.2
dest-ip 10.2.2.2
src-port 2000
dest-port 3000
tcp sack
tcp mws 32
tcp kad 7200
ip tos 0
inservice
end
Router#

Router# config t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# int fcpa 1/0
Router(config-if)# no fc-tunnel
Router#

Router(config-if)# fc-tunnel abc
Router(config-if-fc-tunnel)# no inservice
Router#

Router(config)# int fcpa 1/0
Router(config-if)# shut

Router# clear interface fcpa 1/0
Router#
```

Checking the Configuration

After configuring the new interface, use **show** commands to display the status of the new interface or all interfaces, and use the **ping** command to check connectivity. This section includes the following subsections:

- Using show Commands to Verify the New Interface Status, page 4-13
- Using the ping Command to Verify Network Connectivity, page 4-20

Using show Commands to Verify the New Interface Status

This section demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the port adapter appears in them correctly. Sample displays of the output of selected **show** commands appear in the sections that follow. For complete command descriptions and examples, refer to the publications listed in the "Related Documentation" section on page viii.

If an interface is shut down and you configured it as up, or if the displays indicate that the hardware is not functioning properly, ensure that the interface is properly connected and terminated. If you still have problems bringing up the interface, contact a service representative for assistance. This section includes the following subsections:

- Using the show controllers Commands, page 4-13
- Using the show protocols Command, page 4-15
- Using the show running-config Command, page 4-15
- Using the show startup-config Command, page 4-16
- Using the show version or show hardware Commands, page 4-18
- Using the show diag Command, page 4-19
- Using the show interfaces Command, page 4-19

Using the show controllers Commands

Display all the current interface processors and their interfaces using the **show controllers** command.

Note The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.:

The following is an example of the **show controllers** command:

```
Router# show controllers fcpa 3/0
Interface Fcpa3/0
Hardware is Fiber Channel over TCP
NS idb=0x62DF785C ds=0x62DF9904
Counters Info :
Cordova o/p pkts = 0, bytes = 0
Cordova i/p pkts = 0, bytes = 0
Northstar Tx fc pkts = 0, bytes = 0
Northstar Rx punted pkts = 0, bytes = 0
Base Addresses :
NS PCI=0x3D800000, NS Register=0x3D800C00,
```

```
Rx Desc=0x07166C80, Rx Stat=0x07167B80,
Tx Desc=0x07167840, Tx Stat=0x071F9940
Rx ring :
Current Index=0, Desc Avail=32, Stat Index=0
Tx ring :
Current Index=0, Desc Avail=32, Stat Index=0
Counters :
Rx int count=0, Tx int count=0,No buffer errors=0,
NS fatal errors=0, Tx completion errors=0
NS Rx status full=0, NS Tx status full=0
Int mask=0xFFFE787F, Int status=0x10000000,
Line protocol is UP
TCB index: 0
SDRAM 0 Layout :
Pkt memory start address=0x00000100, Pkt memory end address=0x010000FF,
Buf table start address=0x01000100, Buf table end address=0x010400F8,
TCB start address=0x01040100, TCB end address=0x01040300,
ROB start address=0x01040300, Pback start address=0x01040700,
Pprobe start address=0x01040800, PendQ start address=0x01040880,
PendQ end address=0x0105CFC0
SDRAM 1 Layout :
Pkt memory start address=0x00000100, Pkt memory end address=0x010000FF,
Buf table start address=0x01000100, Buf table end address=0x010400F8
Hardware is i82544 (Cordova) A2
network link is up
Config is 1000MB, Full Duplex
loopback type is none
10/100/1000 PHY is NOT enabled
i82543 MAC registers:
CTRL =0x183C1A41, STATUS=0x0000C383, CTRL_X=0x000040D0, IMS =0x00000092
RCTL =0x00428022, RDBAL =0x07700000, RDBAH =0x00000000, RDLEN =0x00004000
RDH =0x00000000, RDT =0x000003FF, RDTR =0x00000000
TCTL =0x000400FA, TDBAL =0x07705000, TDBAH =0x00000000, TDLEN =0x00004000
TDH =0x00000000, TDT =0x00000000, TIPG =0x00602008
ETT =0x00000000, TXDMAC=0x00000001
TXCW =0x00000000, RXCW =0x0C000000, FCRTH =0x0000AFF0, FCRTL =0x80001200
FCAH =0x00000100, FCAL =0x00C28001, FCT =0x00008808, FCTTV =0x00000080
RDFH =0x00000000, RDFT =0x00000000, RDFPC =0x00000000
TDFH =0x00001800, TDFT =0x00001800, TDFPC =0x00000000
RX is normal, enabled TX is normal, enabled
Device status = full-duplex, link up
Device Speed = 1000Mbps
PHY registers:
PHY is UNKNOWN (0x0)
Link is Unknown, Speed is Unknown, Duplex Mode is Unknown PCI
configuration registers:
bus_no=6, device_no=1
DeviceID=0x1008, VendorID=0x8086, Command=0x0156, Status=0x0230
Class=0x02/0x00/0x00, Revision=0x02, LatencyTimer=0xFC, CacheLineSize=0x10
BaseAddr0=0x49400004, BaseAddr1=0x00000000, MaxLat=0x00, MinGnt=0xFF
SubsysDeviceID=0x1008, SubsysVendorID=0x8086
Cap_Ptr=0x000000DC Retry/TRDY Timeout=0x00000000
PMC=0x0022E401 PMCSR=0x00000000
i82543 Internal Driver Information:
lc_ip_turbo_fs=0x605CDC74, ip_routecache=0x11(dfs=0/mdfs=0)
i82543_ds=0x62F9D268, registers=0x3DC00000
rx cache size=1000, rx cache end=0, rx_nobuffer=0
max_mtu=1524
ring sizes: RX=1024, TX=1024
rxring=0x77700000, shadow=0x62F9D63C, head=0, rx_buf_size=512
txring=0x07705000, shadow=0x62F9E668, head=0, tail=0
chip_state=2, pci_rev=2
tx_count=0, tx_limited=0 (1024)
rx_overrun=0, rx_seq=0, rx_no_enp=0, rx_discard=0
```

