Inverse Multiplexing over ATM Port Adapter Installation and Configuration

Product Numbers: PA-A3-8T1 IMA=, PA-A3-8E1 IMA=
Platforms Supported: Cisco 7100 Series Routers, Cisco 7200 Series Routers, Cisco 7200 VXR Routers, Cisco 7201 Router, Cisco 7301 Router, Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 Router, Cisco 7401ASR Router, VIP in the Cisco 7500 Series, FlexWAN Module on Catalyst 6000 Family Switches and Cisco 7600 Series Routers

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Preface

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

- Document Revision History, page i
- Objectives, page i
- Organization, page ii
- Related Documentation, page ii
- Obtaining Documentation, Obtaining Support, and Security Guidelines, page v

Document Revision History

The Document Revision History table below, beginning with version OL-3462-04, records technical changes to this document.

Document Version	Date	Change Summary
OL-3462-04	March, 2010	Added table 4-7 in chapter Configuring the PA-A3-IMA.
OL-3462-04	April, 2007	Adds Cisco 7201 router information.

Objectives

This document describes how to install and configure the eight-port T1/E1 inverse multiplexing over ATM (IMA) port adapters (PA-A3-8T1 IMA and PA-A3-8E1 IMA), hereafter referred to as the PA-A3-IMA, which are used in the following platforms:

- FlexWAN module in the Catalyst 6000 family switches
- Cisco 7100 series routers, consisting of the Cisco 7120 series and Cisco 7140 series
- Cisco 7200 series routers and Cisco 7200 VXR routers, consisting of the two-slot Cisco 7202, four-slot Cisco 7204 and Cisco 7204VXR, and the six-slot Cisco 7206 and Cisco 7206VXR
- Cisco 7201 router
- Cisco 7301 router
- Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 router

- Cisco 7401ASR router

Note PA-A3-8E1 IMA is not supported on the Cisco 7401ASR router.

- Versatile Interface Processor (VIP2, VIP4, and VIP6-80) in Cisco 7500 series routers, consisting of the five-slot Cisco 7505, the seven-slot Cisco 7507, and the thirteen-slot Cisco 7513
- FlexWAN module in Cisco 7600 series routers

Organization

This document contains the following chapters:

Section	Title	Description
Chapter 1	Overview	Describes the PA-A3-IMA and its LED displays, cables, and receptacles.
Chapter 2	Preparing for Installation	Describes safety considerations, tools required, and procedures you should perform before the actual installation.
Chapter 3	Removing and Installing Port Adapters	Describes the procedures for installing and removing PA-A3-IMA port adapters in the supported platforms.
Chapter 4	Configuring the PA-A3-IMA	Provides instructions for configuring your port adapter on the supported platforms.

Related Documentation

Your router 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.

Note You can access Cisco IOS software configuration and hardware installation and maintenance documentation on the World Wide Web at http://www.cisco.com, http://www-china.cisco.com, or http://www-europe.cisco.com.

- Catalyst 6000 family switches with FlexWAN module:
  - For an online directory to quickly access documents for Cisco Catalyst 6000 family switches, refer to the *Cisco Catalyst 6500 Series Switches Documentation Roadmaps* index at the following URL:

    http://www.cisco.com/en/US/products/hw/switches/ps708/products_documentation_roadmaps_list.html
  - For hardware installation and maintenance information, refer to the following documents:
    - *Catalyst 6000 Family FlexWAN Module Installation and Configuration Note*
    - The hardware and software publications for your Catalyst 6000 family switch
- Cisco 7100 series routers:
  - For an online directory to quickly access documents for Cisco 7100 series routers, refer to the *Cisco 7100 Series Documentation* roadmap at the following URL:

    http://www.cisco.com/en/US/products/hw/vpndevc/ps333/products_product_index09186a00800fa142.html
  - For hardware installation and configuration information refer to the *Cisco 7100 Series VPN Router Installation and Configuration Guide*.
  - For information on setting up a Virtual Private Network, refer to the *Cisco 7100 Series VPN Configuration Guide*.
- Cisco 7200 series routers:
  - For an online directory to quickly access documents for Cisco 7200 series routers, refer to the *Cisco 7200 Series Routers Documentation Roadmap* at the following URL:

    http://www.cisco.com/en/US/products/hw/routers/ps341/products_documentation_roadmap09186a00801c0915.html
  - For hardware installation and configuration information (including the Cisco 7206 or Cisco 7206VXR as a router shelf in a Cisco AS5800 Universal Access Server), refer to the online installation and configuration guide and quick start for your Cisco 7200 series router.
  - For port adapter hardware and memory configuration guidelines, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines*.
  - For information on network processing engines or network services engines, refer to the *Network Processing Engine and Network Services Engine Installation and Configuration* document.
- Cisco 7200 VXR routers:
  - *Cisco 7200 Series Routers Documentation Roadmap* at the following URL:

    http://www.cisco.com/en/US/products/hw/routers/ps341/products_documentation_roadmap09186a00801c0915.html
  - For hardware installation and maintenance information, refer to the *Cisco 7200 VXR Installation and Configuration Guide* or the *Cisco 7200 VXR Routers Quick Start Guide*.

- Cisco 7201 router:
  - For an online directory to quickly access documents for the Cisco 7201 router, refer to the *Cisco 7201 Router Documentation Roadmap* at the following URL:

    http://www.cisco.com/en/US/customer/products/hw/routers/ps341/products_documentation_roadmap09186a00807f635a.html
  - For hardware installation and maintenance information, refer to the *Cisco 7201 Installation and Configuration Guide* or the *Cisco 7201 Router Quick Start Guide*.
- Cisco 7301 router:
  - For an online directory to quickly access documents for the Cisco 7301 router, refer to the *Cisco 7301 Internet Router Documentation Roadmap* at the following URL:

    http://www.cisco.com/en/US/products/hw/routers/ps352/products_documentation_roadmap09186a00801c0f21.html
  - For hardware installation and maintenance information, refer to the *Cisco 7301 Installation and Configuration Guide* or the *Cisco 7301 Router Quick Start Guide*.
- Cisco 7304 PCI port adapter carrier card in Cisco 7304 router:
  - For an online directory to quickly access documents for the Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7301 router, refer to the *Cisco 7304 Router Line Card, Carrier Card, Port Adapter, Modular Services Card, and Shared Port Adapter Documentation Roadmap* at the following URL:

    http://www.cisco.com/en/US/products/hw/routers/ps352/products_documentation_roadmap09186a00801c0f5e.html
  - For hardware installation and maintenance information, refer to the *Cisco 7304 PCI Port Adapter Carrier Card Installation and Configuration Guide*.
- Cisco 7401ASR router:
  - For an online directory to quickly access documents for the Cisco 7401ASR router, refer to the *Cisco 7401ASR Router Documentation Roadmap* at the following URL:

    http://www.cisco.com/en/US/products/hw/routers/ps354/products_documentation_roadmap09186a00801c0fd5.html
  - For hardware installation and maintenance information, refer to the *Cisco 7401ASR Installation and Configuration Guide* or the *Cisco 7401ASR Router Quick Start Guide.*
- Cisco 7500 series routers:
  - For an online directory to quickly access documents for the Cisco 7500 series routers, refer to the *Cisco 7500 Series Routers Documentation Roadmap* at the following URL:

    http://www.cisco.com/en/US/products/hw/routers/ps359/products_documentation_roadmap09186a00801c0f9b.html
  - For hardware installation and maintenance information, refer to the following documents:
    - *Cisco 7500 Series Installation and Configuration Guide* or the quick start for your Cisco 7500 series router.
    - *Second-Generation Versatile Interface Processor (VIP2) Installation and Configuration*
    - *Fourth-Generation Versatile Interface Processor (VIP4) Installation and Configuration*
    - *Versatile Interface Processor (VIP6-80) Installation and Configuration Guide*

- Cisco 7600 series routers with the FlexWAN module:
  - For an online directory to quickly access documents for the Cisco 7600 series routers, refer to the *Cisco 7600 Series Routers Documentation Roadmap* at the following URL:

    http://www.cisco.com/en/US/products/hw/routers/ps368/products_documentation_roadmap09186a00801ebed9.html
  - For hardware installation and maintenance information, refer to the online installation and configuration guide for your Cisco 7600 series router.
- For international agency compliance, safety, and statutory information for WAN interfaces, r, refer to the following documents. Use the documentation roadmap for your particular router to link to the appropriate documents for your router:
  - *Regulatory Compliance and Safety Information for the Catalyst 6000 Family Switches*
  - *Regulatory Compliance and Safety Information for the Cisco 7100 Series VPN Routers*
  - *Regulatory Compliance and Safety Information for the Cisco 7200 Series Routers*
  - *Regulatory Compliance and Safety Information for the Cisco 7301 Internet Router*
  - *Regulatory Compliance and Safety Information for the Cisco 7304 Internet Router*
  - *Regulatory Compliance and Safety Information for the Cisco 7401ASR Internet Router*
  - *Regulatory Compliance and Safety Information for the Cisco 7500 Series Routers*
  - *Regulatory Compliance and Safety Information for the Cisco 7600 Series Internet Routers*

Obtaining Documentation, Obtaining Support, and Security Guidelines

For information on obtaining documentation, obtaining support, providing documentation feedback, security guidelines, and also recommended aliases and general Cisco documents, see the monthly What's New in Cisco Product Documentation, which also lists all new and revised technical documentation at:

http://www.cisco.com/en/US/docs/general/whatsnew/whatsnew.html

CHAPTER 1

Overview

This chapter describes the PA-A3-IMA port adapter and contains the following sections:

- Port Adapter Overview, page 1-1
- Inverse Multiplexing over ATM Overview, page 1-2
- Features, page 1-3
- LEDs, page 1-4
- Cables, Connectors, and Pinouts, page 1-5
- Port Adapter Slot Locations on the Supported Platforms, page 1-6
- Identifying Interface Addresses, page 1-13

Port Adapter Overview

The PA-A3-IMA (see Figure 1-1 and Figure 1-2) is a single-width port adapter that allows the Cisco 7100 series routers, Cisco 7200 series routers, Cisco 7200 VXR routers, Cisco 7201 router, Cisco 7301 router, Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 router, Cisco 7401ASR routes, Cisco 7500 series routers, and Catalyst 6000 family switches and Cisco 7600 series routers with a FlexWAN module to support inverse multiplexing over ATM. The PA-A3-IMA supports data rates between DS1 and DS3 levels, or E1 and E3 levels, by combining the bandwidth of multiple DS1 or E1 links into groups that collectively provide higher intermediate rates. This Peripheral Component Interconnect (PCI)-based port adapter is available in a T1 version (PA-A3-8T1 IMA) and an E1 version (PA-A3-8E1 IMA).

Note PA-A3-8E1 IMA is not supported on Cisco 7401ASR routers.

Note To allow a full view of the port adapter faceplate detail, port adapter handles are not shown in Figure 1-1 and Figure 2-2.

Figure 1-1 PA-A3-8T1 IMA—Faceplate View

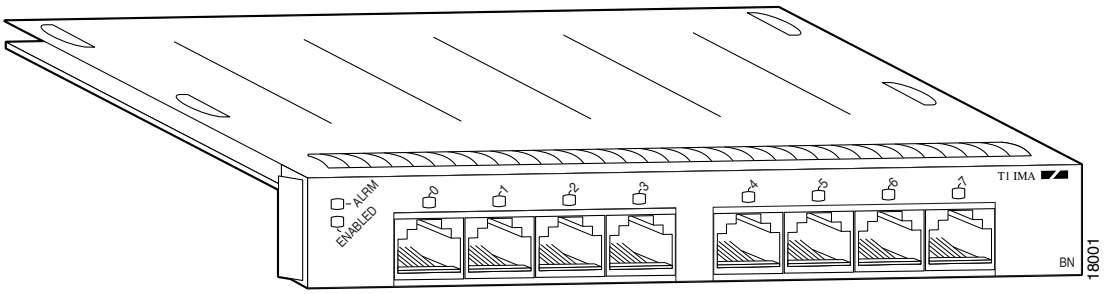
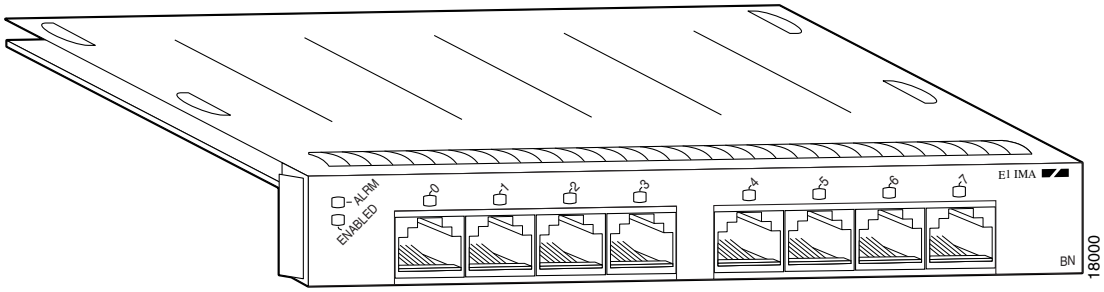


Figure 1-2 PA-A3-8E1 IMA—Faceplate View



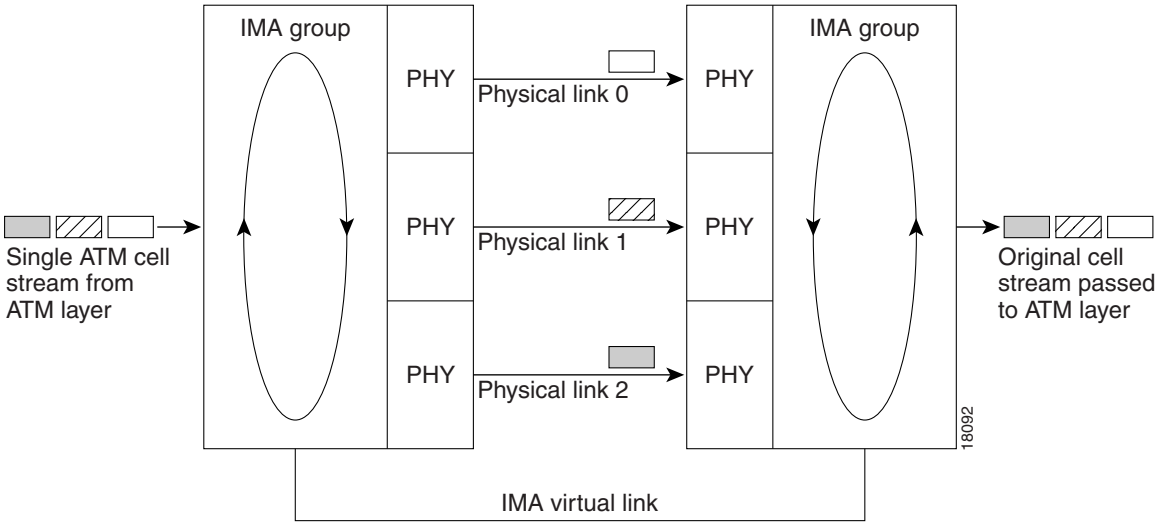
The PA-A3-IMA can be installed in a Cisco 7100 series router, Cisco 7200 series router, Cisco 7200 VXR router, Cisco 7201 router, Cisco 7301 router, Cisco 7304 PCI Port Adapter Carrier Card in the Cisco 7304 router, Cisco 7401ASR router, VIP for Cisco 7500 series routers, or Catalyst 6000 family FlexWAN module for the Catalyst 6000 family switches and Cisco 7600 series routers. See the "Port Adapter Slot Locations on the Supported Platforms" section on page 1-6 for the available slot locations.

Inverse Multiplexing over ATM Overview

Inverse multiplexing (IMA) provides a means of access to ATM networks at rates between DS1/E1 and DS3/E3 levels (1.544 Mbps/2.048 Mbps to 44.736 Mbps/34.368 Mbps) by combining the bandwidth of multiple DS1/E1 links into groups that collectively provide higher intermediate rates. These multiple links are especially desirable in networks where DS3/E3 links are scarce.

IMA breaks up the ATM cell stream and distributes the cells over the multiple physical links of an IMA group (inverse multiplexing) and then recombines the cells into a single stream at the other end of the connection. The ATM cells are distributed in a round-robin fashion over the physical links of the IMA group, demultiplexed at the receiving IMA group, and passed in their original form to the ATM layer (see Figure 1-3). Using the multiple links of an IMA group increases the logical link bandwidth to approximately the sum of the individual link rates.

Figure 1-3 Inverse Multiplexing and Demultiplexing of ATM Cells Through IMA Groups



Features

The PA-A3-IMA has the following features:

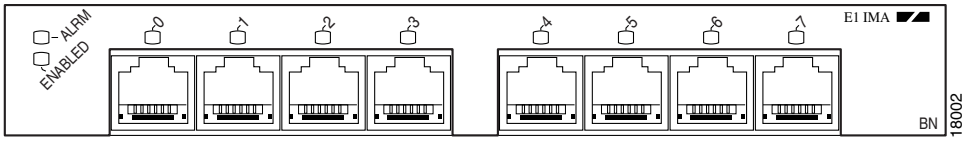
- Up to four IMA groups
- Eight standard T1/E1 (1.544/2.048 Mbps) interfaces, with two integrated quad RJ-45 connectors
- Inverse multiplexing over ATM
- Up to 4096 total virtual connections (open VCs)
- Mixed mode operation, with some links in User Network Interface (UNI) mode and the others in IMA groups
- Maximum differential delay of 250 milliseconds for T1 and 190 milliseconds for E1 between the individual circuits that constitute part of an IMA group
- Binary 8-zero substitution (B8ZS) line encoding for T1 and High-Density Bipolar (HDB3) line encoding for E1 in accordance with ATM UNI standards; also alternate mark inversion (AMI) line encoding for both T1 and E1
- Super Frame (SF) and Extended Super Frame (ESF) framing for T1; and Basic Frame, Clear E1, and CCS-CRC framing for E1
- Header Error Control (HEC)-based cell delineation for ATM framing
- Facility Data Link (FDL) processing for T1
- Selectable Tx clock sources for T1/E1 lines
- Online insertion and removal (OIR)
- VP shaping
- IP-ATM class of service mapping

- These QoS classes:
  - UBR (unspecified bit rate)
  - VBR (variable bit rate)
  - ABR (available bit rate)

LEDs

The PA-A3-IMA has ten LEDs: one bicolor alarm LED, one green ENABLED LED, and eight bicolor port status LEDs (see Figure 1-4).

Figure 1-4 PA-A3-IMA LEDs



After system initialization, the ENABLED LED goes on to indicate that the port adapter has been enabled for operation.

The following conditions must be met before the PA-A3-IMA is enabled:

- The PA-A3-IMA is correctly connected and is receiving power.
- A valid system software image for the port adapter has been downloaded successfully.
- The system recognizes the PA-A3-IMA, a VIP with a PA-A3-IMA, or a Catalyst 6000 family switch or Cisco 7600 series Router with a FlexWAN module with a PA-A3-IMA.

If any of the above conditions are not met, or if the initialization fails for other reasons, the ENABLED LED does not go on.

Table 1-1 lists LED colors and indications.

Table 1-1 PA-A3-IMA LEDs

LED Label	Color	State	Function
ALRM	Yellow	On	Indicates a minor alarm on one of the T1/E1 ports
	Red	On	Indicates a major alarm on one of the T1/E1 ports
ENABLED	Green	On	Indicates IMA port adapter is enabled for operation
Port 0–7	Green	On	Indicates port is enabled and in frame
	Green/Yellow	Off	Indicates port is not initialized or is in alarm condition
	Yellow	On	Indicates port is in loopback

Cables, Connectors, and Pinouts

The eight DS1/E1 interface receptacles on the PA-A3-IMA are RJ-45 connectors for T1 (100 ohm) or E1 (120 ohm). All eight may be used simultaneously as ATM interfaces, or they may be used to create IMA groups.

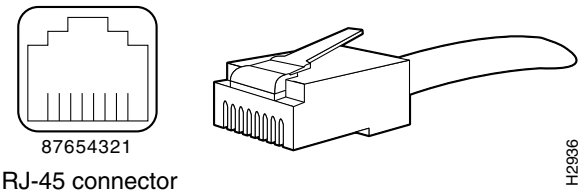
Note After you properly connect a port to a line, it takes approximately 30 seconds for Cisco IOS software to report that the line is up.

Each connection supports T1 (100-ohm) or E1 (120-ohm) interfaces that meet T1.403 and ACCUNET TR62411 standards. The RJ-45 connection does not require an external transceiver. The DS1 ports are T1 interfaces that use foil twisted-pair (FTP) cables.

Note To meet VCCI Class II EMI requirements, you must use FTP cables.

Figure 1-5 shows the PA-A3-IMA interface cable connector. See Chapter 4, "Configuring the PA-A3-IMA," for directions on connecting the cables of an IMA group.

Figure 1-5 PA-A3-IMA Interface Connector



IMA Interface Cable RJ-45 Connector PinoutsTable 1-2 lists the signal pinouts and descriptions for the RJ-45 connector.

Table 1-2 IMA Interface Cable RJ-45 Connector Pinouts

Pin	Signal	Signal	To
J1-1	RX[1] ring	TX[2] ring	J2-4
J1-2	RX tip	TX tip	J2-5
J1-3	RX shield	TX shield	NC
J1-4	TX ring	RX ring	J2-1
J1-5	TX tip	RX tip	J2-2
J1-6	TX shield	RX shield	NC
J1-7	NC[3]	NC	
J1-8	NC	NC	

1. RX = receive
2. TX = transmit
3. NC = no connect

Port Adapter Slot Locations on the Supported Platforms

The following sections provide port adapter slot locations and related information:

- Cisco 7100 Series Routers Slot Numbering, page 1-6
- Cisco 7200 Series Routers and Cisco 7200 VXR Routers Slot Numbering, page 1-7
- Cisco 7201 Router Slot Numbering, page 1-8
- Cisco 7301 Router Slot Numbering, page 1-8
- Cisco 7304 PCI Port Adapter Carrier Card Slot Numbering, page 1-9
- Cisco 7304 PCI Port Adapter Carrier Card Slot Numbering, page 1-9
- Cisco 7500 Series Routers VIP Slot Numbering, page 1-10
- Catalyst 6000 Family Switches and Cisco 7600 Series Routers with FlexWAN Module Slot Numbering, page 1-11

Cisco 7100 Series Routers Slot Numbering

The PA-A3-IMA can be installed in port adapter slot 3 in the Cisco 7120 series routers, and in port adapter slot 4 in the Cisco 7140 series routers. Figure 1-6 shows the slot numbering on a Cisco 7120 series router. Figure 1-7 shows the slot numbering on a Cisco 7140 series router.

