Cisco 7200 Series Port Adapter Hardware Configuration Guidelines

Bandwidth Points Documentation

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
http://www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 527-0883

Text Part Number: OL-3875-10

THE SPECIFICATIONS AND INFORMATION REGARDING THE PRODUCTS IN THIS MANUAL ARE SUBJECT TO CHANGE WITHOUT NOTICE. ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS MANUAL ARE BELIEVED TO BE ACCURATE BUT ARE PRESENTED WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. USERS MUST TAKE FULL RESPONSIBILITY FOR THEIR APPLICATION OF ANY PRODUCTS.

THE SOFTWARE LICENSE AND LIMITED WARRANTY FOR THE ACCOMPANYING PRODUCT ARE SET FORTH IN THE INFORMATION PACKET THAT SHIPPED WITH THE PRODUCT AND ARE INCORPORATED HEREIN BY THIS REFERENCE. IF YOU ARE UNABLE TO LOCATE THE SOFTWARE LICENSE OR LIMITED WARRANTY, CONTACT YOUR CISCO REPRESENTATIVE FOR A COPY.

The following information is for FCC compliance of Class A devices: 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.

The following information is for FCC compliance of Class B devices: The equipment described in this manual generates and may radiate radio-frequency energy. If it is not installed in accordance with Cisco's installation instructions, it may cause interference with radio and television reception. This equipment has been tested and found to comply with the limits for a Class B digital device in accordance with the specifications in part 15 of the FCC rules. These specifications are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation.

Modifying the equipment without Cisco's written authorization may result in the equipment no longer complying with FCC requirements for Class A or Class B digital devices. In that event, your right to use the equipment may be limited by FCC regulations, and you may be required to correct any interference to radio or television communications at your 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.)

Modifications to this product not authorized by Cisco Systems, Inc. could void the FCC approval and negate your authority to operate the product.

The Cisco implementation of TCP header compression is an adaptation of a program developed by the University of California, Berkeley (UCB) as part of UCB's public domain version of the UNIX operating system. All rights reserved. Copyright © 1981, Regents of the University of California.

NOTWITHSTANDING ANY OTHER WARRANTY HEREIN, ALL DOCUMENT FILES AND SOFTWARE OF THESE SUPPLIERS ARE PROVIDED "AS IS" WITH ALL FAULTS. CISCO AND THE ABOVE-NAMED SUPPLIERS DISCLAIM ALL WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING, WITHOUT LIMITATION, THOSE OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OR ARISING FROM A COURSE OF DEALING, USAGE, OR TRADE PRACTICE.

IN NO EVENT SHALL CISCO OR ITS SUPPLIERS BE LIABLE FOR ANY INDIRECT, SPECIAL, CONSEQUENTIAL, OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, LOST PROFITS OR LOSS OR DAMAGE TO DATA ARISING OUT OF THE USE OR INABILITY TO USE THIS MANUAL, EVEN IF CISCO OR ITS SUPPLIERS HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Cisco 7200 Series Port Adapter Hardware Configuration Guidelines

CONTENTS

Preface

Document Revision History

The Document Revision History below, beginning with Online Part number OL-3875-05, records technical changes to this document.

Revision	Date	Change Summary
OL-3875-11	July, 2007	Adding PA-TE/E3-EC information.
OL-3875-10	December, 2006	Adding PA-MC-TE-EC information.
OL-3875-09	October, 2006	Adding VPN Service Adapter (VSA) information.
OL-3875-08	May, 2006	Adding NPE-G2 information.
OL-3875-07	March, 2006	Adding Port Adapter Jacket Card information.
OL-3875-06	February, 2006	Adding network processing engine support information for the PA-GE.
OL-3875-05	February, 2005	Adding PA-POS-1OC3 and SA-VAM2+ information.

Introduction

This document explains the port adapter hardware configuration guidelines for Cisco 7200 series routers. The Cisco 7200 series routers include the:

- 2-slot Cisco 7202
- 4-slot Cisco 7204
- 4-slot Cisco 7204VXR
- 6-slot Cisco 7206
- 6-slot Cisco 7206VXR

This document includes brief explanations of Cisco 7200 series architecture, port adapter bandwidth allocations, port adapter slot numbering, and memory requirements.