```
throttled=0, enabled=0, disabled=0, bypassed=0
reset=2(init=1, check=0, restart=1, pci=0), auto_restart=2
link_reset=0, tx_carrier_loss=0, fatal_tx_err=0
isl_err=0, wait_for_last_tdt=0, rx_stuck=0
tx_stuck=0, rx_max_spin=1
HW addr filter: 0x62DF9E80, ISL disabled, Promiscuous mode disabled
Entry= 0: Addr=000A.8B63.2C06
(All other entries are empty)
i82543 Statistics
CRC error 0 Symbol error 0
Missed Packets 0 Single Collision 0
Excessive Coll 0 Multiple Coll 0
Late Coll 0 Collision 0
Defer 0 Receive Length 0
Sequence Error 0 XON RX 0
XON TX 0 XOFF RX 0
XOFF TX 0 FC RX Unsupport 0
Packet RX (64) 0 Packet RX (127) 0
Packet RX (255) 0 Packet RX (511) 0
Packet RX (1023) 0 Packet RX (1522) 0
Good Packet RX 0 Broadcast RX 0
Multicast RX 0 Good Packet TX 0
Good Octets RX.H 0 Good Octets RX.L 0
Good Octets TX.H 0 Good Octets TX.L 0
RX No Buff 0 RX Undersize 0
RX Fragment 0 RX Oversize 0
RX Octets High 0 RX Octets Low 0
TX Octets High 0 TX Octets Low 0
TX Packet 0 RX Packet 0
TX Broadcast 0 TX Multicast 0
Packet TX (64) 0 Packet TX (127) 0
Packet TX (255) 0 Packet TX (511) 0
Packet TX (1023) 0 Packet TX (1522) 0
TX Underruns 0 TX No CSR 0
RX Error Count 0 RX DMA Underruns 0
RX Carrier Ext 0
TCP Segmentation 0 TCP Seg Failed 0
Router#
```

Using the show protocols Command

Display protocols configured for the entire system and for specific interfaces using the **show protocols** command.

Note The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

The following is an example of the **show protocols** command:

```
Router# show protocols fcpa 6/0
Fcpa6/0 is up, line protocol is up
Internet address is 10.1.1.1/24
Router#
```

Using the show running-config Command

Display the running configuration file using the **show running-config** command.

Note The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

The following is an example of the **show running-config** command for the PA-FC-1G in slot 2:

```
Router# show running-config interface fcpa 2/0

interface fcpa2/0
 ip address 10.1.1.1 255.255.255.0
 fc-tunnel abc
   src-ip 10.1.1.2
   dest-ip 10.2.2.2
   src-port 2000
   dest-port 3000
   tcp sack
   tcp mws 64
   tcp kad 7200
   ip tos 0
   no inservice
```

Using the show startup-config Command

Display the configuration stored in the NVRAM using the **show startup-config** command.

Note The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

The following is an example of the **show startup-config** command:

```
Router# show startup-config
Current configuration : 1090 bytes
!
version 12.2
no parser cache
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname hw-5.14-7401asr-a
!
boot system disk0:c7400-js-mz.ggnear
!
ip subnet-zero
!
!
no ip domain lookup
!
ip cef
mpls ldp log-neighbor-changes
!
!
!
!
!
!
!
!
```

```
!
no voice hpi capture buffer
no voice hpi capture destination
!
!
!
!
!
!
interface GigabitEthernet0/0
 ip address 9.1.1.10 255.255.255.0
 duplex full
 speed 1000
 media-type gbic
 negotiation auto
!
interface GigabitEthernet0/1
 no ip address
 shutdown
 duplex full
 speed 1000
 media-type gbic
 negotiation auto
!
interface Fcpa1/0
ip address 10.1.1.1 255.255.255.0
 fc-tunnel GGPA
   src-ip 10.1.1.10
   dest-ip 10.2.1.11
   src-port 5200
   dest-port 2000
   tcp sack
   tcp mws 32
   tcp kad 7200
   ip tos 0
   inservice
!
ip classless
ip route 10.2.1.0 255.255.255.0 9.1.1.11
no ip http server
!
!
!
!
!
!
call rsvp-sync
!
!
mgcp profile default
!
dial-peer cor custom
!
!
!
!
gatekeeper
 shutdown
!
!
line con 0
 exec-timeout 0 0
line aux 0
line vty 0 4
```

```
 login
line vty 5 15
 login
!
!
end
```

Using the show version or show hardware Commands

Display the configuration of the system hardware, the number of each interface type installed, the Cisco IOS software version, the names and sources of configuration files, and the boot images using the **show version** (or **show hardware**) command.

Note The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Following is an example of the **show version** command from a Cisco 7401ASR router:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7400 Software (C7400-JS-M), Experimental Version 12.2(20021230:084514)
[BLD-ggnear.ios-nightly 103]
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Mon 30-Dec-02 03:31 by irvrel
Image text-base: 0x60008954, data-base: 0x61ED4000

ROM: System Bootstrap, Version 12.2(1r)DD1, RELEASE SOFTWARE (fc1)
BOOTLDR: 7400 Software (C7400-KBOOT-M), Version 12.2(4)B4, EARLY DEPLOYMENT RELEASE
SOFTWARE (fc1)

hw-5.14-7401asr-a uptime is 4 hours, 50 minutes
System returned to ROM by power-on
System image file is "disk0:c7400-js-mz.ggnear"

cisco 7401ASR (NSE) processor (revision A) with 491520K/32768K bytes of memory.
Processor board ID 0
R7000 CPU at 375Mhz, Implementation 39, Rev 3.3, 256KB L2, 2000KB L3 Cache
1 slot ASR midplane, Version 2.0

Last reset from power-on
Bridging software.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
TN3270 Emulation software.
PXF processor tmc is running.
5 Gigabit Ethernet/IEEE 802.3 interface(s)
1 Fiber Channel over IP interface(s)
509K bytes of non-volatile configuration memory.

125440K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x2102
Router#
```

Using the show diag Command

Display the types of port adapters installed in your system (and specific information about each) using the **show diag** *slot* command, where *slot* is the *port adapter slot*.

Note The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Following is an example of the **show diag** *slot* command that shows a PA-FC-1G in slot 1 of a Cisco 7401ASR router:

```
Router# show diag 1
Slot 1:
    FCIP Single Width Port adapter, 1 port
    Port adapter is analyzed
    Port adapter insertion time 2d17h ago
    EEPROM contents at hardware discovery:
    Hardware Revision : 1.2
    PCB Serial Number : JAB06490529
    Part Number : 73-8429-03
    Board Revision : A0
    RMA Test History : 00
    RMA Number : 0-0-0-0
    RMA History : 00
    Deviation Number : 0-0
    Product Number : PA-FC-1G
    Top Assy. Part Number : 800-22343-03
    Chassis MAC Address : 1122.2233.4455
    MAC Address block size : 1
    EEPROM format version 4
    EEPROM contents (hex):
    0x00: 04 FF 40 03 D6 41 01 02 C1 8B 4A 41 42 30 36 34
    0x10: 39 30 35 32 39 82 49 20 ED 03 42 41 30 03 00 81
    0x20: 00 00 00 00 04 00 80 00 00 00 00 CB 94 50 41 2D
    0x30: 46 43 2D 31 47 20 20 20 20 20 20 20 20 20 20 20
    0x40: 20 C0 46 03 20 00 57 47 03 C3 06 11 22 22 33 44
    0x50: 55 43 00 01 FF FF FF FF FF FF C4 82 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 interfaces Command

The **show interfaces** command displays status information (including the physical slot and interface address) for the interfaces you specify.

For complete descriptions of interface commands and the configuration options available for specific interfaces, refer to the publications listed in the "Related Documentation" section on page viii.

Note The outputs that appear in this document may not match the output you receive when running these commands. The outputs in this document are examples only.

Using the **show interfaces** *type port-adapter-slot-number/interface-port-number* command displays status information about a specific type of interface—in this example, a fibre channel interface—on a Cisco 7401ASR router.

Following is an example of the **show interfaces** command for a Cisco 7401ASR router. In this example, the PA-FC-1G is in slot 1.