Figure 1-6 Port Adapter Slots in the Cisco 7120 Series Router

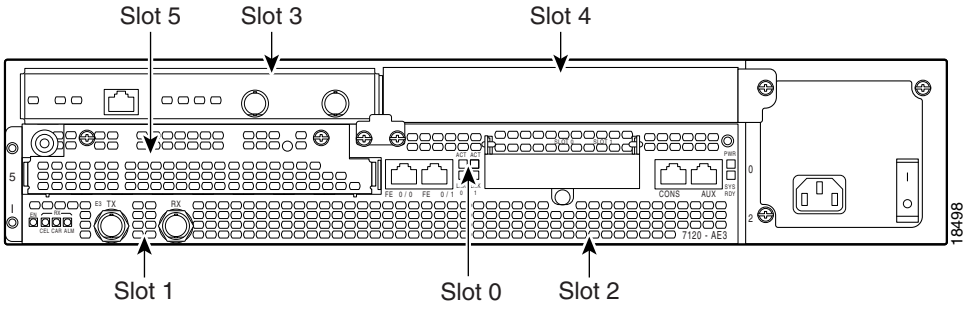
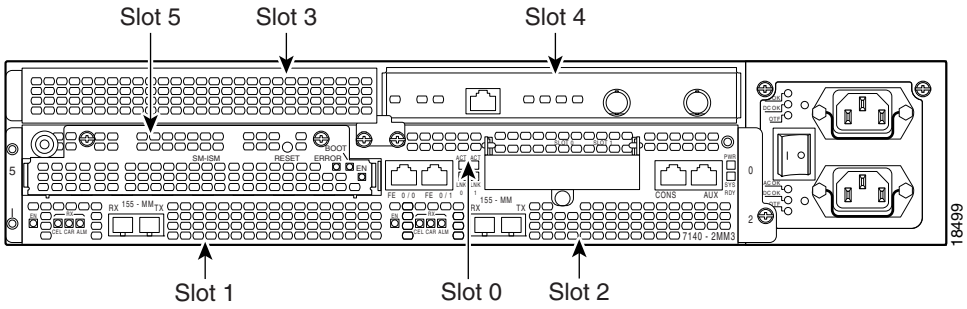


Figure 1-7 Port Adapter Slots in the Cisco 7140 Series Router



Cisco 7200 Series Routers and Cisco 7200 VXR Routers Slot Numbering

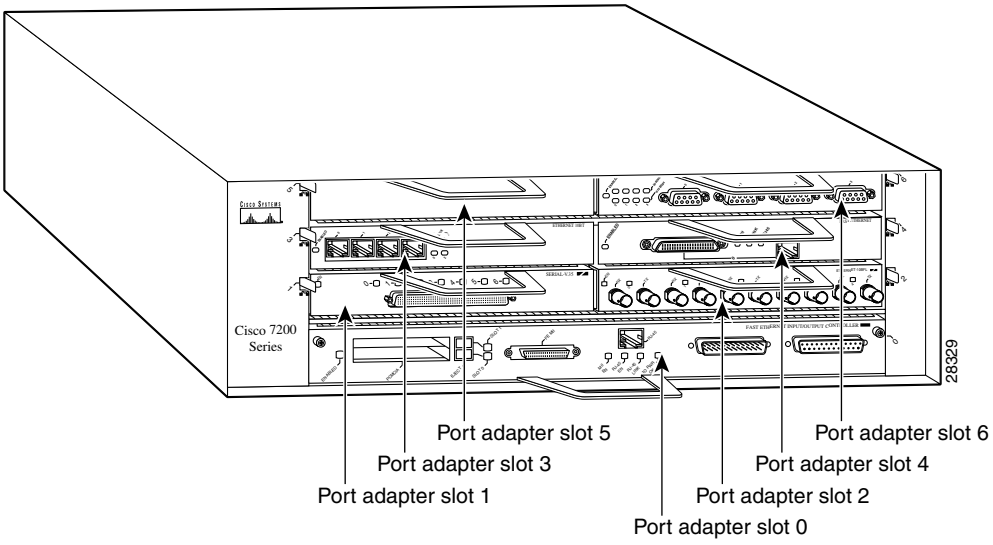
Cisco 7202 routers have two port adapter slots. The slots are numbered from left to right. You can place a port adapter in either of the slots (slot 1 or slot 2). The Cisco 7202 router is not shown.

Cisco 7204 routers and Cisco 7204VXR routers have four slots for port adapters, and one slot for an input/output (I/O) controller. The slots are numbered from the lower left to the upper right, beginning with slot 1 and continuing through slot 4. You can place a port adapter in any of the slots (slot 1 through slot 4). Slot 0 is always reserved for the I/O controller. The Cisco 7204 router and Cisco 7204VXR are not shown.

Cisco 7206 routers and Cisco 7206VXR routers (including the Cisco 7206 and Cisco 7206VXR routers as router shelves in a Cisco AS5800 Universal Access Server) have six slots for port adapters, and one slot for an input/output (I/O) controller. The slots are numbered from the lower left to the upper right, beginning with slot 1 and continuing through slot 6. You can place a port adapter in any of the six slots (slot 1 through slot 6). Slot 0 is always reserved for the I/O controller.

Figure 1-8 shows the slot numbering on a Cisco 7206 router. The Cisco 7206VXR router is not shown.

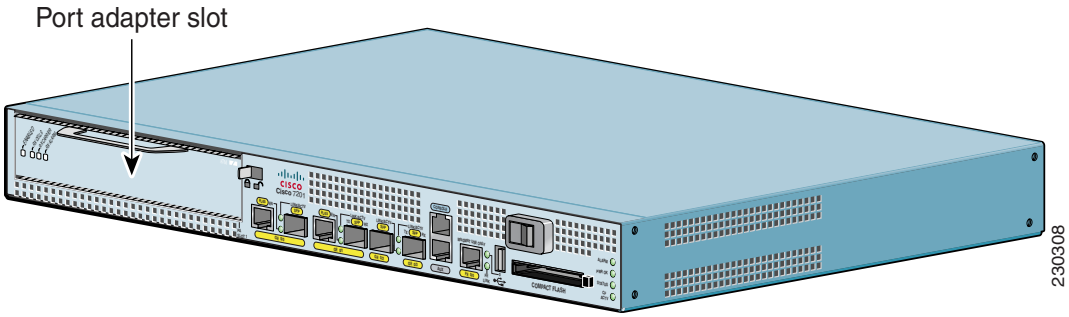
Figure 1-8 Port Adapter Slots in the Cisco 7206 Router



Cisco 7201 Router Slot Numbering

Figure 1-9 shows the front view of a Cisco 7201 router with a port adapter installed. There is only one port adapter slot (slot 1) in a Cisco 7201 router.

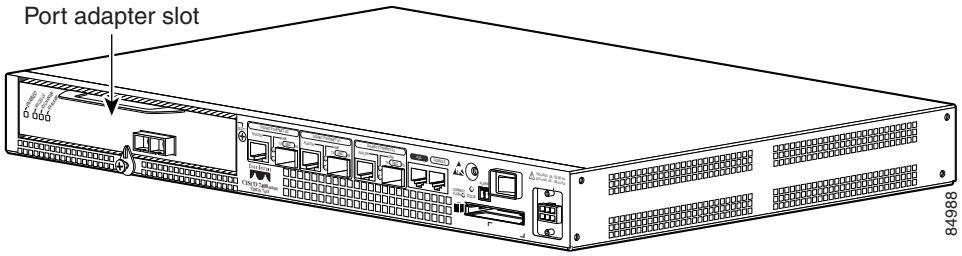
Figure 1-9 Port Adapter Slot in the Cisco 7201 Router



Cisco 7301 Router Slot Numbering

Figure 1-10 shows the front view of a Cisco 7301 router with a port adapter installed. There is only one port adapter slot (slot 1) in a Cisco 7301 router.

Figure 1-10 Port Adapter Slot in the Cisco 7301 Router



Cisco 7304 PCI Port Adapter Carrier Card Slot Numbering

The Cisco 7304 PCI Port Adapter Carrier Card installs in Cisco 7304 router module slots 2 through 5. Figure 1-11 shows a Cisco 7304 PCI Port Adapter Carrier Card with a port adapter installed. The Cisco 7304 PCI Port Adapter Carrier Card accepts one single-width port adapter.

Figure 1-12 shows the module slot numbering on a Cisco 7304 router. The port adapter slot number is the same as the module slot number. Slot 0 and slot 1 are reserved for the NPE module or NSE module.

Figure 1-11 Cisco 7304 PCI Port Adapter Carrier Card—Port Adapter Installed

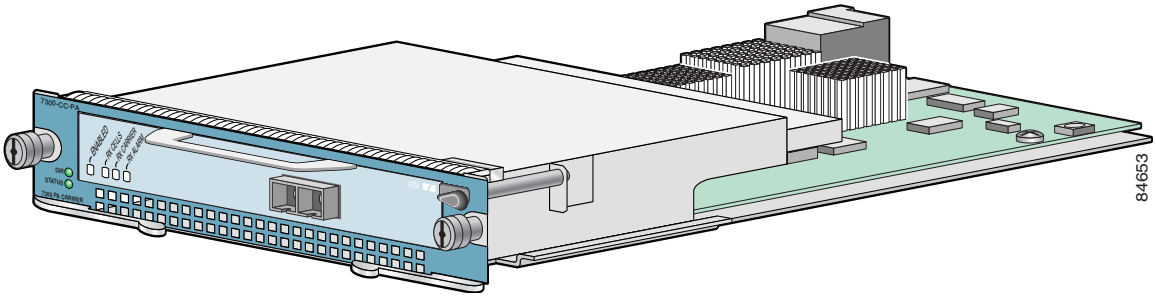
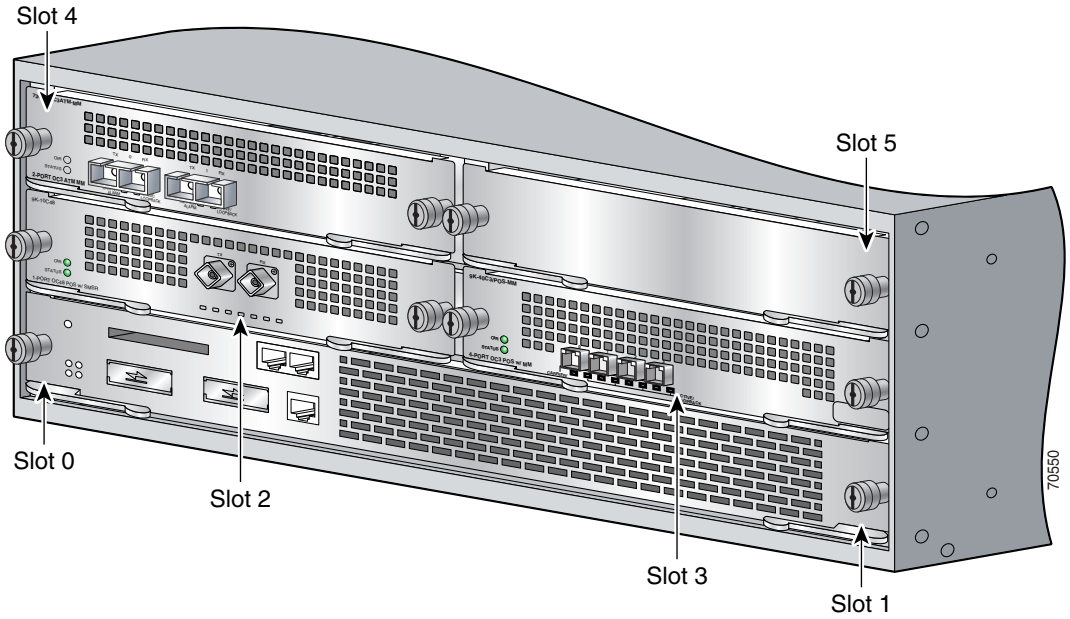


Figure 1-12 Module Slots on the Cisco 7304 Router

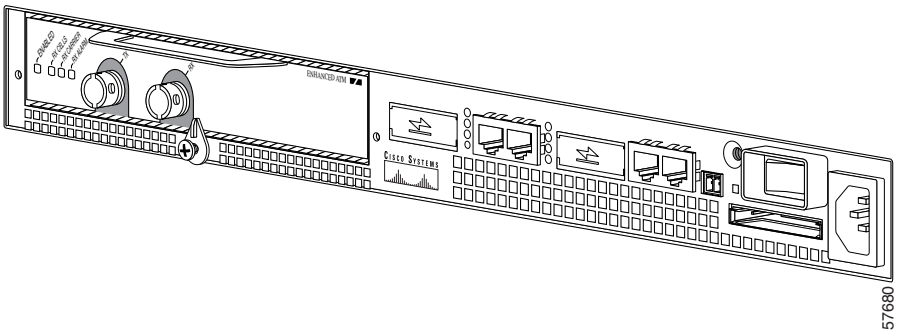


Cisco 7401ASR Router Slot Numbering

Figure 1-13 shows the front view of a Cisco 7401ASR router with a port adapter installed. There is only one port adapter slot (slot 1) in a Cisco 7401ASR router.

Note PA-A3-8E1 IMA is not supported on Cisco 7401ASR routers.

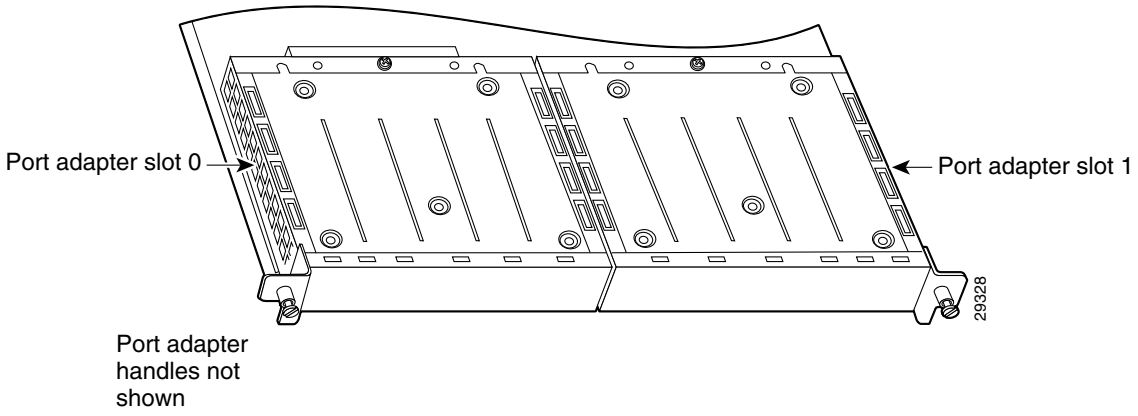
Figure 1-13 Port Adapter Slot in the Cisco 7401ASR Router



Cisco 7500 Series Routers VIP Slot Numbering

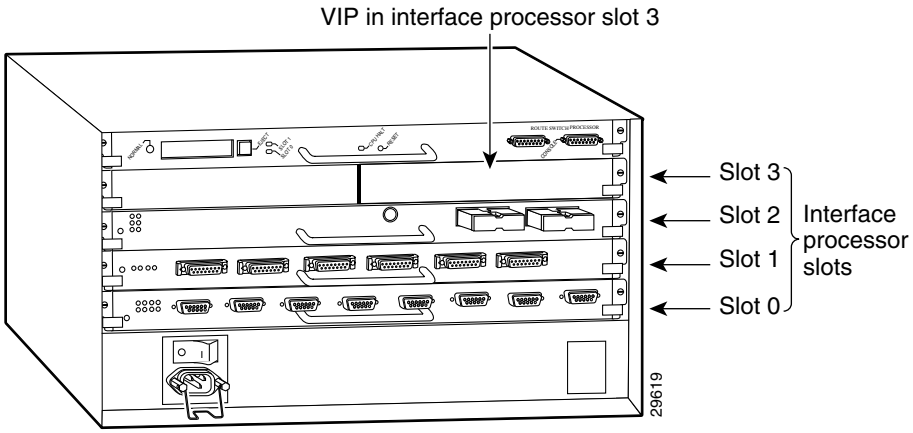
Port adapters are supported on the VIPs (versatile interface processors) used in Cisco 7500 series routers. In the Cisco 7505 router, the VIP motherboard is installed horizontally in the VIP slot. In the Cisco 7507 router and Cisco 7513 router, the VIP motherboard is installed vertically in the VIP slot. A port adapter can be installed in either bay (port adapter slot 0 or 1) on the VIP. The bays are numbered from left to right on the VIP. Figure 1-14 shows the slot numbering on a VIP.

Figure 1-14 VIP Slot Locations—Partial View, Horizontal Orientation



Cisco 7505 routers have four slots for port adapters, and one slot for an RSP. The slots are numbered from bottom to top. You can place a port adapter in any of the VIP interface slots (slot 0 through 3). One slot is always reserved for the RSP. Figure 1-15 shows the slot numbering on a Cisco 7505 router.

Figure 1-15 VIP Slots in the Cisco 7505 Router



Cisco 7507 routers have five slots for port adapters, and two slots for RSPs. The slots are numbered from left to right. You can place a port adapter in any of the VIP interface slots (slot 0, 1, 4, 5, or 6). Slots 2 and 3 are always reserved for RSPs. The Cisco 7507 router is not shown.

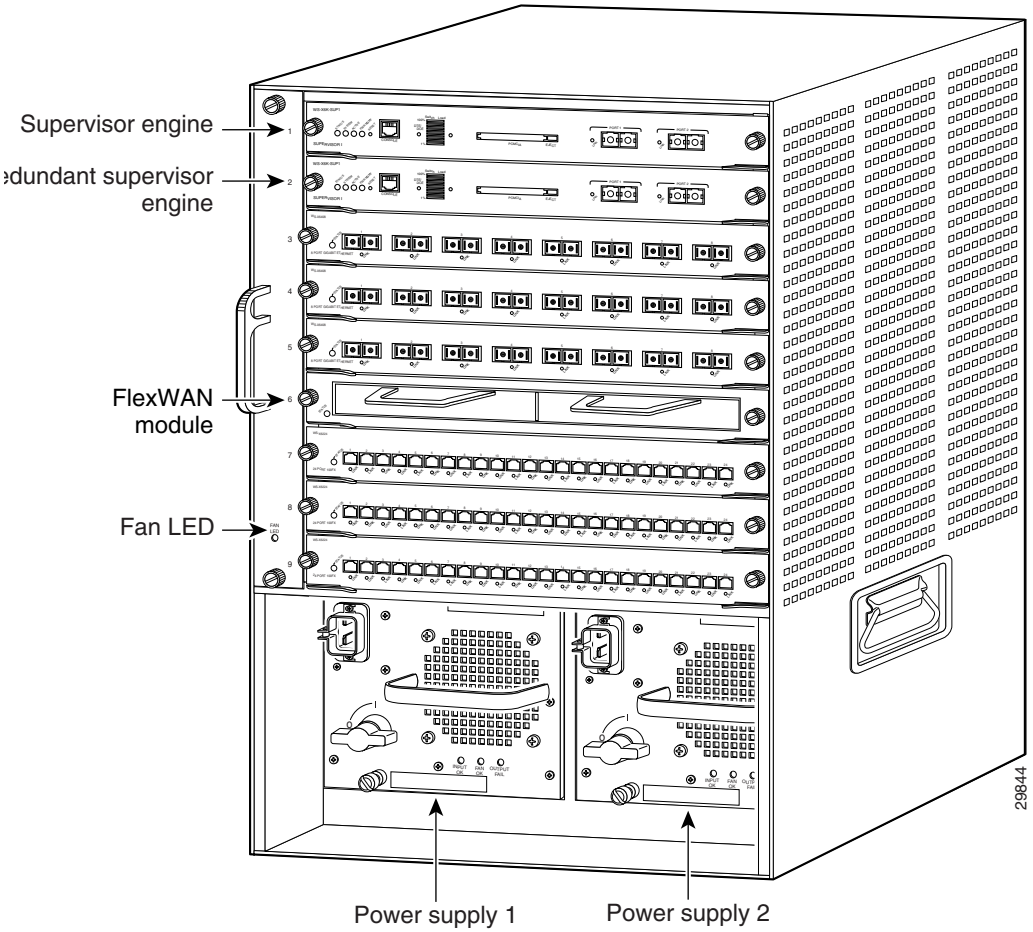
Cisco 7513 routers have eleven slots for port adapters, and two slots for RSPs. The slots are numbered from left to right. You can place a port adapter in any of the VIP interface slots (slots 0 through 5, or slots 9 through 12). Slots 6 and 7 are always reserved for RSPs. The Cisco 7513 router is not shown.

Catalyst 6000 Family Switches and Cisco 7600 Series Routers with FlexWAN Module Slot Numbering

The FlexWAN module can be installed in any slot of a Catalyst 6000 family switch or a Cisco 7600 series router except slot 1, which is reserved for the supervisor engine. Port adapters can be installed into either module bay 0 or module bay 1 on the FlexWAN module. Figure 1-16 shows a FlexWAN module with two blank port adapters installed. The bays are numbered from left to right on the FlexWAN module. The slot numbering is the same for Catalyst 6000 family switches and Cisco 7600 series routers.

Note Slot 1 is reserved for the supervisor engine. If a redundant supervisor engine is used, it would go in slot 2; otherwise, slot 2 can be used for other modules.

Figure 1-16 Catalyst 6000 Family Switch with Port Adapters Installed on FlexWAN Module



Cisco 7603 routers have two slots for port adapters. The slots are numbered from top to bottom. You can place the port adapters in either of the FlexWAN module slots (slot 2 or 3). Slot 1 is always reserved for the supervisor engine. The Cisco 7603 router is not shown.

Cisco 7606 routers have five slots for port adapters. The slots are numbered from top to bottom. You can place the port adapters in any of the FlexWAN module slots (slots 2 through 6). Slot 1 is always reserved for the supervisor engine. The Cisco 7606 router is not shown.

Cisco 7609 routers have eight slots for port adapters. The slots are numbered from right to left. You can place the port adapters in any of the FlexWAN module slots (slots 2 through 9). Slot 1 is always reserved for the supervisor engine. The Cisco 7609 router is not shown.