Note The Cisco 7206 and the Cisco 7206VXR can be used as router shelves in a Cisco AS5800 Universal Access Server. References to Cisco 7200 series routers in this document include the Cisco 7206 and Cisco 7206VXR router shelves, unless indicated otherwise.

This preface contains the following sections:

Other Documentation

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

- For Cisco IOS software 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 documentation and Cisco 7200 series routers hardware installation and maintenance documentation on Cisco.com. Choose the appropriate router from the drop-down menu. The hardware pages also have links to troubleshooting information.

- For a list all Cisco 7200 series routers documentation, see: *Cisco 7200 Series Routers Documentation Roadmap* at http://www.cisco.com/en/US/products/hw/routers/ps341/products_documentation_roadmap09186a00801c0915.html for a list of all Cisco 7200 series routers documentation and troubleshooting tools and information.
- For a list of all Cisco 7200 series routers port adapter documentation, see: *Cisco 7200 Series Routers Port Adapter Documentation Roadmap* at http://www.cisco.com/en/US/products/hw/routers/ps341/products_documentation_roadmap09186a00801c0a32.html for a list of all Cisco 7200 series routers-supported port adapter documentation.
- For a list of all Cisco 7200 series routers troubleshooting documentation, including links to tools, utilities and TAC Tech Notes, see: *Cisco 7200 Series Routers Troubleshooting Documentation Roadmap* at http://www.cisco.com/en/US/products/hw/routers/ps341/prod_troubleshooting_guide09186a00801c0f65.html for links to troubleshooting tools, utilities, and Tech Notes.
- c0f65.html for links to troubleshooting tools, utilities, and Tech Notes.
- For a list of Cisco 7200 series routers supported hardware and corresponding boot image information, see the Cisco 7200 Series Routers Boot Images Information document at: http://www.cisco.com/en/US/products/hw/routers/ps341/prod_installation_guide09186a00805e7d4d.html

- For hardware installation and maintenance information and software configuration information on the Cisco AS5800 Universal Access Server, refer to the following publications:
  - *Cisco AS5800 Universal Access Server Hardware Installation Guide*
  - Configuration documents for the Cisco AS5800

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

Cisco 7200 Series Port Adapter Installation Requirements

Cisco 7200 series routers (the 2-slot Cisco 7202, the 4-slot Cisco 7204 and Cisco 7204VXR, and the 6-slot Cisco 7206 and Cisco 7206VXR) support multiprotocol, multimedia routing and bridging with a wide variety of protocols and media types. Network interfaces reside on port adapters that provide a connection between the routers' Peripheral Component Interconnect (PCI) buses and external networks. Port adapters can be placed in any available port adapter slot, in any desired combination.

Note For information about the Cisco 7206 and Cisco 7206VXR as router shelves in a Cisco AS5800 Universal Access Server, refer to the Cisco AS5800 Universal Access Server documentation listed in the "Other Documentation" section on page vi.

This chapter contains the following sections:

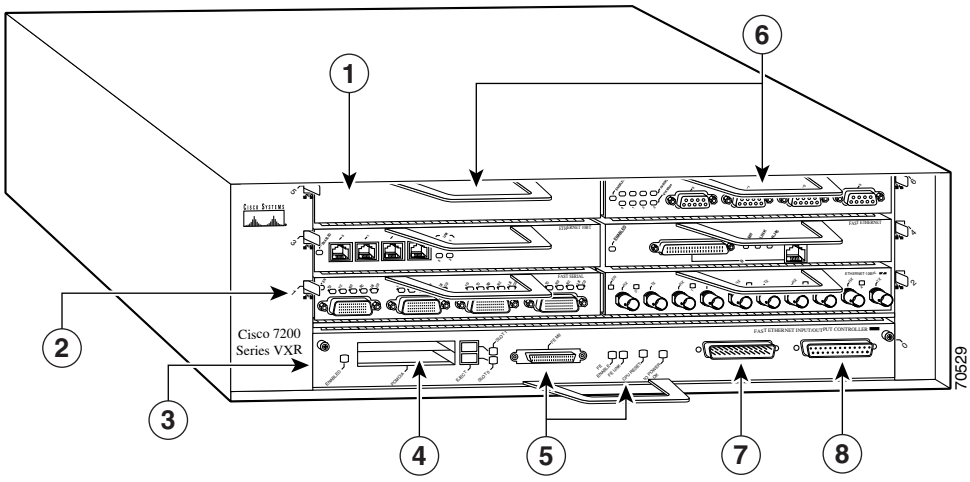
Chassis Overview—Front View

The front of Cisco 7200 series routers provides access to an input/output (I/O) controller and up to two, four, or six network interface port adapters. The I/O controller has a local console port for connecting a data terminal (or data terminal equipment [DTE]) and an auxiliary port for connecting a modem (or other data communications equipment [DCE]) or other devices for configuring and managing the router; PC Card slots for PC Cards or Flash Disks; and optional Ethernet, Fast Ethernet, or Gigabit Ethernet ports.

The NPE-G1 and NPE-G2 work with the I/O controller when installed in a Cisco 7200 VXR router. The NPE-G1 or NPE-G2 can also be used without an I/O controller; both have three Gigabit Ethernet interfaces, with a total of three of six ports (three RJ-45 and three GBIC modules on the NPE-G1, or three SFP modules on the NPE-G2) available at one time, a CompactFlash Disk, and a console port and auxiliary port. In addition, the NPE-G2 has a Fast Ethernet Management port and two USB ports for security tokens and data file storage. The Port Adapter Jacket Card can be used in the I/O controller slot, if an NPE-G1 or NPE-G2 is installed.

Figure 1-1 shows a Cisco 7206VXR with installed port adapters and an I/O controller with a Fast Ethernet port.

Figure 1-1 Cisco 7200 Series Router—Front View (Cisco 7206VXR Shown)



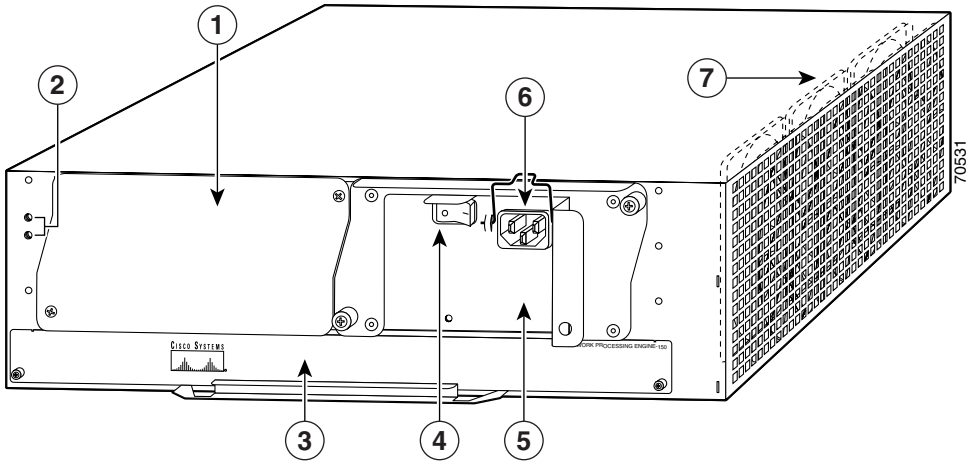
1	Blank port adapter	**5**	Optional Fast Ethernet port (MII port and RJ-45 port)
2	Port adapter lever	**6**	Port adapters
3	I/O controller	**7**	Auxiliary port
4	PC Card slots	**8**	Console port

Note A blank port adapter is installed in port adapter slot 5 in Figure 1-1. To ensure adequate airflow across the router's internal components, ensure that each port adapter slot is filled with either a port adapter or a blank port adapter.