```
Router# show interfaces fcpa 1/0
Fcpa1/0 is up, line protocol is up
Hardware is FC over TCP/IP
Internet address is 10.1.1.1/8
MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
reliability 255/255, txload 195/255, rxload 17/255
Encapsulation ARPA, loopback not set
Full-duplex, 1000Mb/s, media type is unknown 0
output flow-control is unsupported, input flow-control is unsupported
ARP type: ARPA, ARP Timeout 04:00:00
Last input never, output 00:00:02, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/233/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue :0/40 (size/max)
5 minute input rate 2122360000 bits/sec, 44192148 packets/sec
5 minute output rate 18200000 bits/sec, 20181 packets/sec
0 packets input, 0 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 233 ignored, 0 abort
0 watchdog, 0 multicast, 0 pause input
99 packets output, 5940 bytes, 0 underruns
0 output errors, 0 collisions, 13 interface resets
0 output buffer failures, 0 output buffers swapped out
Router#
```

Using the ping Command to Verify Network Connectivity

Using the **ping** command, you can verify that an interface port is functioning properly. This section provides a brief description of this command. Refer to the publications listed in the "Related Documentation" section on page viii for detailed command descriptions and examples.

The **ping** command sends echo request packets out to a remote device at an IP address that you specify. After sending an echo request, the system waits a specified time for the remote device to reply. Each echo reply is displayed as an exclamation point (!) on the console terminal; each request that is not returned before the specified timeout is displayed as a period (.). A series of exclamation points (!!!!!) indicates a good connection; a series of periods (.....) or the messages [timed out] or [failed] indicate a bad connection.

Following is an example of a successful **ping** command to a remote server with the address 10.0.0.10:

```
Router# ping 10.0.0.10 <Return>
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 10.0.0.10, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/15/64 ms
Router#
```

If the connection fails, verify that you have the correct IP address for the destination and that the device is active (powered on), and repeat the **ping** command.

Pinging the PA-FC-1G

After the PA-FC-1G is enabled using the **no shut** command, pinging the PA-FC-1G IP address should be successful. Pinging the TCP tunnel source and destination IP addresses is successful only after the TCP tunnel has been brought into service using the **inservice** command.

Note The TCP tunnel source IP address cannot be the source address of a **ping** command.

Note The TCP tunnel source and destination IP addresses cannot be reached using the **telnet** command.

Troubleshooting

This section describes troubleshooting the physical connectivity between the fibre channel switch and the PA-FC-1G. Possible problems, observations and comments, and solutions are indicated for the following troubleshooting symptoms:

- PA-FC-1G is down and the line protocol is down
- B_port is not initialized
- TCP tunnel is not established
- Fibre channel fabric is segmented
- Lower than expected performance

PA-FC-1G Is Down and the Line Protocol Is Down

Possible Problem	Observations and Comments	Solutions
Loss of physical connectivity or optical signal	FC Link LED is off or amber	Make sure the SFP is inserted properly in the fibre channel switch or the PA-FC-1G. Check for a faulty fibre channel cable by using a different fibre channel cable. Make sure the fibre channel cable is correctly connected to the fibre channel switch or the PA-FC-1G.
Speed mismatch between the fibre channel switch and the PA-FC-1G	PA-FC-1G currently supports 1 Gbps	Make sure the speed of the port on the fibre channel switch to which the PA-FC-1G is connected is manually set to 1 Gbps.
PA-FC-1G is administratively shut down		Use the **no shut** command to bring up the PA-FC-1G.

B_Port Is Not Initialized		
Possible Problem	**Observations and Comments**	**Solutions**
Exchange Link Parameter (ELP) is not being received from the connecting fibre channel switches	Output of the **show fc-tunnel detail** command	Enable fibre channel debug commands: **debug fcpa all errors** **debug fcpa fd events** **debug fcpa fcap events** **debug fcpa fcap extras** **debug fcpa fd states**

TCP Tunnel Is Not Established		
Possible Problem	**Observations and Comments**	**Solutions**
Configuration mismatch between the peers	Output of **show running-config interface** *slot/port* command	Make sure the TCP tunnel source IP address is in the same subnet as the PA-FC-1G IP address. Make sure the source and destination IP addresses and port numbers match the destination and source IP addresses and port numbers, respectively. Make sure the source and destination IP addresses and port numbers are unique on each peer.
No static ARP entry for either the PA-FC-1G IP address or the TCP tunnel source IP address	Output of **show arp** command	Make sure the port on the fibre channel switch to which the PA-FC-1G is connected, is enabled. Make sure the line protocol is up by verifying the fibre channel cable is connected at both ends. Use the **no shut** command to bring up the PA-FC-1G.
No IP connectivity between the two peers	Output of the **show ip route** command	Use the **ping** or **traceroute** commands to verify that the PA-FC-1G IP address and the TCP tunnel source and destination IP addresses are reachable.
Path MTU is lower than 850 bytes	Console messages Minimum supported MTU is 850 MTU less than 850 causes the TCP tunnel to be brought out of service	Use the **ip mtu** command to increase the path MTU. Then use the **inservice** command to put the TCP tunnel back in service.
Retransmissions and TCP-related errors	Output of **show fc-tunnel tcp-statistics** command Can be due to drops in the path between the peer routers	If pings to the remote TCP tunnel IP addresses are successful and the configuration is verified, use the **shut/no shut** commands or the **clear interface** command to reset the PA-FC-1G.
TCP tunnel connection toggling	Counters in the **show fc-tunnel tcp-statistics** command	Make sure fibre channel cables are firmly connected. Make sure the SFP is firmly seated in the PA-FC-1G. Make sure the maximum window size is adjusted for the delay across the WAN connection. Enable **debug fcpa fd events**, **debug fcpa fd states**.

Fibre Channel Fabric Is Segmented

Possible Problem	Observations and Comments	Solutions
Overlap in the domain IDs of the fibre channel switches	Fabric segmentation does not occur when you add a switch to a fabric with a conflicting domain ID. In this case, the existing switch assigns a new domain ID to the conflicting switch from its address space (if it is not statically configured).	Assign unique domain IDs to the fibre channel switches.

Lower Than Expected Performance

Possible Problem	Observations and Comments	Solutions
Path MTU is less than 1500 bytes		Use the **ip mtu** command to increase the path MTU.
Maximum window size is too small for the delay in the IP network		Use the **tcp mws** command to adjust the maximum window size.
Drops on the outgoing interface, which are causing retransmissions	Bursty traffic	Try a lower maximum window size.
Errors in the show **fc-tunnel tcp-statistics** and **show fc-tunnel fc-statistics** counters	Errors are increasing gradually.	Use the **shut/no shut** commands or the **clear interface** command to reset the PA-FC-1G.
Errors in the **show fc-tunnel gmac-statistics** counters. (Northstar Asic statistics)	CRC > 0	Call TAC to determine if the PA-FC-1G is faulty and needs to be replaced.
Drops in the network		Make sure all network devices in the fabric and the network as a whole are functional.

Debug Commands

There are many debug command options to review the status of the PA-FC-1G. The debug command has the format **debug fcpa** {module} {submodule}

- Module options
  - **all**: all modules
  - **cli**: command line interface — PA-FC-1G interface configuration commands
  - **cordova-driver**: Gigabit Ethernet driver that interfaces with PA-FC-1G GMAC
  - **fcap**: fibre channel application — module that maintains the B_port state machine
  - **fd**: fibre channel frame distributor module that provides services to fcap and checks TCP connection status periodically
  - **northstar-driver**: driver that interfaces with Northstar ASIC and provides services to fibre channel and TCP
  - **sm**: session manager, the module responsible for TCP connection, configuration, and timer management
  - **tcp**: TCP library
- Submodule options
  - **all**: all submodules
  - **errors**: errors that occurred in the selected module
  - **events**: specific events information in the selected module
  - **extra**: not generally required, quite verbose
  - **packets**: packets handled by the selected module
  - **states**: information for the fibre channel, session manager, and TCP states

Note Under heavy traffic, do not enable **debug fcpa cordova-driver packets**, **debug fcpa northstar-driver events**, or **debug fcpa northstar-driver extra**. These debug commands degrade performance and make the console unusable.