Cisco 7613 routers have twelve slots for port adapters. The slots are numbered from top to bottom. You can place the port adapters in any of the FlexWAN module slots (slots 2 through 13). Slot 1 is always reserved for the supervisor engine. The Cisco 7613 router is not shown.

Note Some of the slots used for the FlexWAN module on the Cisco 7606 router, Cisco 7609 router, and Cisco 7613 router can also be used for other supervisor engines, RSPs, or OSMs. For details, refer to the *Cisco 7600 Series Router Installation Guide* at the following URL: http://www.cisco.com/en/US/products/hw/routers/ps368/products_installation_guide_book09186a008080269a.html

Identifying Interface Addresses

This section describes how to identify interface addresses for the PA-A3-IMA in supported platforms. Interface addresses specify the actual physical location of each interface on a router or switch.

Interfaces on a PA-A3-IMA 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.

Interfaces on a PA-A3-IMA installed in a VIP or FlexWAN module maintain the same address regardless of whether other interface processors or modules are installed or removed. However, when you move a VIP or FlexWAN module to a different slot, the interface processor or module slot number changes to reflect the new interface processor or module slot.

Note Interface ports are numbered from left to right starting with 0.

The following subsections describe the interface address formats the supported platforms:

- Cisco 7100 Series Routers Interface Addresses, page 1-14
- Cisco 7200 Series Routers and Cisco 7200VXR Series Routers Interface Addresses, page 1-15
- Cisco 7201 Router Slot Numbering, page 1-8
- Cisco 7301 Router Interface Addresses, page 1-16
- Cisco 7304 PCI Port Adapter Carrier Card Interface Addresses, page 1-16
- Cisco 7401ASR Router Interface Addresses, page 1-16
- Cisco 7500 Series Routers VIP Interface Addresses, page 1-16
- Catalyst 6000 Family Switches and Cisco 7600 Series Routers with FlexWAN Module Interface Addresses, page 1-17

Table 1-3 summarizes the interface address formats for the supported routers.

Table 1-3 Identifying Interface Addresses

Platform	Interface Address Format	Numbers	Syntax
Cisco 7120 series router	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 3 Interface port—0 through 7	`3/1`
Cisco 7140 series router	Port-adapter-slot-number/interface-port-number	Port adapter slot—always 4 Interface port—0 through 7	`4/0`
Cisco 7200 series routers and Cisco 7200 VXR routers (7202, 7204, 7204VXR, 7206, and 7206VXR)	Port-adapter-slot-number/interface-port-number	Port adapter slot—1[1] through 6 (depends on the number of slots in the router) Interface port—0 through 7	`1/0`
Cisco 7201 router	Port-adapter-slot-number/interface-port number	Port adapter slot—always 1 Interface port—0 through 7	`1/0`
Cisco 7301 router	Port-adapter-slot-number/interface-port number	Port adapter slot—always 1 Interface port—0 through 7	`1/0`

Table 1-3 Identifying Interface Addresses (continued)

Platform	Interface Address Format	Numbers	Syntax
Cisco 7304 PCI port adapter carrier card in Cisco 7304 router	Module-slot-number/interface-port-number	Module slot—2 through 5 Interface port—0 through 7	`3/0`
Cisco 7401ASR router	Port-adapter-slot-number/interface-port number	Port adapter slot—always 1 Interface port—0 through 7	`1/0`
Cisco 7500 series routers (7505, 7507, 7513) with VIP	Interface-processor-slot-number/port-adapter -slot-number/interface-port number	Interface processor slot—0 through 12 (depends on the number of slots in the router) Port adapter slot— 0 or 1 Interface port—0 through 7	`3/1/0`
FlexWAN or Enhanced FlexWAN module in Catalyst 6000 family switches or Cisco 7600 series routers (7603, 7606, 7609, 7613)	Module-slot-number/port-adapter-bay-number/ interface-port-number	Module slot number—2[2] through 13 (depends on the number of slots in the switch/router) Port adapter bay—0 or 1 Interface port—0 through 7	`3/0/0`

1. Port adapter slot 0 is reserved for the Fast Ethernet port on the I/O controller (if present).
2. Slot 1 is reserved for the supervisor engine. If a redundant supervisor engine is used, it must go in slot 2; otherwise, slot 2 can be used for other modules.

Cisco 7100 Series Routers Interface Addresses

In Cisco 7120 series router, port adapters are installed in port adapter slot 3. See Figure 1-6. In the Cisco 7140 series router, port adapters are installed in port adapter slot 4. See Figure 1-7.

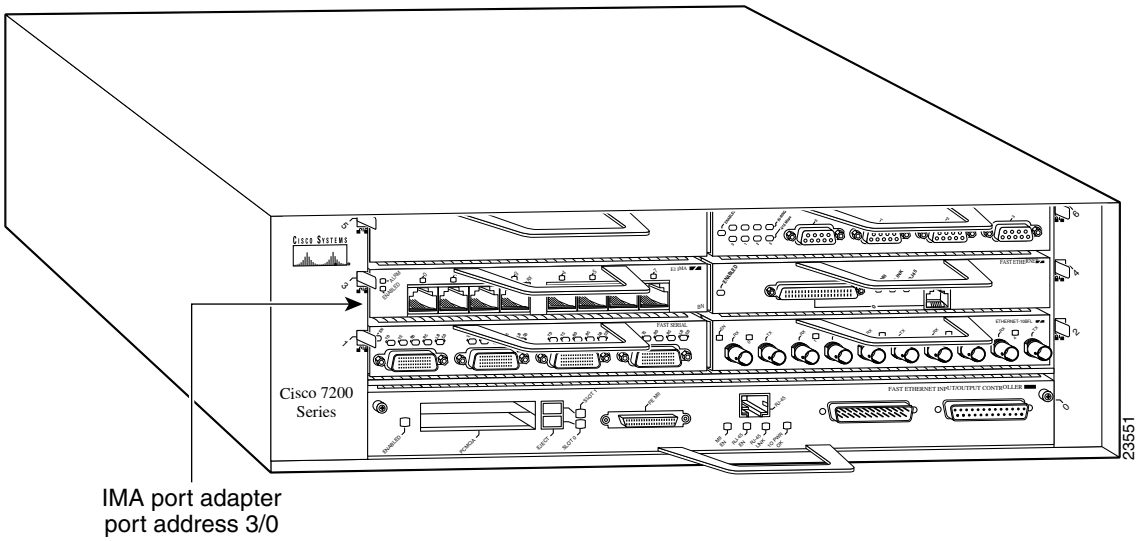
The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number.* See Table 1-3. For example, if an eight-port PA-A3-IMA is installed on a Cisco 7120 router, the interface addresses would be 3/0 through 3/7 (port adapter slot 3, and interfaces 0,1, 2, 3, 4, 5, 6, and 7). If an eight-port PA-A3-IMA is installed on a Cisco 7140 router, the interface addresses would be 4/0 through 4/7 (port adapter slot 4, and interfaces 0,1, 2, 3, 4, 5, 6, and 7).

Cisco 7200 Series Routers and Cisco 7200VXR Series Routers Interface Addresses

In Cisco 7200 series routers and Cisco 7200 VXR routers, port adapter slots are numbered from the lower left to the upper right, beginning with slot 1 and continuing through slot 2 for the Cisco 7202, slot 4 for the Cisco 7204 and Cisco 7204VXR, and slot 6 for the Cisco 7206 and Cisco 7206VXR. Port adapters can be installed in any available port adapter slot from 1 through 6 (depending on the number of slots in the router). (Slot 0 is reserved for the I/O controller.) See Figure 1-8.

Figure 1-17 shows a PA-A3-IMA in port adapter slot 3 of the Cisco 7206 router.

Figure 1-17 PA-A3-IMA in Slot 3 of a Cisco 7206 Router



The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See Table 1-3. For example, if an eight-port PA-A3-IMA is installed in slot 3 of a Cisco 7200 series router (as shown in Figure 1-17 for a Cisco 7206 router), the interface addresses would be 3/0 through 3/7 (port adapter slot 3 and interfaces 0 through 7).

Cisco 7201 Router Interface Addresses

In the Cisco 7201 router, only one slot accepts port adapters and it is numbered as slot 1. See Figure 1-9.

The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See Table 1-3. For example, if an eight-port PA-A3-IMA is installed in a Cisco 7201 router, the interface addresses would be 1/0 through 1/7.

Cisco 7301 Router Interface Addresses

In the Cisco 7301 router, only one slot accepts port adapters and it is numbered as slot 1. See Figure 1-10.

The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See Table 1-3. For example, if an eight-port PA-A3-IMA is installed in a Cisco 7301 router, the interface addresses would be 1/0 through 1/7.

Cisco 7304 PCI Port Adapter Carrier Card Interface Addresses

In the Cisco 7304 router, port adapters are installed in a Cisco 7304 PCI port adapter carrier card, which installs in Cisco 7304 router module slots 2 through 5. The port adapter slot number is the same as the module slot number. See Figure 1-11 and Figure 1-12.

The interface address is composed of a two-part number in the format *module-slot-number/interface-port-number*. See Table 1-3. For example, if an eight-port PA-A3-IMA is installed in the Cisco 7304 PCI port adapter carrier card in Cisco 7304 router module slot 3, the interface addresses would be 3/0 through 3/7.

Cisco 7401ASR Router Interface Addresses

In the Cisco 7401ASR router, only one slot accepts port adapters and it is numbered as slot 1. See Figure 1-13.

The interface address is composed of a two-part number in the format *port-adapter-slot-number/interface-port-number*. See Table 1-3. For example, if an eight-port PA-A3-IMA is installed in a Cisco 7401ASR router, the interface addresses would be 1/0 through 1/7.

Cisco 7500 Series Routers VIP Interface Addresses

In Cisco 7000 series routers and Cisco 7500 series routers, port adapters are installed on a versatile interface processor (VIP), which installs in interface processor slots 0 through 12 (depending on the number of slots in the router). The port adapter can be installed in either bay (port adapter slot 0 or 1) on the VIP. See Figure 1-14 and Figure 1-15.

The interface address for the VIP is composed of a three-part number in the format *interface-processor-slot-number/port-adapter-slot-number/interface-port-number*. See Table 1-3.

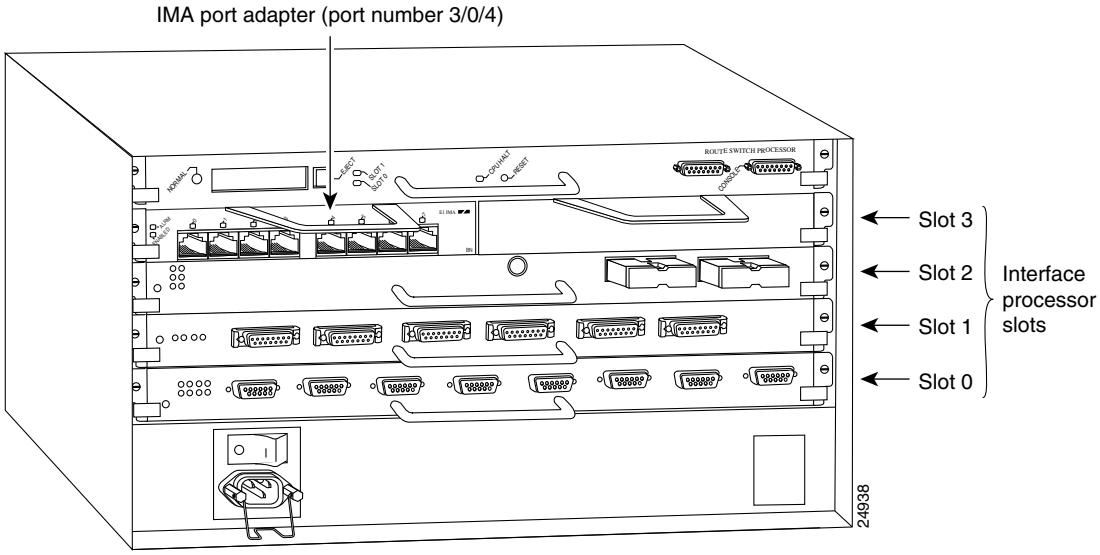
The first number identifies the slot in which the VIP is installed (slot 0 through 12, depending on the number of slots in the router).

The second number identifies the bay (port adapter slot) on the VIP in which the port adapter is installed (0 or 1). The bays are numbered from left to right on the VIP.

The third number identifies the physical port number (interface port number) on the port adapter. The port numbers always begin at 0 and are numbered from left to right. The number of additional ports depends on the number of ports on the port adapter. The PA-A3-IMA is an eight-port port adapter, therefore the port can be 0 through 7.

Figure 1-18 shows a PA-A3-IMA in port adapter slot 3 of the Cisco 7505 router.

Figure 1-18 PA-A3-IMA in Slot 3 of a Cisco 7505 Shown



For example, if an eight-port PA-A3-IMA is installed in a VIP in interface processor slot 3, port adapter slot 1 (as shown in Figure 1-18 for a Cisco 7505 router), the interface addresses would be 3/1/0 through 3/1/7 (interface processor slot 3, port adapter slot 1, and interfaces 0, 1, 2, 3, 4, 5, 6, and 7).

Note Although the processor slots in the seven-slot Cisco 7507 and thirteen-slot Cisco 7513 and Cisco 7576 are vertically oriented and those in the five-slot Cisco 7505 are horizontally oriented, all Cisco 7500 series routers use the same method for slot and port numbering.

Catalyst 6000 Family Switches and Cisco 7600 Series Routers with FlexWAN Module Interface Addresses

In Catalyst 6000 family switches and Cisco 7600 series routers, port adapters are installed in a FlexWAN module, which installs in module slots 2 through 13 (depending on the number of slots in the router). The port adapter can be installed in either bay (port adapter bay 0 or 1) on the FlexWAN module. See Figure 1-16.

The interface address is composed of a three-part number in the format *module-slot-number/port-adapter-bay-number/interface-port-number*. See Table 1-3.

The first number identifies the module slot of the chassis in which the FlexWAN module is installed (slot 2 through slot 3, 6, 9, or 13 depending on the number of slots in the chassis). These module slots are generally numbered from top to bottom, starting with 1. The Cisco 7609 is the exception with slots numbered right to left, starting with 1.

The second number identifies the bay of the FlexWAN module in which the port adapter is installed (0 or 1). The bays are numbered from left to right on the FlexWAN module.

The third number identifies the physical port number on the port adapter. The PA-A3-IMA is an eight-port port adapter, therefore the port can be 0 through 7.

For example, if an eight-port PA-A3-IMA is installed in the FlexWAN module, which is inserted in module slot 3, port adapter bay 0, the interface addresses would be 3/0/0 through 3/0/7 (interface processor slot 3, port adapter slot 0, and interfaces 0, 1, 2, 3, 4, 5, 6, and 7). If the same port adapter is in port adapter bay 1 on the FlexWAN module, the interface addresses would be 3/1/0 through 3/1/7 (interface processor slot 3, port adapter slot 1, and interfaces 0, 1, 2, 3, 4, 5, 6, and 7).

Note The FlexWAN module physical port address begins with slot 0, which differs from the conventional Catalyst 6000 family port address, which begins with slot 1.

CHAPTER 2

Preparing for Installation

This chapter describes the general equipment, safety, and site preparation requirements for installing the PA-A3-IMA. This chapter contains the following sections:

- Required Tools and Equipment, page 2-1
- Minimum Software and Hardware Requirements, page 2-2
- Checking Hardware and Software Compatibility, page 2-5
- Safety Guidelines, page 2-5
- FCC Class A Compliance, page 2-12

Required Tools and Equipment

You need the following tools and parts to install a PA-A3-IMA. If you need additional equipment, contact your service representative for ordering information.

- PA-A3-8T1 IMA or PA-A3-8E1 IMA
- Cisco 7304 PCI Port Adapter Carrier Card (for installation in Cisco 7304 routers)
- VIP (for installation in Cisco 7500 series chassis only). For information about the specific VIP models that support the PA-A3-IMA, see the "Minimum Software and Hardware Requirements" section on page 2-2.
- FlexWAN module (for installation in Catalyst 6000 family switches or Cisco 7600 series Internet Routers)
- Foil twisted-pair (FTP) interface cables to connect the IMA port adapter to the ATM network
- Number 1 Phillips and a 3/16-inch flat-blade screwdriver (for VIP installation only)
- 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 software releases required for the PA-A3-IMA on the supported platforms. For the latest software releases supporting the port adapter, see the "Hardware Requirements" section on page 2-3.

Software Requirements

Table 2-1 lists the recommended minimum Cisco IOS software release required to use the PA-A3-IMA in supported router platforms.

Table 2-1 PA-A3-IMA Software Requirements

Platform	Recommended Minimum Cisco IOS Release
Cisco 7100 series routers • Cisco 7120 series and Cisco 7140 series	Cisco IOS Release 12.0(6)XE or a later release of Cisco IOS Release 12.0XE
Cisco 7200 series and Cisco 7200 VXR routers	Cisco IOS Release 12.0(5)XE or a later release of Cisco IOS Release 12.0XE, or Cisco IOS Release 12.1(5)T or a later release of Cisco IOS Release 12.1T Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2B
Cisco 7201 router	Cisco IOS Release 12.4(4)XD7 or a later release of Cisco IOS Release 12.4XD, or Cisco IOS Release 12.2(31)SB5 or a later release of Cisco IOS Release 12.2SB
Cisco 7301 router	Cisco IOS Release 12.2(11)YZ or a later release of Cisco IOS Release 12.2YZ
Cisco 7304 router • With Cisco 7304 PCI Port Adapter Carrier Card	Cisco IOS Release 12.2(14)SZ2 or a later release of Cisco IOS Release 12.2SZ2
Cisco 7401ASR router[1]	Cisco IOS Release 12.2(1)DX or a later release of Cisco IOS Release 12.2DX Cisco IOS Release 12.2(4)B or a later release of Cisco IOS Release 12.2B
VIP2 in the Cisco 7500 series routers[2, 3, 4] • With VIP2-40(=) • With VIP2-50(=)	Cisco IOS Release 12.0(5)S or a later release of Cisco IOS Release 12.0S, Cisco IOS Release 12.1(7)E or a later release of Cisco IOS Release 12.1E, Cisco IOS Release 12.2(0).14T or a later release of Cisco IOS Release 12.2.14T, or Cisco IOS Release 12.2(1)T or a later release of Cisco IOS Release 12.2T
VIP4 in the Cisco 7500 series routers • With VIP4-50(=) • With VIP4-80(=)	Cisco IOS Release 12.0(11)S or a later release of Cisco IOS Release 12.0S, Cisco IOS Release 12.1(7)E or a later release of Cisco IOS Release 12.1E, or Cisco IOS Release 12.2(2)T or a later release of Cisco IOS Release 12.2T

Platform	Recommended Minimum Cisco IOS Release
VIP6-80 in the Cisco 7500 series routers	Cisco IOS Release 12.0(11)S or a later release of Cisco IOS Release 12.0S, Cisco IOS Release 12.0(5)XE or a later release of Cisco IOS Release 12.0 E, Cisco IOS Release 12.1(7)E or a later release of Cisco IOS Release 12.1E, Cisco IOS Release 12.2(1) or a later release of Cisco IOS Release 12.2, or Cisco IOS Release 12.2(1)T or a later release of Cisco IOS Release 12.2
FlexWAN module	
• Cisco IOS software on both the supervisor engine and the MSFC	Cisco IOS Release 12.1(12c)E1 or a later release of Cisco IOS 12.1E
• Catalyst software on the supervisor engine and Cisco IOS software on the MSFC	• Catalyst 6000 family supervisor engine software release 5.4(1) or later • Cisco IOS Release 12.1(12c)E2 or a later release of Cisco IOS 12.1E

1. PA-A3-8E1 IMA is not supported on Cisco 7401ASR routers.
2. The PA-A3-IMA can be used in the VIP2 in all Cisco 7500 series routers using a Route Switch Processor (RSP).
3. The specific VIP2 models recommended for the PA-A3-IMA in all Cisco 7500 series routers are the VIP2-40(=), which has 2 MB of SRAM and 32 MB of DRAM, and the VIP2-50(=), which has 4 to 8 MB of SRAM and 32 to 128 MB of SDRAM. The PA-A3-IMA is not supported by the VIP2-15(=) and VIP2-20= models.
4. There are no restrictions on the number of installed PA-A3-IMA port adapters when Cisco 7500 series routers are running Cisco IOS Release 12.0(5)XE or a later release of 12.0 XE. The PA-A3-IMA can be installed in either port adapter slot 0 or slot 1 on the VIP.

Hardware Requirements

The PA-A3-IMA is compatible with the following platform configurations.

Cisco 7100 Series Routers Hardware Requirements

The PA-A3-IMA can be installed in slot 3 of any Cisco 7120 series router.

The PA-A3-IMA can be installed in slot 4 of any Cisco 7140 series router.

Cisco 7200 Series Routers and Cisco 7200 VXR Routers Hardware Requirements

Port adapters are rated by data-carrying capacity as high-, medium-, or low-bandwidth. Cisco 7200 series routers have certain data-carrying capacity, or bandwidth, restrictions that affect the number of high-, medium-, and low-bandwidth port adapters you can install. For more information on port adapter installation restrictions, refer to the *Cisco 7200 Series Port Adapter Hardware Configuration Guidelines* at the following URL:

http://www.cisco.com/en/US/products/hw/modules/ps2033/products_configuration_guide_book09186a00801056ef.html

The PA-A3-IMA and Cisco 7200 series router network processor memory configurations include the NPE-150, NPE-175, NPE-200, or NPE-225 with 4 MB of SRAM and a minimum of 64 MB of DRAM required for booting the default Cisco IOS image (c7200-js-mz). The NPE-100 *does not* support the PA-A3-IMA in Cisco 7200 series routers.

The PA-A3-IMA in a Cisco 7200 VXR router requires the NPE-300, 4 MB of SRAM, and a minimum of 64 MB of DRAM.

All of the PA-A3-IMA receive buffers are allocated from SRAM or DRAM. As a result, during bootup, if the PA-A3-IMA cannot find enough *contiguous* SRAM or DRAM for its use, the system ceases to bring up the PA-A3-IMA and displays an error message such as the following:

```
%IMAPA-3-PCIMEMNOTENOUGH: Not Enough PCI memory (0x19874) to support IMA PA on bay 5
```

Cisco 7201 Router Hardware Requirements

The PA-A3-IMA can be installed in the single port adapter slot of the Cisco 7201 router.

Cisco 7301 Router Hardware Requirements

The PA-A3-IMA can be installed in the single port adapter slot of the Cisco 7301 router.