The port adapters installed in Cisco 7200 series routers are of the same type as those installed in other Cisco 7000 family routers. Cisco 7200 series routers support the online insertion and removal (OIR) of installed port adapters.

Chassis Overview—Rear View

Figure 1-2 Cisco 7200 Series Router—Rear View



1	Power supply filler plate	**5**	AC-input power supply
2	Chassis grounding receptacles	**6**	AC-input power receptacle
3	Network processing engine or network services engine	**7**	Internal fans
4	Power switch		

The rear of Cisco 7200 series routers provides access to a network processing engine (NPE) or network services engine (NSE) and up to two 280W AC-input or DC-input power supplies (see Figure 1-2).

Most NPEs and the NSE have no external connectors or LEDs. There is a handle for removing and installing the engines and two captive installation screws for securing them to the chassis.

The NPE-G1 and NPE-G2 have external connectors for Gigabit Ethernet interfaces, and a console port and auxiliary port; the NPE-G2 also has a Fast Ethernet Management port. The NPE-G1 and NPE-G2 also have a cable-management bracket.

A fully configured Cisco 7200 series router operates with only one installed power supply; however, a second, optional power supply of the same type provides hot-swappable, load-sharing, redundant power. The power supply has the router's main power switch and either an AC-input power receptacle, or three hardwired DC-input power leads (depending on the type of installed power supply). Adjacent to the power supply bays are two chassis grounding receptacles that provide a chassis ground connection for ESD equipment or a two-hole grounding lug (see Figure 1-2).

Note The Cisco 7200 series routers do not support a mix of installed AC-input and DC-input power supplies. Figure 1-2 shows the rear of a Cisco 7200 series router configured with a single 280W AC-input power supply. (A power supply filler plate is installed over the second power supply bay.)

Three internal fans draw cooling air into the chassis interior and across internal components to maintain an acceptable operating temperature (see Figure 1-2). The three fans are enclosed in a tray that is located in the subchassis.

The I/O controller, port adapters, Port Adapter Jacket Card, power supplies, and NPE or NSE slide into their respective chassis slots and connect directly to the router midplane; there are no internal cables to connect.

Configuration Guidelines and Requirements

Understanding the relationship between the three Peripheral Component Interconnect (PCI) buses, I/O controller, and port adapters is important in understanding the rationale for the bandwidth point information that is provided in this document.

PCI Buses and Port Adapter and I/O Controller Architecture

All port adapters and service adapters installed in Cisco 7200 series routers connect to one of two Peripheral Component Interconnect (PCI) buses, mb1(left bus) or mb2 (right bus), on the router midplane that provide a path to packet I/O memory and the system (routing and switching) processor.

The optional ports on the I/O controller connect to a third PCI bus, mb0 (left bus), that connects to one of the PCI buses or to both of the PCI buses, depending on which network processing engine (NPE) or network services engine (NSE) is installed and supported in your system.

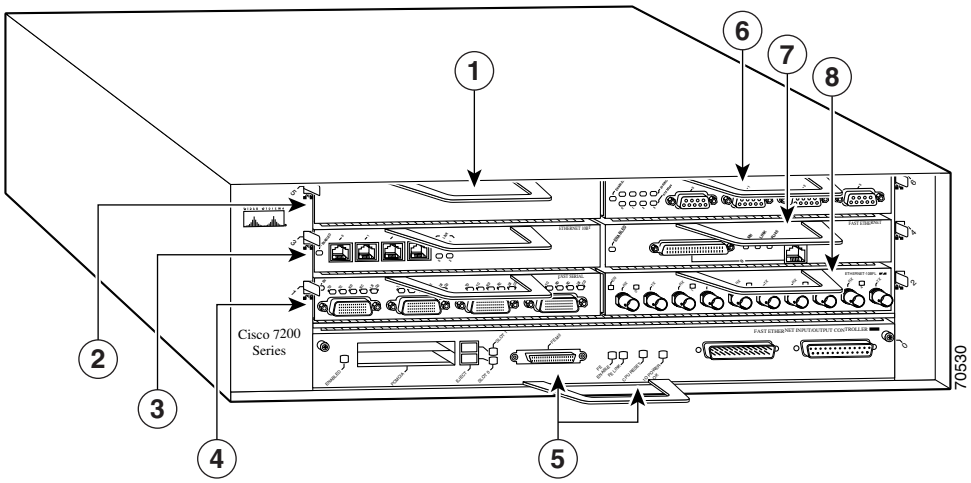
With an NPE-G1 or NPE-G2 installed, the I/O controller connects on the third PCI bus, mb0, which connects directly into the NPE-G1 or NPE-G2. When installed with the NPE-G1 or NPE-G2, the I/O controller does not take bandwidth from the two PCI buses (left and right) dedicated to the port adapters.