Cisco 7304 PCI Port Adapter Carrier Card in Cisco 7304 Routers Hardware Requirements

One PA-A3 can be installed in the Cisco 7304 PCI Port Adapter Carrier Card. The Cisco 7304 PCI Port Adapter Carrier Card installs in Cisco 7304 router module slots 2 through 5.

Cisco 7401ASR Router Hardware Requirements

The PA-A3-IMA can be installed in the single port adapter slot of the Cisco 7401ASR router.

Cisco 7500 Series Routers Hardware Requirements

The PA-A3-IMA can be installed on the VIP2-40, the VIP2-50, the VIP4-50, the VIP4-80, and the VIP6-80 in a Cisco 7500 series router with either the Route Switch Processor 2 (RSP2) or the RSP4. The VIP2-15 and VIP2-20 *do not* support the PA-A3-IMA port adapter.

Flexwan Module Hardware Requirements

The PA-A3-IMA can be installed in a FlexWAN module used in the Cisco 7600 series routers. The FlexWAN module can be installed in any slot of a Cisco 7600 series router except slot 1, which is reserved for the supervisor engine. Port adapters can be installed into either module bay 0 or module bay 1 on the FlexWAN module.

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 **Log In** at Cisco.com and go to Support > Tools and Resources. You can also access the tool by pointing your browser directly to http://www.cisco.com/en/US/support/tsd_most_requested_tools.html.

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, may harm you. A warning symbol precedes each warning statement.

Warning **IMPORTANT SAFETY INSTRUCTIONS**

This warning symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents. To see translations of the warnings that appear in this publication, refer to the translated safety warnings that accompanied this device.

Note: SAVE THESE INSTRUCTIONS

Note: This documentation is to be used in conjunction with the specific product installation guide that shipped with the product. Please refer to the Installation Guide, Configuration Guide, or other enclosed additional documentation for further details.

Waarschuwing **BELANGRIJKE VEILIGHEIDSINSTRUCTIES**

Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico's en dient u op de hoogte te zijn van de standaard praktijken om ongelukken te voorkomen. Voor een vertaling van de waarschuwingen die in deze publicatie verschijnen, dient u de vertaalde veiligheidswaarschuwingen te raadplegen die bij dit apparaat worden geleverd.

Opmerking BEWAAR DEZE INSTRUCTIES.

Opmerking Deze documentatie dient gebruikt te worden in combinatie met de installatiehandleiding voor het specifieke product die bij het product wordt geleverd. Raadpleeg de installatiehandleiding, configuratiehandleiding of andere verdere ingesloten documentatie voor meer informatie.

Varoitus **TÄRKEITÄ TURVALLISUUTEEN LIITTYVIÄ OHJEITA**

Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa, ota selvää sähkökytkentöihin liittyvistä vaaroista ja tavanomaisista onnettomuuksien ehkäisykeinoista. Tässä asiakirjassa esitettyjen varoitusten käännökset löydät laitteen mukana toimitetuista ohjeista.

Huomautus SÄILYTÄ NÄMÄ OHJEET

Huomautus Tämä asiakirja on tarkoitettu käytettäväksi yhdessä tuotteen mukana tulleen asennusoppaan kanssa. Katso lisätietoja asennusoppaasta, kokoonpano-oppaasta ja muista mukana toimitetuista asiakirjoista.

Attention **IMPORTANTES INFORMATIONS DE SÉCURITÉ**

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

Remarque CONSERVEZ CES INFORMATIONS

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

Warnung **WICHTIGE SICHERHEITSANWEISUNGEN**

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

Hinweis BEWAHREN SIE DIESE SICHERHEITSANWEISUNGEN AUF

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

Figyelem! **FONTOS BIZTONSÁGI ELÕÍRÁSOK**

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

Megjegyzés ÕRIZZE MEG EZEKET AZ UTASÍTÁSOKAT!

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

Avvertenza **IMPORTANTI ISTRUZIONI SULLA SICUREZZA**

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

Nota CONSERVARE QUESTE ISTRUZIONI

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

Advarsel VIKTIGE SIKKERHETSINSTRUKSJONER

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

Merk TA VARE PÅ DISSE INSTRUKSJONENE

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

Aviso INSTRUÇÕES IMPORTANTES DE SEGURANÇA

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

Nota GUARDE ESTAS INSTRUÇÕES

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

¡Advertencia! INSTRUCCIONES IMPORTANTES DE SEGURIDAD

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

Nota GUARDE ESTAS INSTRUCCIONES

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

Varning! VIKTIGA SÄKERHETSANVISNINGAR

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

OBS! SPARA DESSA ANVISNINGAR

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

Предупреждение ВАЖНЫЕ СВЕДЕНИЯ ПО БЕЗОПАСНОСТИ

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

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

警告 有关安全的重要说明

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

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

警告 安全上の重要な注意事項

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

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

Предупреждение ВАЖНЫЕ СВЕДЕНИЯ ПО БЕЗОПАСНОСТИ

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

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

警告 有关安全的重要说明

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

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

警告 安全上の重要な注意事項

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

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

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 (Mohm).

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.)

Note The PA-A3-IMA port adapter 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.

Compliance Information

The following sections provide compliance information about the PA-A3-IMA.

ITU-T Compliance

ITU-T recommendation G.823 specifies that it is important to restrict jitter gain. Figure 4 of G.823 shows a typical jitter transfer characteristic. (Note that small jitter gain is allowed.)
British Standard 6328: Section 8.1 1990 gives the allowable gain as 0.5 dB. The PA-A3-IMA line mode clocking complies with these sections.

CTR Compliance

The PA-A3-IMA complies with European CTR standards.

CHAPTER 3

Removing and Installing Port Adapters

This chapter describes how to remove the PA-A3-IMA port adapter from the supported platforms and how to install a new or replacement port adapter. This chapter includes the following sections:

- Handling Port Adapters, page 3-1
- Online Insertion and Removal, page 3-2
- Warnings and Cautions, page 3-3
- Port Adapter Removal and Installation, page 3-4
- Connecting the PA-A3-IMA Interface Cables, page 3-14

Handling Port Adapters

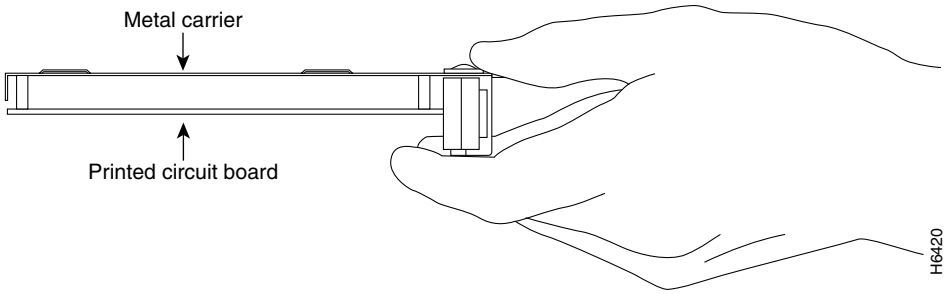
Each port adapter circuit board is mounted to a metal carrier and is sensitive to electrostatic discharge (ESD) damage.

Note When a port adapter is not in use, a blank port adapter must fill the empty slot to allow the router to conform to electromagnetic interference (EMI) emissions requirements, and to allow proper airflow across the 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 port adapter.

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

Caution 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

Several platforms support online insertion and removal (OIR) of port adapters; therefore, you do not have to power down routers when removing and replacing a PA-A3-IMA in the Cisco 7100 series routers, Cisco 7200 series routers, Cisco 7200 VXR routers, Cisco 7201 routers Cisco 7301 router, or Cisco 7401ASR router.

Note PA-A3-8E1 IMA is not supported on the Cisco 7401ASR router.

Although the Cisco 7304 PCI port adapter carrier card, VIP, and FlexWAN module support online insertion and removal, individual port adapters do not. To replace port adapters, you must first remove the Cisco 7304 PCI port adapter carrier card, VIP, or FlexWAN module from the chassis and then install or replace port adapters as required. If a blank port adapter is installed on the Cisco 7304 PCI port adapter carrier card, VIP, or FlexWAN module on which you want to install a new port adapter, you must first remove the Cisco 7304 PCI port adapter carrier card, VIP, or FlexWAN module from the chassis, and then remove the blank port adapter.

Caution To prevent system problems, do not remove port adapters from the Cisco 7304 PCI port adapter carrier card, VIP, or FlexWAN module or attempt to install other port adapters on the motherboard when the system is operating. To install or replace port adapters, first remove the Cisco 7304 PCI port adapter carrier card, VIP, or FlexWAN module from its interface processor slot.

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, OIR administratively shuts down all active interfaces in the module.

OIR allows you to install and replace port 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 port adapter in a supported platform, refer to the "Port Adapter Removal and Installation" section on page 3-4.

Each port adapter has a bus connector that connects it to the router. The 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.

Note Before you begin installation, read Chapter 2, "Preparing for Installation," for a list of parts and tools required for installation.

Warnings and Cautions

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

Caution 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.

Note 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.

Caution 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 illustrations in the "Port Adapter Removal and Installation" section on page 3-4.

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.**

Port Adapter Removal and Installation

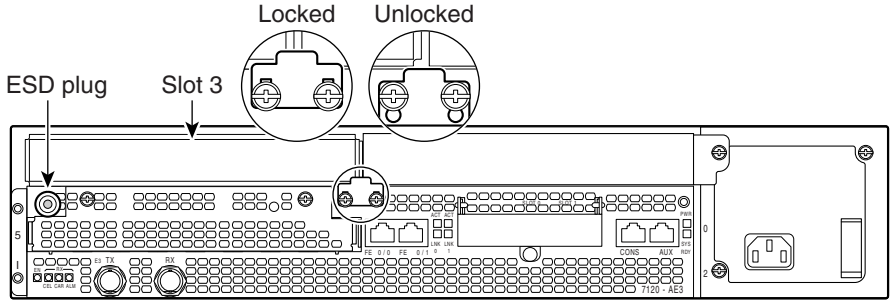
In this section, the illustrations that follow give step-by-step instruction on how to remove and install port adapters. This section contains the following illustrations:

- Cisco 7100 Series Routers—Removing and Installing a Port Adapter, page 3-5
- Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Removing and Installing a Port Adapter, page 3-6
- Cisco 7201 Router—Removing and Installing a Port Adapter, page 3-7
- Cisco 7301 Router—Removing and Installing a Port Adapter, page 3-8
- Cisco 7304 PCI Port Adapter Carrier Card—Removing and Installing a Port Adapter, page 3-9
- Cisco 7401ASR Router—Removing and Installing a Port Adapter, page 3-11
- VIP—Removing and Installing a Port Adapter, page 3-12
- FlexWAN Module—Removing and Installing a Port Adapter, page 3-13

Cisco 7100 Series Routers—Removing and Installing a Port Adapter

Step 1

To remove the port adapter, use a number 2 Phillips screwdriver to loosen the screws on the locking tab. Then slide the tab down to 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

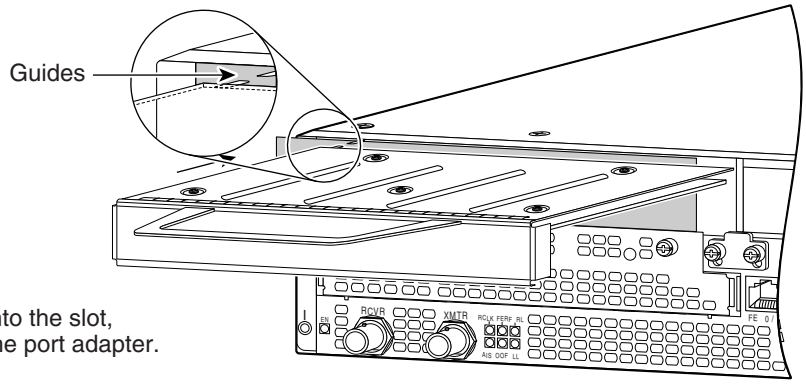
With the port adapter halfway out of the slot, disconnect all cables from the port adapter.

Step 4

After disconnecting the cables, pull the port adapter from its chassis slot.

Step 5

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



Step 6

With the port adapter halfway into the slot, connect all required cables to the port adapter.

Step 7

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 8

After the port adapter is properly seated, lock the port adapter retaining mechanism.

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Cisco 7200 Series Routers and 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

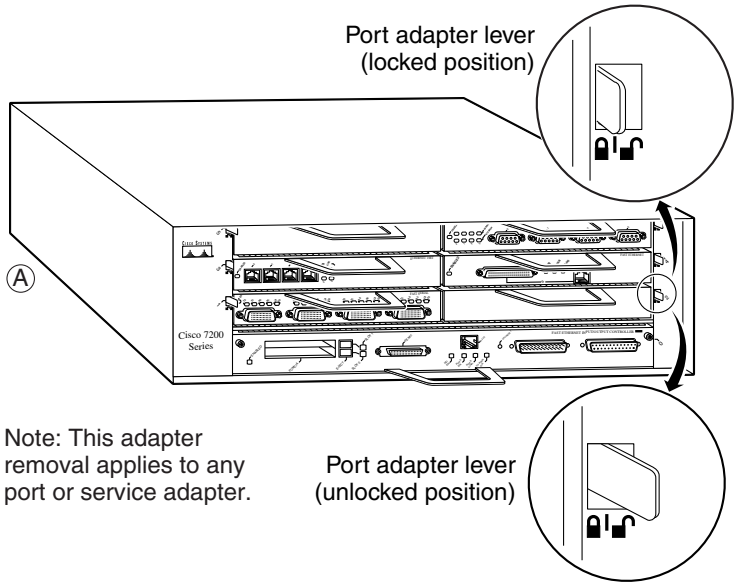
Carefully slide the new port adapter halfway into the port adapter slot. (See B.)

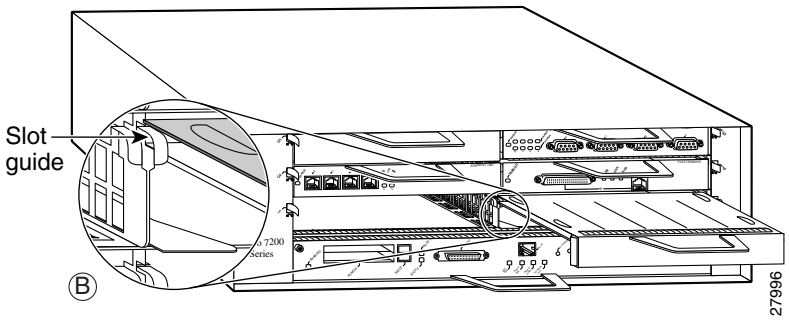
Step 6

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 7201 Router—Removing and Installing a Port Adapter

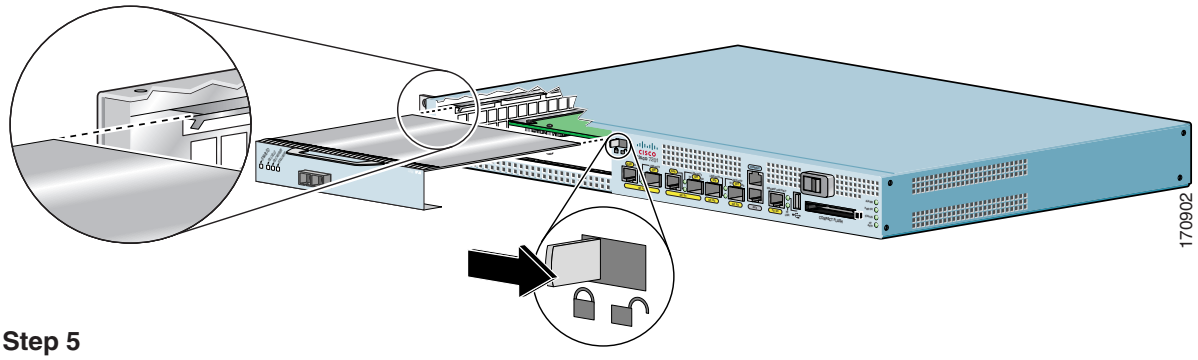
Step 1
Use an ESD wrist strap to ground yourself to the router.

Step 2
To remove the port adapter, place the port adapter lever in the unlocked position. The port adapter lever remains in the unlocked position.

Step 3
Grasp the handle of the port adapter and pull the port adapter 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 4
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 the chassis slot.

Caution
The port adapter must slide into the slot guides close to 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
To insert the port adapter, carefully align the port adapter carrier in the slot guides. Slide the new port adapter halfway into the chassis.

Step 6
Connect all the 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 midplane.

Step 7
After the port adapter is properly seated, lock the port adapter lever.

Cisco 7301 Router—Removing and Installing a Port Adapter

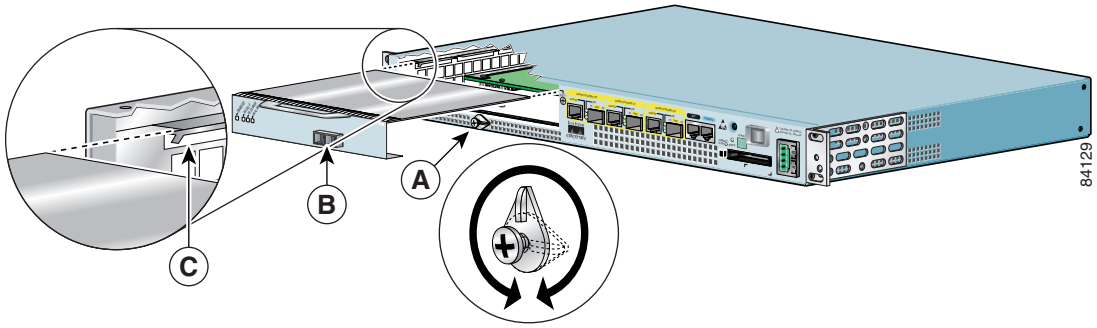
Step 1
Use an ESD wrist strap to ground yourself to the router.

Step 2
To remove a port adapter, use a Phillips screwdriver to turn the screw holding the port adapter latch. The screw should be loose enough to allow the latch to rotate to an unlocked position. (See A.) The latch can rotate 360˚.

Step 3
Grasp the handle and pull the port adapter from the router, about halfway out of its slot. (See B.) If you are removing a blank port adapter, pull the blank port adapter completely out of the chassis slot.

Step 4
With the port adapter halfway out of the slot, diconnect all cables from the port adapter. After disconnecting the cables, pull the port adapter from its chassis slot.

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



Step 5
To insert the port adapter, carefully align the port adapter carrier in the slot guides. (See C.) Slide the new port adapter halfway into the chassis.

Step 6
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 midplane.

Step 7
After the port adapter is properly seated, turn and secure the port adapter latch in the upright, locked position. (See A.) Tighten the screw to ensure the port adapter remains firmly in place.

Cisco 7304 PCI Port Adapter Carrier Card—Removing and Installing a Port Adapter

You can install one single-width port adapter in a Cisco 7304 PCI Port Adapter Carrier Card. This section provides step-by-step instructions for removing and installing a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card.

Warning **When performing the following procedures, wear a grounding wrist strap to avoid ESD damage to the Cisco 7304 PCI Port Adapter Carrier 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.**

To remove and install a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card, refer to Figure 3-2 and do the following:

Step 1 If the Cisco 7304 PCI Port Adapter Carrier Card is still in the router, you must remove the Cisco 7304 PCI Port Adapter Carrier Card before removing a port adapter.

Step 2 To remove the port adapter from the Cisco 7304 PCI Port Adapter Carrier Card, turn the port adapter lock from its locked and horizontal position shown in A of Figure 3-2 to its unlocked and vertical position shown in B of Figure 3-2.

Step 3 Grasp the handle of the port adapter and pull the port adapter from the Cisco 7304 PCI Port Adapter Carrier Card. (You have already disconnected the cables from the port adapter when removing the Cisco 7304 PCI Port Adapter Carrier Card).

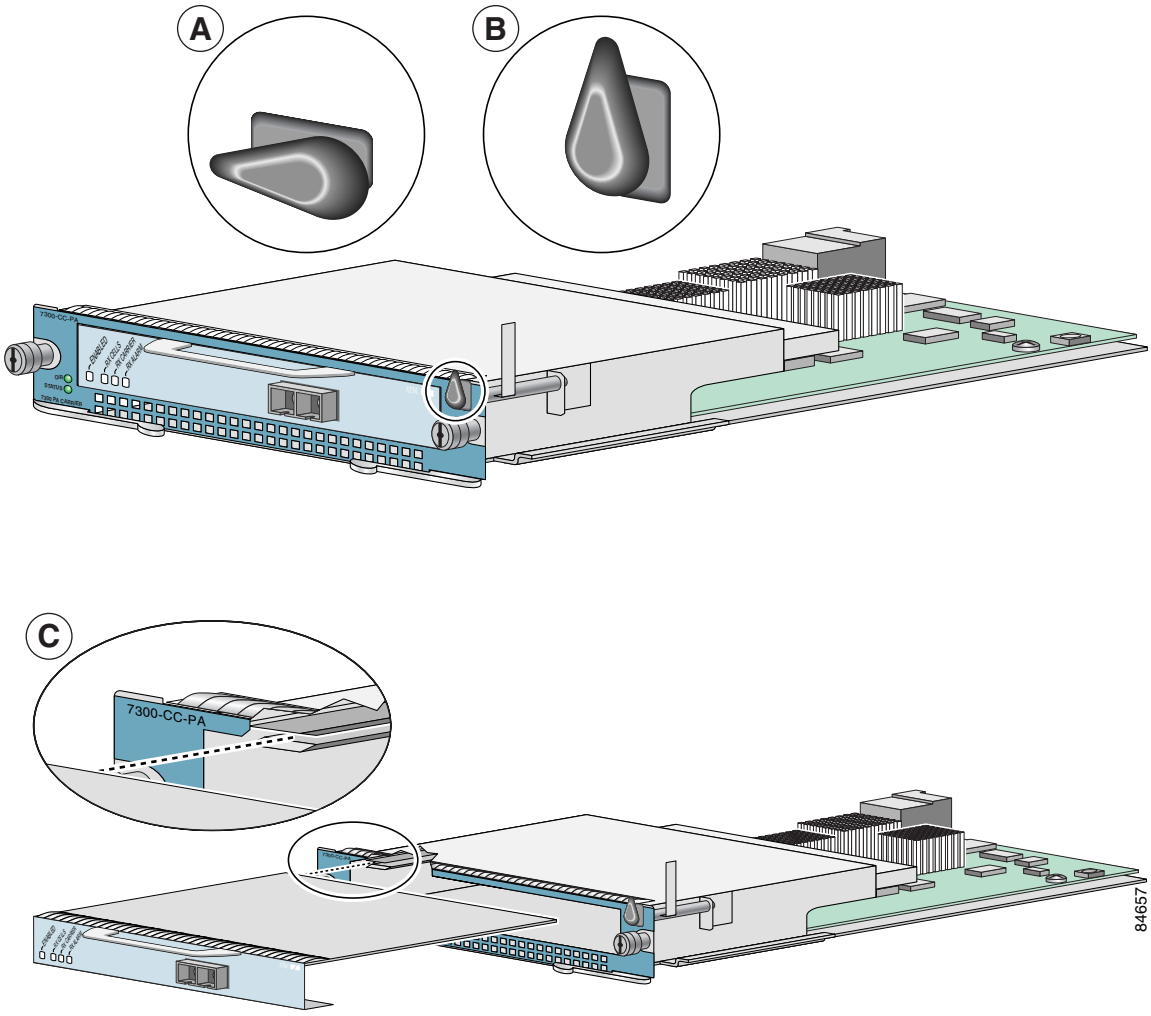
Step 4 To insert the port adapter in the Cisco 7304 PCI Port Adapter Carrier Card, locate the guide rails inside the Cisco 7304 PCI Port Adapter Carrier Card that hold the port adapter in place. They are at the top left and top right of the port adapter slot and are recessed about an inch, as shown in C of Figure 3-2.