The Port Adapter Jacket Card, for use in the Cisco 7200 VXR routers and only with the NPE-G1 or NPE-G2, installs in the I/O controller slot on PCI bus mb0. Because the Port Adapter Jacket Card accepts only one port adapter, and the PCI bus provides another 600 bandwidth points, this bus cannot be oversubscribed because no port adapter is assigned more than 600 bandwidth points.

Guidelines for distributing the port adapters evenly between the two buses are given in the "Guidelines for Installation" section on page 1-6.

Port Adapter Slot Numbering

Figure 1-3 Cisco 7200 Series Port Adapter Slot Numbering—Cisco 7206 Shown



1	Blank port adapter	**5**	Port adapter slot 0
2	Port adapter slot 5 (left bus—mb1)	**6**	Port adapter slot 6 (right bus—mb2)
3	Port adapter slot 3 (left bus—mb1)	**7**	Port adapter slot 4 (right bus—mb2)
4	Port adapter slot 1 ((left bus—mb1)	**8**	Port adapter slot 2 (right bus—mb2)

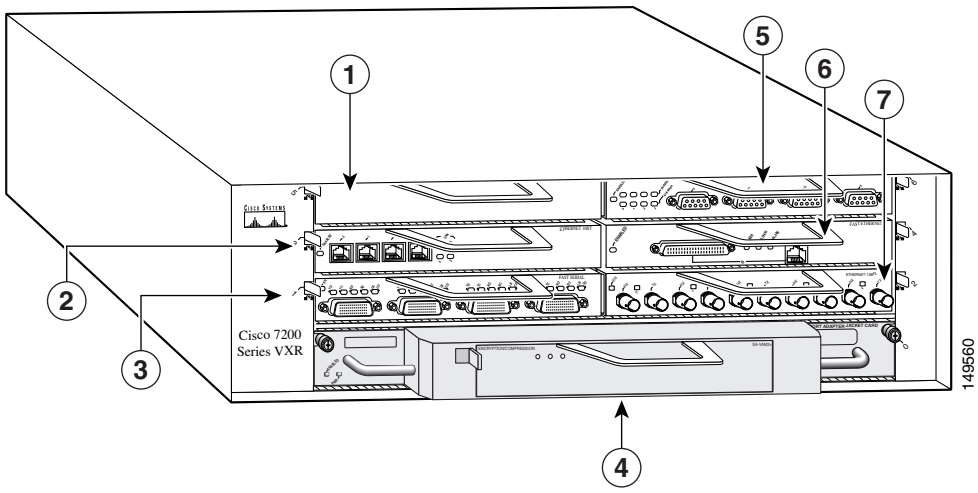
Figure 1-3 shows the port adapter slot numbering for the Cisco 7200 series routers. Figure 1-4 shows the port adapter slot numbering for the Cisco 7200 VXR routers with the Port Adapter Jacket Card installed.

For the Cisco 7202, Cisco 7204, and Cisco 7206 routers, port adapters in odd-numbered slots connect to PCI bus mb1 (left bus). Port adapters in even-numbered slots connect to PCI bus mb2 (right bus). The I/O controller connects to PCI bus mb0 (left bus), port adapter slot 0. The I/O controller is considered part of the left bus when calculating bandwidth points.