Step 5 Carefully slide the port adapter in the Cisco 7304 PCI Port Adapter Carrier Card until the port adapter makes contact with the port adapter interface connector. When fully seated, the port adapter front panel should be flush with the face of the Cisco 7304 PCI Port Adapter Carrier Card.

Step 6 After the port adapter is properly seated, turn the port adapter lock to its locked and horizontal position, as shown in A of Figure 3-2.

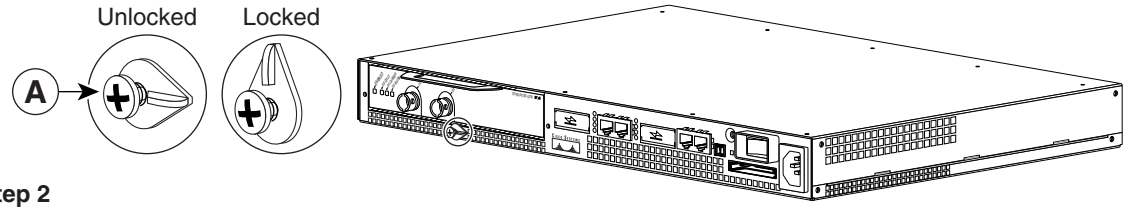
Figure 3-2 illustrates how to remove and install a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card.

Figure 3-2 Cisco 7304 PCI Port Adapter Carrier Card—Port Adapter Removal and Installation



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˚.

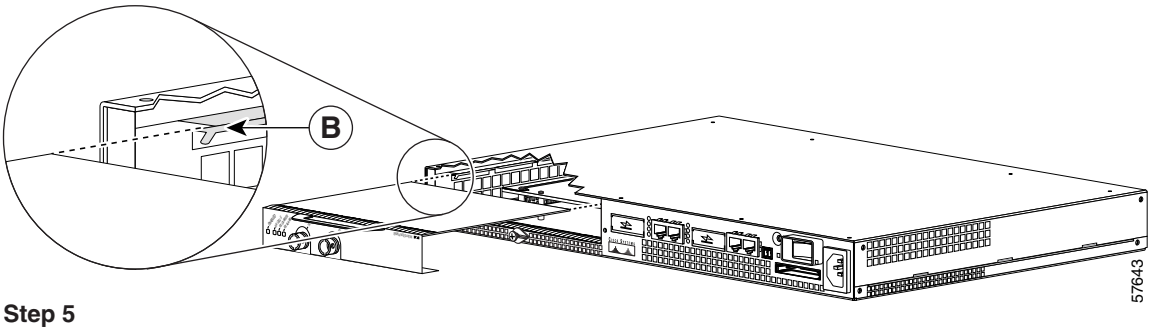


Step 2
Pull the port adapter from the router, about halfway out of its slot. (If you remove a blank port adapter, keep the blank port adapter for use in the router if you should ever remove the port adapter. The port adapter slot must always be filled.)

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 adapter 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.

VIP—Removing and Installing a Port Adapter

Note: You must first remove the VIP from the chassis before removing a port adapter from the VIP.

Step 1

To remove the port adapter, remove the screw that secures the port adapter (or blank port adapter). (See A.)

Step 2

With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its slot, away from the edge connector at the rear of the slot. (See A.)

Step 3

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 4

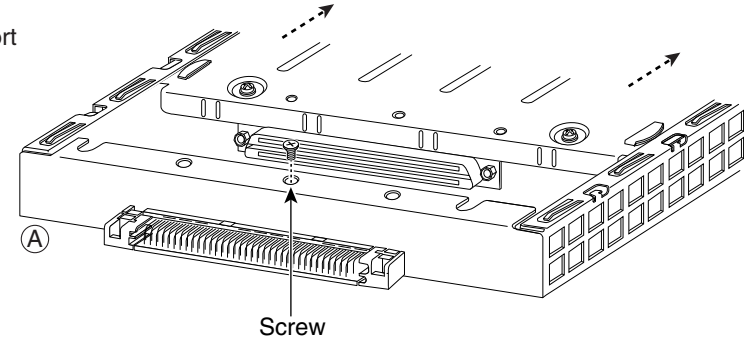
Carefully slide the new port adapter into the port adapter slot until the connector on the port adapter is completely seated in the connector at the rear of the port adapter slot. (See B.)

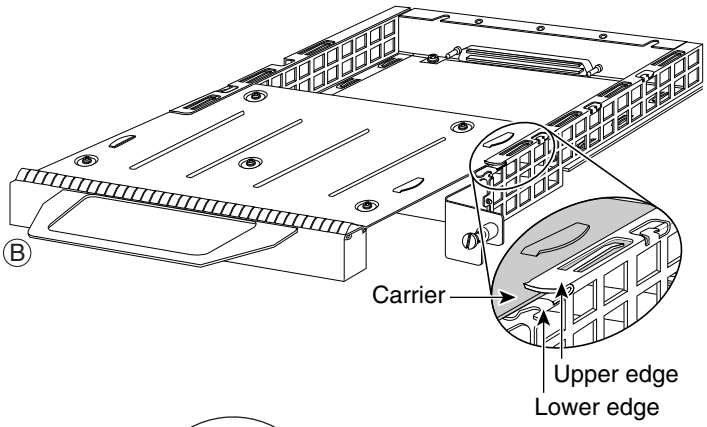
Step 5

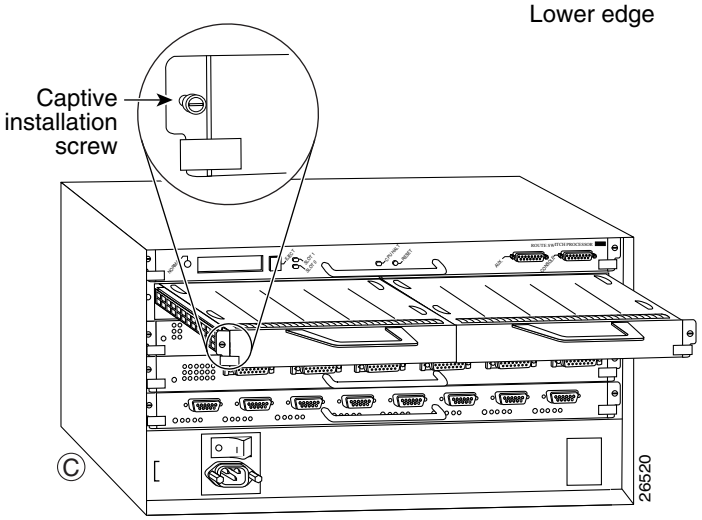
Install the screw in the rear of the port adapter slot on the VIP. Do not overtighten the screw. (See A.)

Step 6

Carefully slide the VIP motherboard into the interface processor slot until the connectors at the rear of the VIP are completely seated in the connectors at the rear of the interface processor slot. Use the ejector levers to seat the VIP in the interface processor slot. Tighten the captive installation screws on the VIP. (See C.)

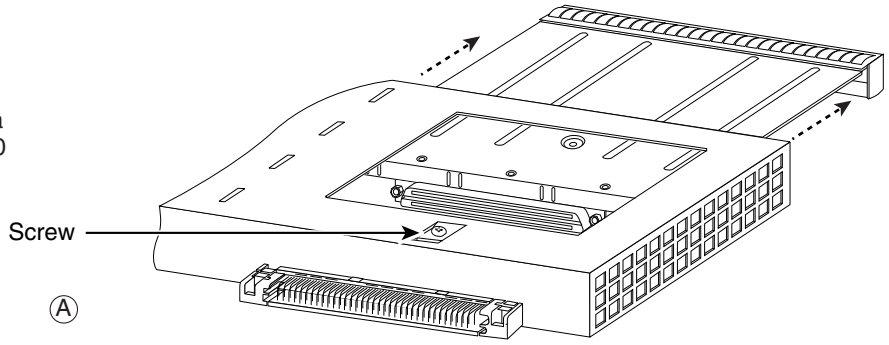






FlexWAN Module—Removing and Installing a Port Adapter

Note: You must first remove the Catalyst 6000 FlexWAN module from the chassis before removing a port adapter from the Catalyst 6000 FlexWAN module.

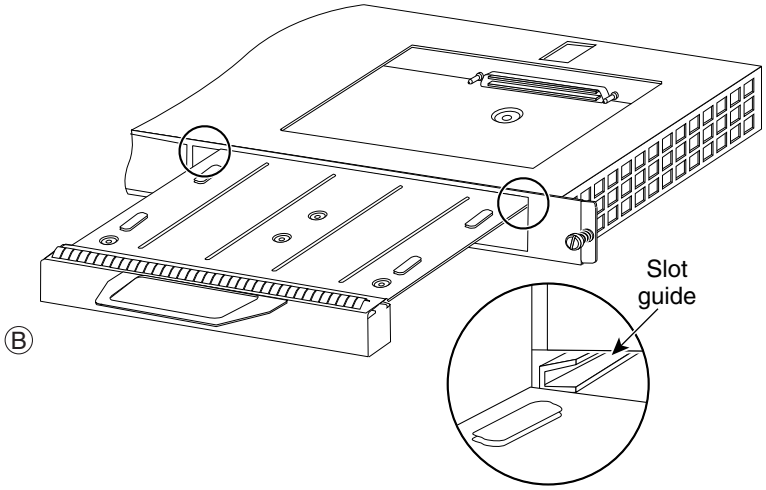


Step 1

To remove the port adapter, remove the screw that secures the port adapter (or blank port adapter). (See A.)

Step 2

With the screw removed, grasp the handle on the front of the port adapter (or blank port adapter) and carefully pull it out of its bay, away from the edge connector at the rear of the bay. (See A.)



Step 3

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

Step 4

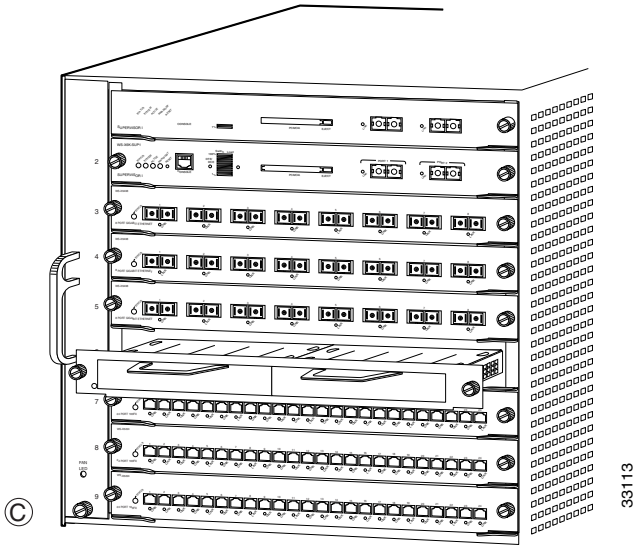
Carefully slide the new port adapter into the port adapter bay until the connector on the port adapter is completely seated in the connector at the rear of the port adapter slot. (See B.)

Step 5

Install the screw in the rear of the port adapter bay. Do not overtighten the screw. (See A.)

Step 6

Reinstall the Catalyst 6000 FlexWAN module in the chassis, and tighten the captive installation screw on each side of the Catalyst 6000 FlexWAN module faceplate. (See C.)



Connecting the PA-A3-IMA Interface Cables

On a single PA-A3-IMA, all eight RJ-45 connections can be used as ATM connections, or a combination of two or more can be used as links in an IMA group. To meet VCCI Class II EMI requirements, you must use foil twisted-pair cables with RJ-45 connectors.

Note Foil twisted-pair cables with RJ-45 connectors are not available from Cisco Systems; they are available from outside commercial cable vendors.

To connect the foil twisted-pair cables to the PA-A3-IMA for use as an ATM interface, follow these steps:

Step 1 Attach the foil twisted-pair cable directly to one of the RJ-45 ports on the PA-A3-IMA.

Step 2 Attach the network end of your foil twisted-pair cable to your external equipment.

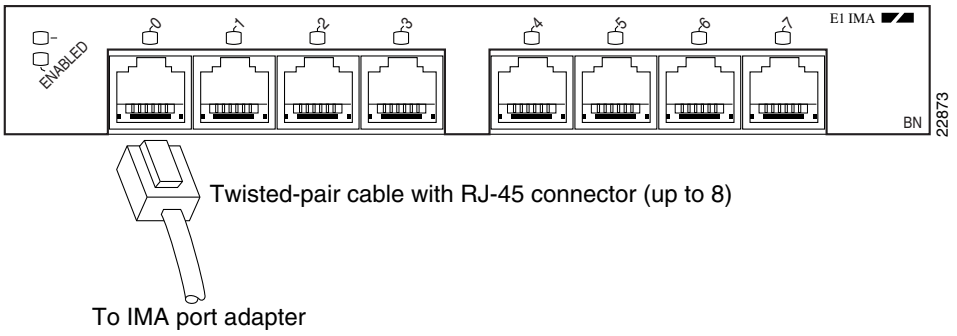
Step 3 Repeat Step 1 and Step 2 for each of the remaining ATM interfaces you want to install.

To connect the foil twisted-pair cables to the PA-A3-IMA as a link in an IMA group, proceed as follows:

Step 1 Configure the IMA groups on both routers. (See the "Configuring Ports on the PA-A3-IMA" section on page 4-10 to determine which ports on the PA-A3-IMA will be connected as IMA links).

Step 2 Attach the foil twisted-pair cable directly to the first RJ-45 port of the PA-A3-IMA that is to be configured as an IMA link in an IMA group. (See Figure 3-3.)

Figure 3-3 Connecting IMA Foil Twisted-Pair Cables



Note Port adapters have a handle attached, but this handle is not shown in Figure 3-3 to allow a full view of the detail on the faceplate.

Step 3 Attach the other end of the foil twisted-pair cable to the first port of the router on the far end of the IMA group.

Step 4 Repeat Step 2 and Step 3 for each of the remaining IMA links in the IMA group.

CHAPTER 4

Configuring the PA-A3-IMA

To continue your PA-A3-IMA port adapter installation, you must configure the IMA interfaces as IMA groups or as individual ATM interfaces. The instructions that follow apply to all supported platforms. Minor differences among the platforms—with Cisco IOS software commands—are noted.

This chapter contains the following sections:

- Using the EXEC Command Interpreter, page 4-1
- Configuring the Interfaces, page 4-2
- Configuring Ports on the PA-A3-IMA, page 4-10
- Configuring ATM Virtual Circuits, page 4-13
- Configuring Permanent Virtual Circuits, page 4-14
- Configuring Switched Virtual Circuits, page 4-16
- Configuring Classical IP and ARP over ATM, page 4-20
- Checking the Configuration, page 4-20

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-mode system prompt (#):

```
Router#
```

Configuring the Interfaces

After you verify that the new PA-A3-IMA is installed correctly (the ENABLED LED goes on), use the privileged-level **configure** command to configure the new interfaces. Be prepared with the information you need, such as the following:

- Protocols you plan to route on each new interface
- IP addresses, if you plan to configure the interfaces for IP routing
- Bridging protocols you plan to use

If you installed a new PA-A3-IMA or if you want to change the configuration of an existing interface, you must enter configuration mode to configure the new interfaces. If you replaced a PA-A3-IMA that was previously configured, the system recognizes the new interfaces and brings each of them up in their existing configurations.

For a summary of the configuration options available and instructions for configuring interfaces on a PA-A3-IMA, refer to the appropriate configuration publications listed in the "Related Documentation" section on page ii.

You execute configuration commands from the privileged level of the EXEC command interpreter, which usually requires password access. Contact your system administrator, if necessary, to obtain password access. (See the "Using the EXEC Command Interpreter" section on page 4-1 for an explanation of the privileged level of the EXEC.)

This section contains the following subsections:

- Shutting Down an Interface, page 4-2
- Performing a Basic Configuration, page 4-7

Shutting Down an Interface

Before you remove an interface cable or remove a port adapter that you will not replace, use the **shutdown** command to shut down (disable) the interfaces to prevent anomalies when you reinstall the new or reconfigured interface processor. When you shut down an interface, it is designated administratively down in the **show** command displays.

Follow these steps to shut down an interface:

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 subcommands, as follows:

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

Step 3 Shut down interfaces by entering the **interface atm** subcommand (followed by the interface address of the interface), and then enter the **shutdown** command.

When you have finished, press **Ctrl-Z**—hold down the **Control** key while you press **Z**—or enter **end** or **exit** to exit configuration mode and return to the EXEC command interpreter.

Table 4-1 shows the **shutdown** command syntax for the supported platforms:

Table 4-1 Syntax of the shutdown Command for the Supported Platforms

Platform	Command	Example

Cisco 7120 series routers	**interface**, followed by the *type* (**atm**) and *slot/port* (port-adapter-slot-number/ interface-port-number)
	
	shutdown
		The example is for interface 0 and interface 1 on a port adapter in port adapter slot 3.
		`Router(config-if)# interface atm 3/0`
		`Router(config-if)# shutdown`
		`Router(config-if)# interface atm 3/1`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

Cisco 7140 series routers	**interface**, followed by the *type* (**atm**) and *slot/port* (port-adapter-slot-number/ interface-port-number)
	
	shutdown
		The example is for interface 0 and interface 1 on a port adapter in port adapter slot 4.
		`Router(config-if)# interface atm 4/0`
		`Router(config-if)# shutdown`
		`Router(config-if)# interface atm 4/1`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

Cisco 7200 series and Cisco 7200 VXR routers	**interface**, followed by the *type* (**atm**) and *slot/port* (port-adapter-slot-number/ interface-port-number)
	
	shutdown
		The example is for interface 0 and interface 1 on a port adapter in port adapter slot 6.
		`Router(config-if)# interface atm 6/0`
		`Router(config-if)# shutdown`
		`Router(config-if)# interface atm 6/1`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

Cisco 7201 router	**interface**, followed by the *type* (**atm**) and *slot/port* (port-adapter-slot-number/ interface-port-number)
	
	shutdown
		The example is for interface 0 and interface 1 on a port adapter in slot 1.
		`Router(config)# interface atm 1/0`
		`Router(config-if)# shutdown`
		`Router(config-if)# interface atm 1/1`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

Cisco 7301 router	**interface**, followed by the *type* (**atm**) and *slot/port* (port-adapter-slot-number/ interface-port-number)
	
	shutdown
		The example is for interface 0 and interface 1 on a port adapter in slot 1.
		`Router(config)# interface atm 1/0`
		`Router(config-if)# shutdown`
		`Router(config-if)# interface atm 1/1`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	**interface**, followed by the *type* (**atm**) and *slot/port* (module-slot-number/ interface-port-number)
	
	shutdown
		The example is for interface 0 on a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card in module slot 3 of a Cisco 7304 router.
		`Router(config-if)# interface atm 3/0`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

Table 4-1 Syntax of the shutdown Command for the Supported Platforms (continued)

Platform	Command	Example

Cisco 7401ASR router	**interface**, followed by the *type* (**atm**) and *slot/port* (port-adapter-slot-number/ interface-port-number)
	
	shutdown
		The example is for interface 0 and interface 1 on a port adapter in slot 1.
		`Router(config)# interface atm 1/0`
		`Router(config-if)# shutdown`
		`Router(config-if)# interface atm 1/1`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

VIP in Cisco 7500 series routers	**interface atm** followed by *slot/port adapter/port* (interface-processor-slot-number/ port-adapter-slot-number/ interface-port-number)
	
	shutdown
		The example is for interface 0 in port adapter slot 1 of a VIP installed in interface processor slot 1.
		`Router(config-if)# interface atm 1/1/0`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

FlexWAN module in Catalyst 6000 family switches and Cisco 7600 series Internet Routers	**interface atm** followed by *mod/bay/port* (module-slot-number/ port-adapter-bay-number/ interface-port-number)
	
	shutdown
		The example is for interface 0 in port adapter bay 0 of a FlexWAN module installed in slot 3.
		`Router(config-if)# interface atm 3/0/0`
		`Router(config-if)# shutdown`
		`Ctrl-Z`
		`Router#`

Note If you need to shut down additional interfaces, enter the **interface atm** command (followed by the interface address of the interface) for each of the interfaces on your port adapter. Use the **no shutdown** command to enable the interface.

Step 4 Write the new configuration to NVRAM as follows:

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

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

Step 5 Verify that the new interfaces are now in the correct state (shut down) using the **show interfaces** command (followed by the interface type and interface address of the interface) to display the specific interface.

Table 4-2 provides examples of the **show interfaces atm** command for the supported platforms.