For the Cisco 7204VXR and Cisco 7206VXR routers, port adapters in odd-numbered slots connect to PCI bus mb1 (left bus). Port adapters in even-numbered slots connect to PCI bus mb2 (right bus). The I/O controller connects to PCI bus mb0 (left bus), port adapter slot 0. The I/O controller is considered part of the left bus when calculating bandwidth points, except in the case of the NPE-G1 or NPE-G2. With the NPE-G1 or NPE-G2 installed, the I/O controller connects on the third PCI bus, mb0, which connects directly into the NPE-G1 or NPE-G2, and so does not use bandwidth points.

Note The NPE-G1 and NPE-G2 installs only in the Cisco 7204VXR and Cisco 7206VXR routers.

Figure 1-4 Cisco 7200 VXR Port Adapter Slot Numbering—With Port Adapter Jacket Card



1	Port adapter slot 5 (left bus)	**5**	Port adapter slot 6 (right bus)
2	Port adapter slot 3 (left bus)	**6**	Port adapter slot 4 (right bus)
3	Port adapter slot 1 (left bus)	**7**	Port adapter slot 2 (right bus)
4	Port Adapter Jacket Card slot 0 (mb0 bus), and port adapter slot 7		

Note The Port Adapter Jacket Card works only with an NPE-G1 or NPE-G2 installed.

The Port Adapter Jacket Card installs into the I/O controller slot on the third PCI bus, mb0. The Port Adapter Jacket Card is designated slot 0, and the port adapter installed in it is designated port adapter slot 7 on the Cisco 7206 VXR router, and slot 5 on the Cisco 7204 VXR router.

Guidelines for Installation

Cisco 7200 series routers have a finite data-carrying capacity, referred to as bandwidth, that affects the port adapter distribution in the chassis, as well as the number and types of port adapters you can install.

To ensure that your Cisco 7200 series router port adapter configuration is within the router operating limits, observe the following guidelines and requirements when planning to install a port adapter, network processing engine or network services engine, or I/O controller. Chapter 2, "Memory Requirements," provides information about various types of memory requirements for the hardware and software that support port adapters.

Table 1-1 provides general guidelines for Cisco 7200 series routers.

Table 1-1 Initial Guidelines for Cisco 7200 Series Routers

Question	Answer
What port adapters are supported on which Cisco IOS release?	If you have a Cisco.com login ID[1], use the Software Advisor. To access the Software Advisor, go to: http://www.cisco.com, Technical Support and Documentation, and click **Tools and Resourcess**, and click **Software Advisor**. Under Software Support for Hardware, click the appropriate link. Then choose your platform and a Cisco IOS release.
Do NPEs or the NSE use bandwidth points?	No. The network processing engine (NPE) or network services engine (NSE) provide bandwidth to the system. Newer NPEs or NSEs provide more bandwidth than older NPEs.
Are there memory requirements associated with both the individual port adapter and the number and type of port adapters that can be installed?	For individual port adapter processor memory requirements, see Table 1-6. For NPE or NSE, Cisco IOS, and router SDRAM memory requirements, see Chapter 2, "Memory Requirements."

1. You can request a Cisco.com login ID. To become a registered user, refer to Registration at http://tools.cisco.com/RPF/register/register.do.

Installation Requirements Based on the NPE or NSE Installed

To ensure that your Cisco 7200 series port adapter configuration is within the router operating limitations, determine your model of network processing engine or network services engine and observe the following guidelines:

- For NPE-G1 or NPE-G2, go to the "NPE-G1 or NPE-G2 Bandwidth Calculation and Configuration Instructions" section on page 1-8.
- NPE-G1 or NPE-G2 with a Port Adapter Jacket Card—Bandwidth Calculation and Configuration Instructions, page 1-9
- For NPE-400, NPE-300 and NSE-1, go to the "NPE-400, NPE-300, and NSE-1 Bandwidth Calculation and Configuration Instructions" section on page 1-9.
- For NPE-225, NPE-200, NPE-175, NPE-150, and NPE-100, go to the "NPE-225, NPE-200, NPE-175, NPE-150, and NPE-100 Bandwidth Calculation and Configuration Instructions" section on page 1-11.