Table 4-2 Examples of the show interfaces atm Command for the Supported Platforms

Platform	Command	Example

Cisco 7120 series routers	**show interfaces atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 3.
		`Router# show interfaces atm 3/0`
		`ATM 3/0 is administratively down, line protocol is down`
		`[Additional display text omitted from this example]`

Cisco 7140 series routers	**show interfaces atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 4.
		`Router# show interfaces atm 4/0`
		`ATM 4/0 is administratively down, line protocol is down`
		`[Additional display text omitted from this example]`

Cisco 7200 series and Cisco 7200 VXR routers	**show interfaces atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 6.
		`Router# show interfaces atm 6/0`
		`ATM 6/0 is administratively down, line protocol is down`
		`[Additional display text omitted from this example]`

Cisco 7201 router	**show interfaces atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 1.
		`Router# show interfaces atm 1/0`
		`ATM 1/0 is administratively down, line protocol is down`
		`[Additional display text omitted from this example]`

Cisco 7301 router	**show interfaces atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 1.
		`Router# show interfaces atm 1/0`
		`ATM 1/0 is administratively down, line protocol is down`
		`[Additional display text omitted from this example]`

Table 4-2 Examples of the show interfaces atm Command for the Supported Platforms (continued)

Platform	Command	Example

Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	**show interfaces atm**, followed by *slot/port* (module-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card in module slot 3 of a Cisco 7304 router.
		`Router(config-if)# show interfaces atm 3/0`
		
		`ATM 3/0 is administratively down, line protocol is down`
		
		`[Additional display text omitted from this example]`

Cisco 7401ASR router	**show interfaces atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for interface 0 on a port adapter in port adapter slot 1.
		`Router# show interfaces atm 1/0`
		
		`ATM 1/0 is administratively down, line protocol is down`
		
		`[Additional display text omitted from this example]`

VIP in Cisco 7500 series routers	**show interfaces atm**, followed by *slot/port adapter/port* (interface-processor-slot-number/ port-adapter-slot-number/ interface-port-number)	The example is for interface 0 in port adapter slot 1 of a VIP in interface processor slot 1.
		`Router# show interfaces atm 1/1/0`
		
		`ATM 1/1/0 is administratively down, line protocol is down`
		
		`[Additional display text omitted from this example]`

FlexWAN module in Catalyst 6000 family switches and Cisco 7600 series Internet Routers	**show interfaces atm**, followed by *mod/bay/port* (module-slot-number/ port-adapter-bay-number/ interface-port-number)	The example is for interface 0 in port adapter bay 0 of a FlexWAN module installed in slot 3.
		`Router# show interfaces atm 3/0/0`
		
		`ATM 3/0/0 is administratively down, line protocol is down`
		
		`[Additional display text omitted from this example]`

Step 6 Re-enable interfaces by doing the following:

a. Repeat Step 3 to re-enable an interface. Substitute the **no shutdown** command for the **shutdown** command.

b. Repeat Step 4 to write the new configuration to memory.

c. Repeat Step 5 to verify that the interfaces are in the correct state. Use the **show interfaces** command followed by the interface type and interface address of the interface.

For complete descriptions of software configuration commands, refer to the publications listed in the "Related Documentation" section on page ii.

Performing a Basic Configuration

Following are instructions for a basic configuration. You might also need to enter other configuration subcommands, depending on the requirements for your system configuration and the protocols you plan to route on the interface. For complete descriptions of configuration subcommands and the configuration options available for ATM interfaces, refer to the appropriate software documentation.

In the following procedure press the **Return** key after each step unless otherwise noted. At any time you can exit the privileged level and return to the user level by entering **disable** at the prompt, as follows:

```
Router# disable

Router>
```

Step 1 Enter configuration mode and specify that the console terminal is the source of the configuration subcommands, as follows:

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

Step 2 Specify the first interface to configure by entering the **interface atm** subcommand, followed by the interface address of the interface you plan to configure.

Table 4-3 provides examples of the **interface atm** subcommand for the supported platforms.

Table 4-3 Examples of the interface atm Subcommand for the Supported Platforms

Platform	Command	Example

Cisco 7120 series routers	**interface atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 3.
		`Router(config)# interface atm 3/0`
		`Router(config-if)#`

Cisco 7140 series routers	**interface atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 4.
		`Router(config)# interface atm 4/0`
		`Router(config-if)#`

Cisco 7200 series routers and Cisco 7200VXR routers	**interface atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 6.
		`Router(config)# interface atm 6/0`
		`Router(config-if)#`

Cisco 7201 router	**interface atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 1.
		`Router(config)# interface atm 1/0`
		`Router(config-if)#`

Table 4-3 Examples of the interface atm Subcommand for the Supported Platforms (continued)

Platform	Command	Example

Cisco 7301 router	**interface atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 1.
		`Router(config)# interface atm 1/0`
		`Router(config-if)#`

Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	**interface atm**, followed by *slot/port* (module-slot-number/ interface-port-number)	The example is for the first interface on a port adapter in a Cisco 7304 PCI Port Adapter Carrier Card in module slot 3 of a Cisco 7304 router.
		`Router(config-if)# interface atm 3/0`
		`Router(config-if)#`

Cisco 7401ASR router	**interface atm**, followed by *slot/port* (port-adapter-slot-number/ interface-port-number)	The example is for the first interface of a port adapter in port adapter slot 1.
		`Router(config)# interface atm 1/0`
		`Router(config-if)#`

VIP in Cisco 7500 series routers	**interface atm**, followed by *slot/port adapter/port* (interface-processor-slot-number/ port-adapter-slot-number/ interface-port-number)	The example is for the interface in port adapter slot 1 of a VIP in interface processor slot 1.
		`Router(config)# interface atm 1/1/0`
		`Router(config-if)#`

FlexWAN module in Catalyst 6000 family switches and Cisco 7600 series Internet Routers	**interface atm** followed by *mod/bay/port* (module-slot-number/ port-adapter-bay-number/ interface-port-number)	The example is for the first interface in port adapter bay 0 of a FlexWAN module installed in slot 3.
		`Router(config-if)# interface atm 3/0/0`
		`Router(config-if)#`

Note When the PA-A3-IMA port adapter comes up for the first time, all ports come up in ATM UNI mode.

Step 3 Assign an IP address and subnet mask to the interface (if IP routing is enabled on the system) by using the **ip address** subcommand, as in the following example:

```
Router(config-if)# ip address 10.0.0.10 255.255.255.0
```

Step 4 Add any additional configuration subcommands required to enable routing protocols and set the interface characteristics.

Step 5 Configure the port for the type of framing used by entering the **framing** configuration command. The following example sets the framing type of a T1 port to Extended Superframe (ESF):

```
Router(config-if)# framing esf
```

The following example sets the framing type of an E1 port to CRC4:

```
Router(config-if)# framing crc4
```

The default is ESF for T1 ports and pcm30adm for E1 ports.

Step 6 Configure transmit attenuation and cable length for applicable T1 links using the **lbo** configuration command. The following example sets the cable length to long and the gain to 26 dB, with a –15 dB pulse:

```
Router(config-if)# lbo long gain26 -15db
```

Note Each T1 port can operate in long-haul or short-haul mode. In long-haul mode, the user must specify the gain and the line build-out. The default value is long-haul with gain 26 dB and 0 dB line build-out. In short-haul mode, the user must specify the cable length in feet. The range is from 0 to 655 feet. The actual mapping is shown in Table 4-4 below.

Table 4-4 Mapping of Cable Length Values to Range

Cable Length Range	Value
0 to 133 ft. (0 to 39.9 m)	133
133 to 266 ft. (39.9 to 79.8 m)	266
266 to 399 ft. (79.8 to 119.7 m)	399
399 to 533 ft. (119.7 to 159.9 m)	533
533 to 655 ft. (159.9 to 196.5 m)	655

Step 7 Set the clock source of the port using the **clock source** command. The default value is line. The example below shows the clock source being set to internal:

```
Router(config-if)# clock source internal
```

Step 8 Set the line code of the port using the **linecode** command. The example below sets the line code of a T1 port to alternate mark inversion (AMI):

```
Router(config-if)# linecode ami
```

The default values are b8zs for T1 and hdb3 for E1.

Step 9 On T1 ports with ESF framing, use the **fdl** command to enable Facility Data Link (FDL) performance reporting. The default value is no fdl. The example below selects ANSI T1.403 for Facility Data Link support.

```
Router(config-if)# fdl ansi
```

Step 10 On E1 ports, set the national and international reserve bits using the **national reserve** command as in the example below:

```
Router(config-if)# national reserve 0 1 1 1 1 0
```

The default values are 1 1 1 1 1 1 1.

Step 11 To enable cell payload scrambling, use the **scrambling** command. The default value is no scrambling.

```
Router(config-if)# scrambling cell-payload
```

Step 12 Set the maximum transmission unit (MTU) size. The range is 64 through 9188 bytes. The default is 4470 bytes. Use the **mtu** command in interface configuration mode to change the maximum MTU packet size, as shown in the following example:

```
Router(config-if)# mtu 5260
```

Step 13 Change the shutdown state to up and enable the interface:

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

Step 14 Repeat Step 2 through Step 12 to configure additional interfaces as required.

Note You do not have to perform Step 5 through Step 12 for each port if the default values are acceptable.

Step 15 When you have included all of the configuration subcommands to complete the configuration, press **Ctrl-Z** to exit configuration mode.

Step 16 Write the new configuration to NAVRAM:

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

Configuring Ports on the PA-A3-IMA

Each port on the PA-A3-IMA can be configured in one of two ways:

- As an independent T1/E1 ATM port, with all the properties of existing ATM interfaces on the platform.
- As an IMA link (a single port in an IMA group). (See the "Creating an IMA Group" section on page 4-11 for information on creating IMA links.)

Note When a port is configured as an IMA link, it no longer has ATM functionality; that is, it can no longer be configured with the standard ATM configuration commands.

The PA-A3-IMA can be configured with as many as four IMA groups. An IMA group works by inverse multiplexing an ATM cell stream over the multiple physical links of the group and recombining the cells into a single stream at the other end of the connection. The ATM cells are distributed in a round robin fashion over the physical links of the IMA group, demultiplexed at the receiving IMA group, and passed in their original form to the ATM layer. The combined links of an IMA group provide the approximate bandwidth of the sum of the individual link rates.

The following sections include steps for configuring and customizing IMA groups:

- Creating an IMA Group, page 4-11
- Configuring IMA Group Parameters, page 4-12

An IMA group can function with some of the IMA links disabled. The minimum number of active IMA links needed before the IMA group fails can be set using the **ima active-links-minimum** command in interface configuration mode. See the "Setting the Minimum Number of Active Links" section on page 4-13 for an example of this command.

Creating an IMA Group

Create IMA groups by assigning individual IMA ports to the same IMA group number. This defines the port as an IMA link. Use the **interface atm** command, followed by the **ima-group** *number* command in configuration mode to define an IMA link.

The example below shows the sequence of commands used to define the first five ports (ports 0 to 4) of the PA-A3-IMA located in slot 1 as IMA links in IMA group number 1, and the last three ports (ports 5 to 7) as IMA links in IMA group number 2:

```
Router(config)# interface atm 1/0
Router(config-if)# ima-group 1
Router(config-if)# no shutdown
Router(config-if)# exit

Router(config)# interface atm 1/1
Router(config-if)# ima-group 1
Router(config-if)# no shutdown
Router(config-if)# exit

Router(config)# interface atm 1/2
Router(config-if)# ima-group 1
Router(config-if)# no shutdown
Router(config-if)# exit


Router(config)# interface atm 1/3
Router(config-if)# ima-group 1
Router(config-if)# no shutdown
Router(config-if)# exit

Router(config)# interface atm 1/4
Router(config-if)# ima-group 1
Router(config-if)# no shutdown
Router(config-if)# exit

Router(config)# interface atm 1/5
Router(config-if)# ima-group 2
Router(config-if)# no shutdown
Router(config-if)# exit

Router(config)# interface atm 1/6
Router(config-if)# ima-group 2
Router(config-if)# no shutdown
Router(config-if)# exit

Router(config)# interface atm 1/7
Router(config-if)# ima-group 2
Router(config-if)# no shutdown
Router(config-if)# exit
```

After assigning each port on the PA-A3-IMA to an IMA group, create IMA groups by using the **interface atm** command with the *ima group number* option as follows:

```
Router(config)# interface atm 1/ima1
Router(config-if)# no shutdown

Router(config)# interface atm 1/ima2
Router(config-if)# no shutdown
```

A maximum of four IMA groups can be created for each PA-A3-IMA. When T1 or E1 ports are assigned to an IMA group, the connecting side (remote end) should also be in the IMA mode of operation. T1 or E1 links that are not assigned to any IMA group will function as standard ATM UNI ports.

Note Use the **no ima-group** command to delete a link from an IMA group.

Configuring IMA Group Parameters

The following commands set the clock mode, maximum differential delay, frame length, and minimum number of active IMA links allowed in the IMA group. These commands are all entered from interface configuration mode. The examples below show the PA-A3-IMA in port adapter slot 1, interface port 1 in IMA group 1.

Setting the Clock Mode

The transmit clock mode determines how the individual IMA links in a group are clocked. To set the transmit clock mode for the IMA group, use the **ima clock-mode** command. The **ima clock-mode** command arguments are as follows:

- **common**—In common mode, all IMA links share a common clock source. When you use a common source, you must enter the number of the IMA link that is to be the clock source.
- **independent**—In independent mode, individual IMA links are clocked independently of one other.

The following example shows that IMA link 2 is to be the clock source for all IMA links:

```
Router(config)# interface atm 1/ima1
Router(config-if)# ima clock-mode common 2
```

Note If Common Transmit Clock (CTC) is configured on an IMA interface using the **ima clock-mode common** *port* command, the port adapter's internal clock will be used as the transmit clock source for all the links of that IMA interface.

Setting the Maximum Differential Delay

The **ima differential-delay-maximum** command sets the maximum delay allowed between the reception of packets from adjacent IMA links on the receiving end. When this delay is exceeded, the data stream cannot be reconstructed correctly.

The following example shows the maximum differential delay being set to 75 milliseconds:

```
Router(config)# interface atm 1/ima1
Router(config-if)# ima differential-delay-maximum 75
```

Setting the Frame Length

The **ima frame-length** command sets the number of cells in the packets sent over the IMA links.

The following example shows the size of the packet being set to 128:

```
Router(config)# interface atm 1/ima1
Router(config-if)# ima frame-length 128
```

Setting the Minimum Number of Active Links

An IMA group can function with some of the IMA links disabled. Set the minimum number of active IMA links needed before the IMA group fails, using the **ima active-links-minimum** command in interface configuration mode.

The following example shows the minimum number of active links being set to 5:

```
Router(config-if)# ima active-links-minimum 5
```

Note The IMA group interface is automatically restarted whenever the clock mode, maximum differential delay, frame length, or minimum number of active links is modified.

Configuring ATM Virtual Circuits

A virtual circuit (VC) is a point-to-point connection between remote hosts and routers. A VC is established for each ATM end node with which the router communicates. The characteristics of the VC are established when the VC is created and include the following:

- Quality of service (QoS)
- ATM adaptation layer 5 (AAL5)
- Encapsulation type (logical link control [LLC], Subnetwork Access Protocol [SNAP], Integrated Local Management Interface [ILMI], multiplexer [MUX], Network Level Protocol ID [NLPD], and Q.2931 Signaling AAL [QSAAL])

When you assign class of service to a VC for QoS management, the following default priority levels apply:

- OAM (Operation, Administration, and Maintenance) and signaling (highest level)
- nrt-VBR (non-real-time variable bit rate)
- Unspecified bit rate (UBR), ILMI (lowest level)

Each VC supports the following router functions:

- Multiple protocols (AppleTalk, connectionless network service [CLNS], DECnet, Internet Protocol [IP], Internetwork Packet Exchange [IPX], virtual integrated network service [VINES], and Xerox network systems [XNS])
- Fast switching of IP packets
- Optimum, flow, and Cisco Express Forwarding (CEF) switching of IP packets
- Pseudobroadcast support for multicast packets

Fast switching is the default on all PA-A3-IMA interfaces. All switching features can be turned off with interface configuration commands. Optimum, flow, or CEF switching must be explicitly enabled for each interface.

Configuring Permanent Virtual Circuits

To use a permanent virtual circuit (PVC), you must configure the PVC in both the router and the ATM switch. PVCs remain active until the circuit is removed from either configuration.

When a PVC is configured, all of the configuration options are passed on to the PA-A3-IMA. You can write these PVCs into nonvolatile RAM (NVRAM); they are used when the system image is reloaded.

Some ATM switches might have point-to-multipoint PVCs that do the equivalent of broadcasting. If a point-to-multipoint PVC exists, it can be used as the sole broadcast PVC for all multicast requests.

To configure a PVC, you first create a PVC and then map a protocol address to it, as described in the following sections:

- Creating a PVC, page 4-14
- Mapping a Protocol Address to a PVC, page 4-15

Creating a PVC

To create a PVC on the PA-A3-IMA interface, use the **atm pvc** *vcd vpi vci aal-encap* [*{peak} {average} {burst}*] [**oam** *{seconds}*] [*{***inarp** *{minutes}}*] command in interface configuration mode, where the command arguments are as follows:

- ***vcd***—The virtual circuit descriptor unique number.

  When you create any PVC, you create a virtual circuit descriptor (VCD) and attach it to the virtual path identifier (VPI) and virtual channel identifier (VCI). A VCD is a PA-A3-IMA-specific mechanism that identifies to the PA-A3-IMA the VPI-VCI pair to be used for a particular packet. The PA-A3-IMA requires this feature in order to manage the packets for transmission. The number chosen for the VCD is independent of the VPI-VCI pair used.
- ***vpi***—The ATM network VPI to use for this VC in the range of 0 through 255.
- ***vci***—The ATM network VCI to use for this VC in the range of 0 through 65,535.
- ***aal-encap***—The encapsulation type to use on this VC. Use one of the following:
  - aal5mux: AAL5 + MUX encapsulation. A protocol type must be specified. A protocol type compatible with the MUX is required.
  - aal5snap: AAL5 + LLC/SNAP encapsulation. This type precedes the protocol datagram.
  - ilmi: Used to set up communication with the Integrated Local Management Interface (ILMI).
  - qsaal: Q.2931 Signaling AAL.
- ***peak***—(Optional) The maximum rate, in kilobits per second, at which this VC can transmit.
- ***average***—(Optional) The average rate, in kilobits per second, at which this VC transmits. If you set this value, you must also specify a value for the *peak* and *burst* arguments.
- ***burst***—(Optional) Burst cell size; an integer value, in the range 1 through 64,000. This value is the maximum number of ATM cells that the virtual circuit can transmit to the network at the peak rate of the PVC.
- **oam** *seconds*—(Optional) Specifies how often to generate an OAM F5 loopback cell from this virtual circuit. The default value is 10 seconds.
- **inarp** *minutes*—(Optional) Specifies how often inverse ARP datagrams are sent on this virtual circuit. The default value is 15 minutes.

The **atm pvc** command creates *PVC n* and attaches the PVC to *VPI* and *VCI*. When you create any PVC, you also specify the ATM adaptation layer (AAL) and encapsulation. The AAL used is specified by *aal* and encapsulation by *encap*.

The *peak* and *average* rate selection values are specified in kilobits per second. Omitting the *peak* and *average* values causes the PVC and those values to default to the line rate, with the *peak* and *average* values being equal.

You can configure the PVC for communication with ILMI. Doing so enables the router to receive Simple Network Management Protocol (SNMP) traps and new network prefixes. Refer to the *Wide-Area Networking Configuration Guide* on Cisco.com for details.

You can also configure the PVC to send Operation, Administration, and Maintenance (OAM) F5 loopback cells, which verify connectivity on the virtual circuit. The remote end must respond by echoing back such cells.

The following example creates a PVC on interface port 0 with a PA-A3-IMA in a Cisco 7200 series router port adapter slot 2 with VPI 0 and VCI 6. The PVC uses AAL AAL5-MUX with IP.

```
Router(config-if)# interface atm 2/0
Router(config-if)# atm pvc 1 0 6 aal5mux ip
```

Mapping a Protocol Address to a PVC

This section describes the procedure for mapping a protocol address to a PVC, which is a required task if you are configuring a PVC. The ATM interface supports a static mapping scheme that identifies the ATM addresses of remote hosts or routers. An address is specified as a virtual circuit descriptor (VCD) for a PVC (or a network services access point [NSAP] address for switched virtual circuit operation).

You enter mapping commands as groups. You first create a map list and then associate it with an interface. Begin the following task steps in global configuration mode:

Step 1 Create a map list by naming it, and enter map-list configuration mode:

```
Router(config)# map-list name
```

Step 2 Associate a protocol and an address to a specific virtual circuit:

```
Router(config)# protocol protocol-address atm-vc vcd [broadcast]
```

Step 3 Associate a protocol and an address to a different virtual circuit:

```
Router(config)# protocol protocol-address atm-vc vcd [broadcast]
```

Step 4 Specify an ATM interface and enter interface configuration mode:

```
Router(config)# interface atm slot/port (or processor-slot/port-adapter-slot/port for a
VIP)
```

Step 5 Create a PVC:

```
Router(config-if)# atm pvc vcd vpi vci aal-encap [{peak} {average} {burst}] [oam {seconds}]
[{inarp {minutes}}]
```

Step 6 Associate a map list to an interface:

```
Router(config-if)# map-group name
```

A map list can contain multiple map entries, as Step 2 and Step 3 in the preceding task table illustrate. The **broadcast** keyword specifies that this map entry is to be used when the corresponding protocol sends broadcast packets to the interface (for example, any network routing protocol updates). If you do not specify **broadcast**, the ATM software is prevented from sending routing protocol updates to the remote hosts.

If you do specify **broadcast** but do *not* set up point-to-multipoint signaling, pseudobroadcasting is enabled. To eliminate pseudobroadcasting and set up point-to-multipoint signaling on virtual circuits configured for broadcasting, refer to the *Wide-Area Networking Configuration Guide* on Cisco.com.

When the map list is complete, you associate it with an ATM interface by using the *name* argument (see Step 6).

You can create multiple map lists and associate them with one ATM interface only. You must create different map lists to associate with different interfaces.

For further information on configuring the IMA port adapter for PVCs, refer to the *Wide-Area Networking Configuration Guide* on Cisco.com.

Configuring Switched Virtual Circuits

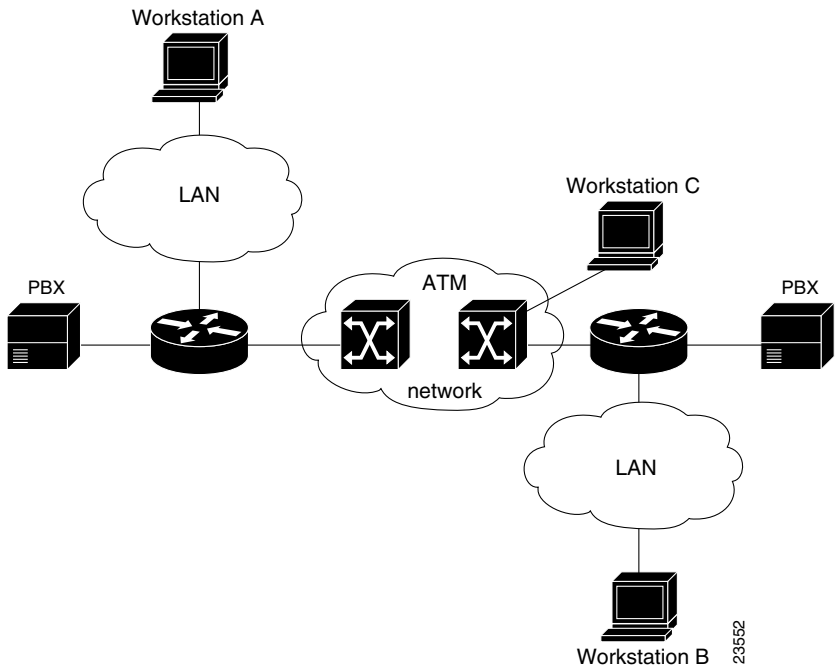
ATM switched virtual circuit (SVC) service operates much like X.25 SVC service, although ATM allows much higher throughput. Virtual circuits are created and released dynamically, providing user bandwidth on demand. This service requires a signaling protocol between the router and the switch.

The ATM signaling software provides a method of dynamically establishing, maintaining, and clearing ATM connections at the User-Network Interface (UNI). The ATM signaling software conforms to the ATM Forum UNI 3.0 specification.

In UNI mode, the user is the router, and the network is an ATM switch. This is an important distinction. The Cisco router does not perform ATM-level call routing. Instead, the ATM switch does the ATM call routing, and the router routes packets through the resulting circuit. The router is viewed as the user and the LAN interconnection device at the end of the circuit, and the ATM switch is viewed as the network.

Figure 4-1 illustrates the router position in a basic ATM environment. The router is used primarily to interconnect LANs through an ATM network. Workstation C in Figure 4-1 is connected directly to the destination ATM switch. You can connect not only routers to ATM switches, but also any computer with an ATM interface that conforms to the ATM Forum UNI specification.

Figure 4-1 Basic ATM Environment



To use SVCs, you first configure the PVC that performs SVC call setup and then configure the network service access point address, as described in the following sections:

- Configuring the PVC That Performs SVC Call Setup, page 4-17
- Configuring the Network Service Access Point Address, page 4-18

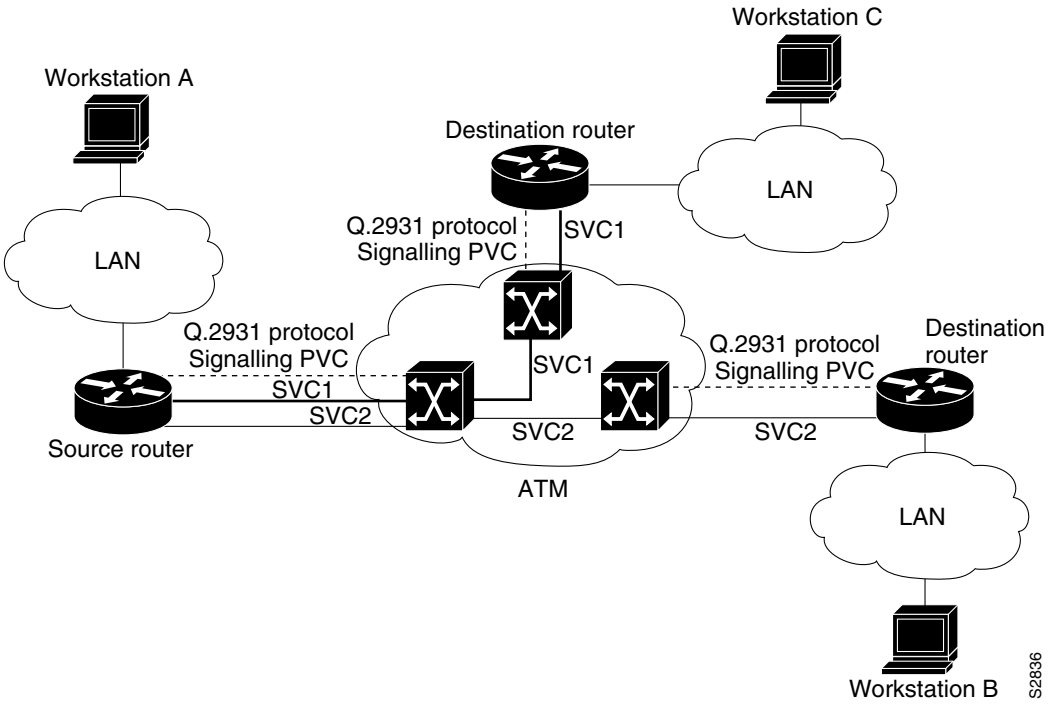
For further information on configuring the IMA port adapter for SVCs, refer to the *Wide-Area Networking Configuration Guide* on Cisco.com.

Configuring the PVC That Performs SVC Call Setup

Unlike X.25 service, which uses in-band signaling (connection establishment done on the same circuit as data transfer), ATM uses out-of-band signaling. One dedicated PVC exists between the router and the ATM switch, over which all SVC call establishment and call termination requests flow. After the call is established, data transfer occurs over the SVC, from router to router. The signaling that accomplishes the call setup and teardown is called *Layer 3 signaling* or the *Q.2931 protocol*.

For out-of-band signaling, a signaling PVC must be configured before any SVCs can be set up. In Figure 4-2, a signaling PVC from the source router to the ATM switch is used to set up two SVCs. This is a fully meshed network; workstations A, B, and C all can communicate with one other.

Figure 4-2 One or More SVCs Require a Signaling PVC



To configure the signaling PVC for all SVC connections, use the **atm pvc** command in interface configuration mode.

Note This signaling PVC can be set up on a major interface only, not on the subinterfaces.

The VPI and VCI values must be configured to be consistent with those of the local switch. The standard value of VPI is 0; the standard value of VCI is 5.

Configuring the Network Service Access Point Address

Every ATM interface involved with signaling must be configured with a network service access point (NSAP) address. The NSAP address is the ATM address of the interface and must be unique across the network.

You can do one of the following to configure an NSAP address:

- Configure the entire NSAP address manually.
- Configure the ESI and Selector fields.

  To configure the ESI and Selector fields, you must also configure a PVC to communicate with the switch through ILMI. The switch then provides the Prefix field of the NSAP address.

Configuring the Complete NSAP Address Manually

When you configure the ATM NSAP address manually, you must enter the entire address in hexadecimal format; that is, each digit entered represents a hexadecimal digit. To represent the complete NSAP address, you must enter 40 hexadecimal digits in the following format:

```
XX.XXXX.XX.XXXXXX.XXXX.XXXX.XXXX.XXXX.XXXX.XXXX.XX
```

Note All ATM NSAP addresses must be entered in the dotted hexadecimal format shown, which conforms to the UNI specification.

Because the interface has no default NSAP address, you must configure the NSAP address for SVCs. To set the ATM interface's source NSAP address, use the **atm nsap-address** command in interface configuration mode.

The following is an example of an NSAP address assigned to ATM interface 4/0 on a Cisco 7200 series router:

```
Router(config-if)# interface atm 4/0
Router(config-if)# atm nsap-address AB.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12
```

You can display the ATM address for the interface by executing the **show interfaces atm** command.

Configuring the ESI and Selector Fields

You can configure the router to get the NSAP address prefix from the switch; however, the switch must be capable of delivering the NSAP address prefix to the router through ILMI, and the router must be configured with a PVC for communication with the switch through ILMI.

To configure the router to get the NSAP prefix from the switch and use locally entered values for the remaining fields of the address, complete the following tasks in interface configuration mode:

Step 1 Configure a PVC for communicating with the switch through ILMI:

```
Router(config-if)# atm pvc vcd 0 16 ilmi
```

Step 2 Enter the ESI and Selector fields of the NSAP address:

```
Router(config-if)# atm esi-address esi.selector
```

where:

- the *esi* argument is 6 hexadecimal bytes long (12 digits)
- the *selector* argument is 1 hexadecimal byte long (2 digits)

In the following example on a Cisco 7200 series router, the ESI and Selector field values are assigned, and the ILMI PVC is set up:

```
Router(config-if)# interface atm 4/0
Router(config-if)# atm pvc 2 0 16 ilmi
Router(config-if)# atm esi-address 345678901234.12
```

Configuring Classical IP and ARP over ATM

Cisco implements both the ATM Address Resolution Protocol (ARP) server and ATM ARP client functions described in RFC 1577. RFC 1577 models an ATM network as a logical IP subnetwork on a LAN.

The tasks required to configure classical IP and ARP over ATM depend on whether the environment uses SVCs or PVCs. For further information, refer to the *Wide-Area Networking Configuration Guide* on Cisco.com.

Checking the Configuration

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

- Using show commands to Verify the New Interface Status, page 4-20
- Using the ping Command to Verify Network Connectivity, page 4-34
- Using loopback Commands, page 4-34
- Checking Bit Errors Using a Bit Error Rate Test, page 4-35
- Using the debug ATM Commands, page 4-38

Using show commands to Verify the New Interface Status

Table 4-5 demonstrates how you can use the **show** commands to verify that new interfaces are configured and operating correctly and that the PA-A3-IMA appears in them correctly. Sample displays of the output of selected **show** commands appear in the sections that follow. Table 4-6 demonstrates how you can use the ATM **show** commands to verify the current state of the ATM network and connected virtual circuits. For complete command descriptions and examples, refer to the publications listed in the "Related Documentation" section on page ii.

Table 4-5 Using show Commands

Command	Function	Example
show version	Displays system hardware configuration, the number of each interface type installed, Cisco IOS software version, names and sources of configuration files, and boot images	`Router# show version`
show controllers	Displays all the current interface processors and their interfaces	`Router# show controllers`
show diag *slot*	Displays types of port adapters installed in your system and information about a specific port adapter slot, interface processor slot, or chassis slot	`Router# show diag 2`

Table 4-5 Using show Commands (continued)

Command	Function	Example
show interfaces atm *slot* **3/***interface-port-number*	Displays status information about an ATM interface in a Cisco 7120 series router	`Router# show interfaces atm 3/1`
show interfaces atm *slot* **4/***interface-port-number*	Displays status information about an ATM interface in a Cisco 7140 series router	`Router# show interfaces atm 4/1`
show interfaces *atm* *slot-number/interface-port-number*	Displays status information about an ATM interface on a Cisco 7200 series router, Cisco 7200VXR router, Cisco 7201 router, Cisco 7301 router, or Cisco 7401ASR router	`Router# show interfaces atm 1/0`
show interfaces *atm* *slot-number/interface-port-number*	Displays status information about an ATM interface on a Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router	`Router# show interfaces atm 3/0`
show interfaces atm *interface-processor-slot-number/port-adapter-slot-number/interface-port-number*	Displays status information about an ATM interface on a VIP in a Cisco 7500 series router	`Router# show interfaces atm 3/1/0`
show interfaces atm *mod/ bay/ port*	Displays status information about an ATM interface on a FlexWAN module	`Router# show interfaces atm 3/0/0`
show protocols	Displays protocols configured for the entire system and for specific interfaces	`Router# show protocols`
show running-config	Displays the running configuration file	`Router# show running-config`
show startup-config	Displays the configuration stored in NVRAM	`Router# show startup-config`

Table 4-6 Using ATM show Commands

Command	Function	Example
show atm interface atm *slot*	Displays ATM-specific information about an ATM interface.	`Router# show atm interface atm 1/ima1`
show atm map	Displays the configured list of ATM static maps to remote hosts on an ATM network.	`Router# show atm map`
show atm traffic	Displays information about global traffic to and from all ATM networks connected to the router. Displays a list of counters of all ATM traffic on this router.	`Router# show atm traffic`

Table 4-6 Using ATM show Commands (continued)

Command	Function	Example
show atm-vc	Displays ATM virtual circuit and traffic information about all PVCs and SVCs (or a specific virtual circuit).	`Router# show atm-vc`
show atm-vc [*vcd*] ***n***	Displays ATM virtual circuit information for a particular PVC (where *n* is the VCD unique index value).	`Router# show atm-vc 4`
show sscop atm	Displays Service Specific Connection-Oriented Protocol (SSCOP) details for an ATM interface.	`Router# show sscop atm 1/ima1`
show atm arp-server	Displays the ATM ARP server table.	`Router# show atm arp-server`
show atm ilmi	Displays ATM ILMI information.	`Router# show atm ilmi`
show ima interface atm *slot*/**ima** *group-number*	Displays IMA information of an IMA group.	`Router# show ima interface atm 1/ima 1`
show ima interface atm *slot/link number*	Displays IMA information of an IMA link.	`Router# show ima interface atm 1/1`
show atm interface atm *slot/ima group-number*	Displays port adapter-specific error statistics, such as CRC errors, giants received, no buffers available, framing errors, application or physical layer errors, and packet timeout errors on receive.	`Router# show interfaces atm 1/ima1`

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 version or show hardware Commands, page 4-23
- Using the show diag Command, page 4-27
- Using the show interfaces Command, page 4-30
- Using the show ima interfaces atm Command to Display IMA Group Information, page 4-33

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.

The following sections provide platform-specific output examples using the **show version** command:

- Cisco 7100 Series Routers—Example Output of the show version Command, page 4-23
- Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show version Command, page 4-24
- Cisco 7201 Router—Example Output of the show version Command, page 4-24
- Cisco 7401ASR Router—Example Output of the show version Command, page 4-25
- VIP in Cisco 7500 Series Routers—Example Output of the show version Command, page 4-25
- FlexWAN Module—Example Output of the show version Command, page 4-26

Cisco 7100 Series Routers—Example Output of the show version Command

Following is an example of the **show version** command from a Cisco 7100 series router with a PA-A3-IMA installed:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) EGR Software (C7100-JS-M), Version 12.0(6)XE
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Tue 07-Sep-99 21:42 by rs
Image text-base:0x60008900, data-base:0x61360000

ROM:System Bootstrap, Version 12.0(6)XE [100]RELEASE SOFTWARE
BOOTFLASH:EGR Software (c7100-BOOT-M), Version 12.0(6)XE (fc1)

Router uptime is 10 hours 32 minutes
System returned to ROM by power-on
System image file is "c7100-js-mz"

cisco 7140-2MM3 (EGR) processor with 61440K/69632K bytes of memory.
R7000 CPU at 262Mhz, Implementation 39, Rev 1.0, 256KB L2, 2048KB L3 Cache
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.
2 FastEthernet/IEEE 802.3 interface(s)
11 ATM network interface(s)
125K bytes of non-volatile configuration memory.

16384K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show version Command

Following is an example of the **show version** command from a Cisco 7200 series router with a PA-A3-IMA installed:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7200 Software (C7200-J-M), Version 12.0(5)XE
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Mon 27-Apr-98 16:59 by mwu
Image text-base: 0x600088E0, data-base: 0x6083C000

ROM: System Bootstrap, Version 12.0(5)XE [rson 5], RELEASE SOFTWARE (fc1)
ROM: 7200 Software (C7200-BOOT-M), Release Version 12.0(5)XE [dx5 118]

router uptime is 22 hours, 57 minutes
System restarted by reload at 15:56:03 UTC Tue Apr 28 1998
System image file is "c7200-j-mz.atmdx.0424",
cisco 7206 (NPE200) processor with 57344K/8192K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0 (512KB Level 2 Cache)
Last reset from power-on
Bridging software.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
4 Ethernet/IEEE 802.3 interfaces.
2 FastEthernet/IEEE 802.3 interfaces.
8 ATM network interfaces.
125K bytes of non-volatile configuration memory.
1024K bytes of packet SRAM memory.

8192K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
20480K bytes of Flash PCMCIA card at slot 1 (Sector size 128K).
4096K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

Cisco 7201 Router—Example Output of the show version Command

Following is an example of the **show version** command from a Cisco 7201 router:

```
Router# show version
Cisco IOS Software, 7200 Software (C7200P-ADVENTERPRISEK9-M), Version
12.4(biffDEV.061001), INTERIM SOFTWARE Copyright (c) 1986-2006 by Cisco Systems, Inc.
Compiled Sun 01-Oct-06 23:42 by biff
ROM: System Bootstrap, Version 12.4(4r)XD5, RELEASE SOFTWARE (fc1)
BOOTLDR: Cisco IOS Software, 7200 Software (C7200P-KBOOT-M), Version 12.4(TAZ3DEV.060927),
INTERIM SOFTWARE
c7201alpha1 uptime is 5 days, 18 hours, 32 minutes System returned to ROM by power-on
System image file is "disk0:c7200p-adventerprisek9-mz.2006-10-01.biffdev"
This product contains cryptographic features and is subject to United States and local
country laws governing import, export, transfer and use. Delivery of Cisco cryptographic
products does not imply third-party authority to import, export, distribute or use
encryption.
Importers, exporters, distributors and users are responsible for compliance with U.S. and
local country laws. By using this product you agree to comply with applicable laws and
regulations. If you are unable to comply with U.S. and local laws, return this product
immediately.
A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html
If you require further assistance please contact us by sending email to export@cisco.com.
Cisco 7201 (c7201) processor (revision A) with 917504K/65536K bytes of memory.
Processor board ID 2222222222222
```

```
MPC7448 CPU at 1666Mhz, Implementation 0, Rev 2.2
1 slot midplane, Version 2.255
Last reset from power-on
1 FastEthernet interface
4 Gigabit Ethernet interfaces
2045K bytes of NVRAM.
62443K bytes of USB Flash usbflash0 (Read/Write)
250880K bytes of ATA PCMCIA card at slot 0 (Sector size 512 bytes).
65536K bytes of Flash internal SIMM (Sector size 512K).
Configuration register is 0x2
```

Cisco 7401ASR Router—Example Output of the show version Command

Following is an example of the **show version** command from a Cisco 7401ASR router with a PA-A3-IMA installed:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) 7401ASR Software (C7401ASR-J-M), Version 12.0(5)XE
Copyright (c) 1986-1998 by cisco Systems, Inc.
Compiled Mon 27-Apr-98 16:59 by mwu
Image text-base: 0x600088E0, data-base: 0x6083C000

ROM: System Bootstrap, Version 12.0(5)XE [rson 5], RELEASE SOFTWARE (fc1)
ROM: 7401ASR Software (C7401ASR-BOOT-M), Release Version 12.0(5)XE [dx5 118]

router uptime is 22 hours, 57 minutes
System restarted by reload at 15:56:03 UTC Tue Apr 28 1998
System image file is "c7401ASR-j-mz.atmdx.0424",
cisco 7206 (NPE200) processor with 57344K/8192K bytes of memory.
R4700 processor, Implementation 33, Revision 1.0 (512KB Level 2 Cache)
Last reset from power-on
Bridging software.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
X.25 software, Version 2.0, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
4 Ethernet/IEEE 802.3 interfaces.
2 FastEthernet/IEEE 802.3 interfaces.
8 ATM network interfaces.
125K bytes of non-volatile configuration memory.
1024K bytes of packet SRAM memory.

8192K bytes of Flash PCMCIA card at slot 0 (Sector size 128K).
20480K bytes of Flash PCMCIA card at slot 1 (Sector size 128K).
4096K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

VIP in Cisco 7500 Series Routers—Example Output of the show version Command

Following is an example of the **show version** command from a Cisco 7500 series router with a PA-A3-IMA installed on a VIP2:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) RSP Software (RSP-JV-M), Version 12.0(5)XE
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Fri 01-Oct-99 18:01 by rs
Image text-base:0x60010908, data-base:0x612E2000

ROM:System Bootstrap, Version 12.0(5) RELEASE SOFTWARE(fc1)
BOOTFLASH:RSP Software (RSP-BOOT-M), Version 12.0(5) [rs]
```

```
Router uptime is 1 day, 20 hours, 23 minutes
System returned to ROM by abort at PC 0x602B8BE0
System image file is "rsp-jv-mztest"

cisco RSP4 (R5000) processor with 131072K/2072K bytes of memory.
R5000 CPU at 200Mhz, Implementation 35, Rev 2.1, 512KB L2 Cache
Last reset from power-on
G.703/E1 software, Version 1.0.
G.703/JT2 software, Version 1.0.
X.25 software, Version 3.0.0.
SuperLAT software (copyright 1990 by Meridian Technology Corp).
Bridging software.
TN3270 Emulation software.
Chassis Interface.
1 VIP2 controller (8 ATM).
1 VIP2 R5K controller (4 Ethernet)(9 ATM).
4 Ethernet/IEEE 802.3 interface(s)
17 ATM network interface(s)
123K bytes of non-volatile configuration memory.

8192K bytes of Flash internal SIMM (Sector size 256K).
Configuration register is 0x0
```

FlexWAN Module—Example Output of the show version Command

Following is an example of the **show version** command from a Catalyst 6000 family switch with a PA-A3-IMA installed in a FlexWAN module:

```
Router# show version
Cisco Internetwork Operating System Software
IOS (tm) c6sup2_rp Software (c6sup2_rp-JSV-M), Version 12.1(nightly.E020507) NIHTLY BUILD
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Tue 07-May-02 06:02 by
Image text-base:0x40008980, data-base:0x41830000

ROM:System Bootstrap, Version 12.1(3r)E2, RELEASE SOFTWARE (fc1)

Router uptime is 35 minutes
System returned to ROM by power-on (SP by power-on)
System image file is "sup-bootflash:c6sup22-jsv-mz"

cisco Catalyst 6000 (R7000) processor with 489472K/34816K bytes of memory.
Processor board ID SAD04440003
R7000 CPU at 300Mhz, Implementation 39, Rev 2.1, 256KB L2, 1024KB L3 Cache
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.
1 FlexWAN controller (9 ATM).
1  4-port OC3  POS controller  (4 POS).
1  4-port OC12 POS controller  (4 POS).
1 Virtual Ethernet/IEEE 802.3  interface(s)
10 Gigabit Ethernet/IEEE 802.3 interface(s)
9 ATM network interface(s)
8 Packet over SONET network interface(s)
381K bytes of non-volatile configuration memory.

16384K bytes of Flash internal SIMM (Sector size 512K).
Configuration register is 0x2
```

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* in the Cisco 7100 series routers, Cisco 7200 series routers, Cisco 7200 VXR routers, Cisco 7201 router, Cisco 7301 router, and Cisco 7401ASR router, the *module slot* in a Cisco 7304 PCI Port Adapter Carrier Card in a Cisco 7304 router, and the *interface processor slot* in Cisco 7500 series routers with a VIP. In the FlexWAN module, the **show diag** command is used without the *slot* designation.

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 sections provide platform-specific output examples using the **show diag** command:

- Cisco 7100 Series Routers—Example Output of the show diag Command, page 4-27
- Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show diag Command, page 4-28
- Cisco 7201 Router—Example Output of the show diag Command, page 4-28
- Cisco 7401ASR Router—Example Output of the show diag Command, page 4-29
- VIP in Cisco 7500 Series Routers—Example Output of the show diag Command, page 4-29
- FlexWAN Module—Example Output of the show diag Command, page 4-29

Cisco 7100 Series Routers—Example Output of the show diag Command

Following is an example of the **show diag** command that shows a a PA-A3-IMA in port adapter slot 4 of a Cisco 7140 series router:

```
Router# show diag 4
Slot 4:
        IMA WAN DS1 Port adapter, 8 ports
        Port adapter is analyzed
        Port adapter insertion time 00:04:23 ago
        EEPROM contents at hardware discovery:
        Hardware revision 1.0           Board revision UNKNOWN
        Serial number     11560312      Part number    73-3614-01
        Test history      0x0           RMA number     00-00-00
        EEPROM format version 1
        EEPROM contents (hex):
          0x20:01 BA 01 00 00 B0 65 78 49 0E 1E 01 00 00 00 00
          0x30:04 00 00 00 99 02 17 00 FF FF FF FF FF FF FF FF
```

Note To use the **show diag** command with the Cisco 7120 series router, replace the slot argument **4** with **3**.

Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show diag Command

Following is an example of the **show diag** command that shows a PA-A3-IMA in port adapter slot 1 of a Cisco 7200 series router:

```
Router# show diag 1
Slot 1:
        IMA WAN DS1 port adapter, 8 ports
        Port adapter is analyzed
        Port adapter insertion time 1d15h ago
        EEPROM contents at hardware discovery:
        Hardware revision 1.0           Board revision UNKNOWN
        Serial number     10972436      Part number    73-3614-01
        Test history      0x0           RMA number     00-00-00
        EEPROM format version 1
        EEPROM contents (hex):
          0x20: 01 BA 01 00 00 A7 6D 14 49 0E 1E 01 00 00 00 00
          0x30: 05 00 00 00 98 11 05 00 FF FF FF FF FF FF FF FF
```

Cisco 7201 Router—Example Output of the show diag Command

Following is an example of the **show diag** command from a Cisco 7201 router:

```
Router# show diag 1
Slot 1:
    Dual OC3 POS Port adapter, 2 ports
    Port adapter is analyzed
    Port adapter insertion time 00:02:19 ago
    EEPROM contents at hardware discovery:
    Hardware Revision : 1.0
    PCB Serial Number : JAE07520DYL
    Part Number : 73-8220-02
    Board Revision : A0
    RMA Test History : 00
    RMA Number : 0-0-0-0
    RMA History : 00
    Deviation Number : 0
    Product (FRU) Number : PA-POS-2OC3
    Top Assy. Part Number : 800-21857-02
    EEPROM format version 4
    EEPROM contents (hex):
        0x00: 04 FF 40 03 E3 41 01 00 C1 8B 4A 41 45 30 37 35
        0x10: 32 30 44 59 4C 82 49 20 1C 02 42 41 30 03 00 81
        0x20: 00 00 00 00 04 00 88 00 00 00 00 CB 94 50 41 2D
        0x30: 50 4F 53 2D 32 4F 43 33 20 20 20 20 20 20 20 20
        0x40: 20 C0 46 03 20 00 55 61 02 FF FF FF FF FF FF FF
        0x50: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
        0x60: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
        0x70: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
```

Cisco 7401ASR Router—Example Output of the show diag Command

Following is an example of the **show diag** command that shows a PA-A3-IMA in port adapter slot 1 of a Cisco 7401ASR router:

```
Router# show diag 1
Slot 1:
        IMA WAN DS1 port adapter, 8 ports
        Port adapter is analyzed
        Port adapter insertion time 1d15h ago
        EEPROM contents at hardware discovery:
        Hardware revision 1.0           Board revision UNKNOWN
        Serial number     10972436      Part number    73-3614-01
        Test history      0x0           RMA number     00-00-00
        EEPROM format version 1
        EEPROM contents (hex):
          0x20: 01 BA 01 00 00 A7 6D 14 49 0E 1E 01 00 00 00 00
          0x30: 05 00 00 00 98 11 05 00 FF FF FF FF FF FF FF FF
```

VIP in Cisco 7500 Series Routers—Example Output of the show diag Command

Following is an example of the **show diag** command that shows a PA-A3-IMA in port adapter slot 0 on a VIP2 in interface processor slot 4:

```
Router# show diag 4
Slot 4:
        Physical slot 4, ~physical slot 0xB, logical slot 4, CBus 0
        Microcode Status 0x4
        Master Enable, LED, WCS Loaded
        Board is analyzed
        Pending I/O Status:None
        EEPROM format version 1
        VIP2 controller, HW rev 2.11, board revision C0
        Serial number:11208804  Part number:73-1684-04
        Test history:0x00        RMA number:00-00-00
        Flags:cisco 7000 board; 7500 compatible
```

FlexWAN Module—Example Output of the show diag Command

Following is an example of the **show diag** command that shows a PA-A3-IMA in a FlexWAN module:

```
Router# show diag
Slot 4:Logical_index 8
        FlexWan controller
        Board is analyzed ipc ready
        HW rev 1.0, board revision A01
        Serial Number: Part number:73-3921-01

        Slot database information:
        Flags:0x2004   Insertion time:0xFD790 (00:20:50 ago)

        Controller Memory Size:
                56 MBytes CPU Memory
                8 MBytes Packet Memory
                64 MBytes Total on Board SDRAM
        IOS (tm) cwlc Software (cwpa-DW-M), Version 12.1(nightly.E020507) NIGHTLY BUILD
```

```
PA Bay 0 Information:
        IMA DS1 PA, 8 ports
        EEPROM format version 1
        HW rev 1.00, Board revision 82
        Serial number:14076108  Part number:73-3614-02
```

Using the show interfaces Command

Display status information (including the physical slot and interface address) for the interfaces you specify using the **show interfaces** 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 sections provide platform-specific output examples using the **show interfaces** command:

- Cisco 7100 Series Routers—Example Output of the show interfaces Command, page 4-30
- Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show interfaces Command, page 4-31
- Cisco 7201 Router—Example Output of the show interfaces Command, page 4-31
- Cisco 7401ASR Router—Example Output of the show interfaces Command, page 4-32
- VIP in Cisco 7500 Series Routers—Example Output of the show interfaces Command, page 4-32
- FlexWAN Module—Example Output of the show interfaces Command, page 4-33

Cisco 7100 Series Routers—Example Output of the show interfaces Command

Following is an example of the **show interfaces atm** command from a Cisco 7140 series router:

```
Router# show interfaces ATM4/0
ATM4/0 is down, line protocol is down
  Hardware is IMA PA
  MTU 4470 bytes, BW 1544 Kbit, DLY 100 usec,
     reliability 0/255, txload 1/255, rxload 1/255
  Encapsulation UNKNOWN, loopback not set
  Keepalive set (10 sec)
  Encapsulation(s):AAL5
  512 maximum active VCs, 0 current VCCs
  VC idle disconnect time:300 seconds
  0 carrier transitions
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue:0/75/0 (size/max/drops); Total output drops:0
  Queueing strategy:weighted fair
  Output queue:0/1000/64/0 (size/max total/threshold/drops)
     Conversations  0/0/256 (active/max active/max total)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 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, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Note To use the **show interfaces** command with the Cisco 7120 series router, replace the interface address arguments with the slot arguments **3/0**, **3/1**, **3/2**, **3/3**, **3/4**, **3/5**, **3/6**,and **3/7**.

Cisco 7200 Series Routers and Cisco 7200 VXR Routers—Example Output of the show interfaces Command

Following is an example of the **show interfaces atm** command from a Cisco 7200 series router. In this example, the eight ATM interfaces (0–7) are on a PA-A3-IMA in port adapter slot 4.

```
Router# show interfaces atm 1/4
ATM1/4 is up, line protocol is down
Hardware is IMA PA
  Internet address is 192.168.0.0/24
  MTU 4470 bytes, BW 1536 Kbit, DLY 20000 usec,
reliablility 255/255, txload 1/255, rxload 1/255
  Encapsulation UNKNOWN, loopback not set
  Keepalive set (10 sec)
  Encapsulation(s):AAL5
  512 maximum active VCs, 0 current VCCs
VC idle disconnect time:300 seconds
  2 carrier transitions
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue:0/75/0 (size/max/drops); Total output drops:0
  Queueing strategy:weighted fair
Output queue:0/1000/64/0 (size/max total/threshold/drops)
Conversations  0/0/256 (active/max active/max total)
Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 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, 0 ignored, 0 abort
0 packets output, 0 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 output buffer failures, 0 output buffers swapped out
```

Cisco 7201 Router—Example Output of the show interfaces Command

Following is an example of the **show interfaces** command from a Cisco 7201 router:

```
Router# show interfaces
GigabitEthernet0/0 is up, line protocol is up
  Hardware is MV64460 Internal MAC, address is 0019.56c5.2adb (bia
0019.56c5.2adb)
  Internet address is 209.165.200.225
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 45/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 1000Mb/s, media type is RJ45
  output flow-control is XON, input flow-control is XON
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:07:03, output 00:00:07, output hang never
  Last clearing of "show interface" counters 00:00:04
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 180240000 bits/sec, 430965 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
```

```
     2222975 packets input, 133378500 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 0 multicast, 0 pause input
     0 input packets with dribble condition detected
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier, 0 pause output
     0 output buffer failures, 0 output buffers swapped out
```

Cisco 7401ASR Router—Example Output of the show interfaces Command

Following is an example of the **show interfaces atm** command from a Cisco 7401ASR router. In this example, the eight ATM interfaces (0–7) are on a PA-A3-IMA in port adapter slot 4.

```
Router# show interfaces atm 1/4
ATM1/4 is up, line protocol is down
Hardware is IMA PA
  Internet address is 192.168.0.0/24
  MTU 4470 bytes, BW 1536 Kbit, DLY 20000 usec,
reliablility 255/255, txload 1/255, rxload 1/255
  Encapsulation UNKNOWN, loopback not set
  Keepalive set (10 sec)
  Encapsulation(s):AAL5
  512 maximum active VCs, 0 current VCCs
VC idle disconnect time:300 seconds
  2 carrier transitions
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue:0/75/0 (size/max/drops); Total output drops:0
  Queueing strategy:weighted fair
Output queue:0/1000/64/0 (size/max total/threshold/drops)
Conversations  0/0/256 (active/max active/max total)
Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 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, 0 ignored, 0 abort
0 packets output, 0 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 output buffer failures, 0 output buffers swapped out
```

VIP in Cisco 7500 Series Routers—Example Output of the show interfaces Command

Following is an example of the **show interfaces atm** command from a VIP2. In this example, the ATM interface (5) is on a port adapter in port adapter slot 1 of a VIP2 in interface processor slot 4.

```
Router# show interfaces atm 4/1/5
ATM4/1/5 is up, line protocol is up
  Hardware is cyBus IMA PA
  Internet address is 10.0.0.3/24
  MTU 4470 bytes, sub MTU 4470, BW 1920 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ATM, loopback not set
  Keepalive not supported
  Encapsulation(s):AAL5
  512 maximum active VCs, 1 current VCCs
  VC idle disconnect time:300 seconds
  1 carrier transitions
```

```
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy:fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     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, 0 ignored, 0 abort
     0 packets output, 0 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

FlexWAN Module—Example Output of the show interfaces Command

Following is an example of the **show interfaces atm** command from a FlexWAN module. In this example, the ATM-configured FlexWAN module is in module slot 8, in port adapter bay 0.

```
Router# show interfaces atm4/0/ima1
ATM4/0/ima1 is up, line protocol is up
  Hardware is IMA PA T1
  Internet address is 100.0.0.1/24
  MTU 4470 bytes, sub MTU 4470, BW 6093 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ATM, loopback not set
  Keepalive not supported
  Encapsulation(s):AAL5
  2048 maximum active VCs, 1 current VCCs
  VC idle disconnect time:300 seconds
  2 carrier transitions
  Last input 00:07:11, output 00:07:11, output hang never
  Last clearing of "show interface" counters never
  Input queue:0/75/0/0 (size/max/drops/flushes); Total output drops:0
  Queueing strategy:fifo
  Output queue :0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     7 packets input, 596 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     7 packets output, 604 bytes, 0 underruns
     0 output errors, 0 collisions, 6 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Using the show ima interfaces atm Command to Display IMA Group Information

Use the **show ima interfaces atm** *slot/* **ima** *group-number* command to display all the information specific to an IMA group, as shown in the example below:

```
Router# show ima interfaces atm 1/ima1
ATM1/ima1 is up, line protocol is up
  Hardware is IMA PA
  Internet address is 192.168.109.1/24
  MTU 4470 bytes, sub MTU 4470, BW 1523 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ATM, loopback not set
  Keepalive not supported
  Encapsulation(s):AAL5
  1536 maximum active VCs, 1 current VCCs
  VC idle disconnect time:300 seconds
```

```
  1 carrier transitions
  Last input 00:13:56, output 00:13:56, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy:fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
5 packets input, 560 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
5 packets output, 540 bytes, 0 underruns
0 output errors, 0 collisions, 1 interface resets
0 output buffer failures, 0 output buffers swapped out
```

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 ii for detailed command descriptions and examples.

The **ping** command sends echo requests 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] indicates that the connection failed.

Following is an example of a successful **ping** command to a remote device 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.

Proceed to the next section, "Using loopback Commands," to finish checking network connectivity.

Using loopback Commands

With the loopback test, you can detect and isolate equipment malfunctions by testing the connection between the PA-A3-IMA interface and a remote device such as a modem or a CSU/DSU. The **loopback** command places an interface in loopback mode, which enables test packets that are generated from the **ping** command to loop through a remote device. If the packets complete the loop, the connection is good. If not, you can isolate a fault to the remote device in the path of the loopback test.

The PA-A3-IMA supports three basic variations of loopback: diagnostic, local, and remote. Diagnostic variation loops the outgoing transmit signal back to incoming receive. Local loopback loops the incoming receive signal back out the transmitter. Remote loopback attempts to set the far end of the T1 interface into loopback mode.

Note E1 does not support remote loopback.

Depending on the mode of the port, issuing the **loopback** command checks the following path:

- When no compact serial cable is attached to the PA-A3-IMA interface port, or if a DCE cable is attached to a port that is configured as line protocol up, the **loopback** command tests the path between the network processing engine and the interface port only (without leaving the network processing engine and port adapter.)
- When a DTE cable is attached to the port, the **loopback** command tests the path between the network processing engine and the near (network processing engine) side of the DSU or modem to test the PA-A3-IMA interface and compact serial cable.

Checking Bit Errors Using a Bit Error Rate Test

To check bit errors using a bit error rate test (BERT), use the following command:

interface atm1/0 bert pattern
{2^11 | 2^15 | 2^20 O.153 | 2^20 QRSS | 2^23 | 0s | 1s | alt-0-1} interval *minutes*

where

2^11 is an exponential number that represents a pseudorandom repeating pattern that is 2048 bits long

2^15 is an exponential number that represents a pseudorandom repeating pattern that is 32,767 bits long

2^20 is a pseudorandom repeating pattern that is 1,048,575 bits long

2^23 is a pseudorandom repeating pattern that is 8,388,607 bits long

0s is a pattern of all zeros (00000000...)

1s is a pattern of all 1s (111111...),

minutes is a value 1–14,400, which designate the time the BERT will run.

To stop the BERT, use the optional **no** form of the command.

The following example runs a BERT that sends the pseudorandom pattern 2^20 and repeats for 60 minutes:

```
Router# bert pattern 2^20 interval 60
```

The following example runs a BERT and then displays the results from a Cisco 7200 series router:

```
Router# configure terminal
Router(config)# interface atm 1/0
Router(config-if)# bert pattern 2^20 interval 1
Router(config-if)# end
Router# show controller atm 1/0
Interface ATM1/0 is up
Hardware is IMA PA - E1 (2Mbps)
Lane client mac address is 0090.b1f8.e454
Framer is PMC PM7344, SAR is LSI ATMIZER II
Firmware rev:DG01, ATMIZER II rev:3
  idb=0x61C03C58, ds=0x61C0B480, vc=0x61C2C860, pa=0x61BF9880
  slot 3, unit 1, subunit 0, fci_type 0x00BB, ticks 658
  400 rx buffers:size=512, encap=64, trailer=28, magic=4
linecode is HDB3
E1 Framing Mode: crc.4 adM format
LBO (Cablelength) is long gain43 120db
Facility Alarms:
        No Alarm

Bert Information:
        state      :OFF, pattern     :2^20
```

```
                interval   :0,   result      :IN_SYNC
                sync count :1,   bit errors  :0
                kbit count :122871
                bit errors since last sync    :0
                kbit count since last sync    :122871

        Some display text omitted.
```

The output of show controllers atm command displays several error counters. Table 4-7 lists the error counters and their related information.

Table 4-7 Error counter Information

Counter	Explanation
`hcs - # uncorrectable HEC errors`	Indicates the number of times that an ATM cell fails the header checksum. ATM cell headers are protected by a 1-byte CRC(Cyclic Redundancy Check) called the Header Checksum (HEC or HCS). This CRC corrects single-bit HCS errors and detects multiple-bit HCS errors (that cannot be modified) in the header.
`chece - # rx Correctable HEC errors`	Indicates that the ATM interfaces protects against changes to the cell header with a header error checksum (HCS) field. This HCS detects errors only in the header, and not in the 48-byte payload. The HCS errors indicate that the source, destination, or ATM network has corrupted the cell header.
`uicell - # unassigned/idle cells dropped`	Indicates the unassigned and idle cells. These cells ensure proper cell decoupling or cell delineation, that enables the ATM interface to recognize the start of each new cell.
`oocd - # rx out of cell deliniation`	Indicates the Out of Cell Delineation(OOCD) event that occurs when seven consecutive cells does not contain a valid HEC (Header Error Check). An OOCD clears when six consecutive HEC valid cells are detected.
`rx_fovr - # rx FIFO over run`	Indicates the number of times the FIFO (first-in-first-out) memory of the framer overruns because of a lack of SAR(Segmentation and Reassembly) buffers.
`tx_fovr - # tx FIFO over run`	Indicates the number of times the FIFO memory of the framer overruns because of a lack of SAR buffers.
`coca - # tx Change of cell allignment`	CACOI (change of cell alignment indicator) is a bit in TXCP(ATM cell processor) Interrupt Enable/Status and Control register, which says that the COCAI bit is set to logic 1 when a change of cell alignment (COCA) is detected. Start of cell indications are indicated by the TSOC(Transmit Start of Cell) input, and are expected during the first octet of the 53 octet data structure written to the transmit FIFO. If the FIFO's internal cell counter indicates that TSOC does not coincide with the first octet or is not present during the first octet, COCAI is set to logic 1. The COCAI bit position is set to logic 0 when this register is read. Hence the 'tx change of cell alignment' counter is incremented whenever there is a change in the cell alignment. TSOC marks the start of cell at the first octet of 53 octet data structure. During internal transmit, when the cell counter does not coincide with this TSOC or if its not present in the first octet then CACOI bit is set to logic 1.
`pcv - # path code violations`	Indicates a frame synchronization bit error in the D4 and E1-no CRC formats, or a CRC error in the Extended Superframe (ESF) and E1-CRC formats. Here, D4 and E1 are framing types where D4 is the superframe and E1 is the extended super frame (ESF).

Table 4-7 Error counter Information

Counter	Explanation
lcv - # line code violations	Indicates a Bipolar Violation (BPV) or Excessive Zeros (EXZ) error event.
es - # errored Seconds	In ESF (Extended Superframe) and E1 CRC links, this indicates the second when one of the following defects are detected: • One or more Path Code Violations. • One or more Controlled Slip events. • Bipolar Violations in a SF and E1 no-CRC links.
ses - # severely errored secs	For ESF signals, this indicates the second when one of the following defects are detected: • 320 or more Path Code Violation errors. • One or more Out of Frame defects. • An AIS (Alarm Indication Signal) defect. For E1-CRC signals, this indicates the second when one of the following defects are detected: • 832 or more Path Code Violation errors. • One or more Out of Frame defects. For E1-nonCRC signals, this is a second with 2048 Line Code Violations or more. For D4 signals, this means a count of 1-second intervals with Framing Errors, or an Out of Frame defect, or 1544 Line Code Violations.
sefs - # severely errored framing secs	A Severely Errored Framing Second is a second with one or more Out of Frame defects or a detected AIS (Alarm Indication Signal) defect.
uas - # unavailable seconds	Indicates a count of the total number of seconds on the interface. This field is calculated by counting the number of seconds when the interface is unavailable.
css - # controlled slip seconds	Indicates the replication or deletion of the payload bits of a domestic trunk interface (DS1) frame. A slip happens when there is a difference between the timing of a synchronous receiving terminal and the received signal.
les - # line errored seconds	A Line Errored Second (LES) is a second in which one or more Line Code Violation errors are detected.
bes - # bursty errored seconds	A Bursty errored seconds is a second in which more than one but lesser than 320 Path Coding Violation errors, no Severely Errored Frame defects and no detected incoming AIS defects are detected. Controlled slips are not included in this parameter.
dm - # degraded minutes	A degraded minute is one in which the estimated error rate exceeds 1E-6 but does not exceed 1E-3.
ss - # stuffed seconds	A Stuffed second (SS) is a second in which one or more bit overloads take place.

Using the debug ATM Commands

The following **debug** commands are available to aid in solving ATM network problems.

To create a dump of all protocol packets, use the **debug atm packet** command. The command displays the contents of the Subnetwork Access Protocol/Network Layer Protocol Identifier/Switched Multimegabit Data Service (SNAP/NLPID/SMDS) header followed by the first 40 bytes of a packet in hexadecimal format.

To display ATM errors, use the **debug atm errors** command. The command displays information from all detected ATM errors, including encapsulation failures and errors during ATM configuration.

To display ATM events, use the **debug atm events** command. The command displays event changes to the IMA port adapter. The command also shows reset, VC configurations, and PA-A3-IMA configurations.

To display information about OAM cells, use the **debug atm oam** command. The command displays the contents of OAM cells as they arrive from the network.

After using a **debug** command, turn off debugging with the **no debug** command.