NPE-G1 or NPE-G2 Bandwidth Calculation and Configuration Instructions

Step 1 For each port adapter in your system, check the footnotes in Table 1-6 to see if any apply to your system.

Step 2 If you have any dual-wide port adapters in your system, carefully read the port adapter configuration document to see what special conditions apply to these port adapters.

Step 3 Calculate the bandwidth points requirements. For each port adapter in your system, go to Table 1-6 and write down the bandwidth points requirements. Use the blank Bandwidth Calculation Table, page 1-22, to record your requirements.

Note Do not calculate bandwidth points for an I/O controller if it is installed in the Cisco 7200 VXR router with an NPE-G1 or NPE-G2. With the NPE-G1 or NPE-G2, I/O controllers do not use bandwidth or bandwidth points.

Step 4 Assign each port adapter in your system to a chassis slot.

- Make sure that the total bandwidth points for slots 0, 1, 3, and 5 (left bus) are less than or equal to 600.
- Make sure that the total bandwidth points for slots 2, 4, and 6 (right bus) are less than or equal to 600.

Step 5 Make sure that the bandwidth points are evenly distributed between the left (odd-numbered slots) and right (even-numbered slots) buses. Include the I/O controller in your determination of balance for the left odd-numbered slots. Fill the slots in the following order: 2, 1, 4, 3, 6, 5.

Step 6 Check your Cisco IOS release and port adapter SDRAM memory requirements as detailed in Chapter 2, "Memory Requirements.".

You are finished calculating your port adapter configuration.

Sample Bandwidth Configuration for the NPE-G1 or NPE-G2

This sample configuration is for a Cisco 7200 VXR chassis with an NPE-G1 or NPE-G2 installed. The maximum points allowed for each PCI bus is 600 points. When any I/O controller is installed with the NPE-G1 or NPE-G2, no bandwidth points are used. The Gigabit Ethernet interfaces on the NPE-G1 or NPE-G2 also require no bandwidth points.

Table 1-2 Valid Configuration—Cisco 7200 VXR Router with NPE-G1 or NPE-G2

Left Bus	Bandwidth Points	Right Bus	Bandwidth Points
Port Adapters:		**Port Adapters:**	
PA-E3	90	PA-E3	90
PA-E3	90	PA-2E3	180
PA-4E1G/120	0	PA-2E3	180
I/O Controller:			
C7200-I/O-2FE/E	0		
Total points left bus:	**180**	**Total points right bus:**	**450**

NPE-G1 or NPE-G2 with a Port Adapter Jacket Card—Bandwidth Calculation and Configuration Instructions

The Port Adapter Jacket Card works only with the NPE-G1 or NPE-G2 installed in Cisco 7200 VXR router. Because of the third PCI bus provided by these network processing engines, the Port Adapter Jacket Card PCI bus mb0 provides an additional 600 bandwidth points. Only one port adapter can be inserted into the port adapter slot in the Port Adapter Jacket Card. Because no port adapter is assigned more than 600 bandwidth points, there is no need to do any calculation of points for port adapter slot 5 (Cisco 7204 VXR) or slot 7 (Cisco 7206 VXR), PCI bus mb0.

NPE-400, NPE-300, and NSE-1 Bandwidth Calculation and Configuration Instructions

Step 1 For the I/O controller and each port adapter in your system, check the footnotes in Table 1-6 to see if any apply to your system.

Step 2 If you have any dual-wide port adapters in your system, carefully read the port adapter configuration document to see what special conditions apply to these port adapters.

Step 3 Calculate the bandwidth points requirements. For the I/O controller and each port adapter in your system, go to Table 1-6 and write down the bandwidth points requirements. Use the blank Bandwidth Calculation Table, page 1-22, to record your requirements.

Step 4 Assign each port adapter in your system to a chassis slot.

- Make sure that the total bandwidth points for slots 0, 1, 3, and 5 (left bus) are less than or equal to 600.
- Make sure that the total bandwidth points for slots 2, 4, and 6 (right bus) are less than or equal to 600.

Step 5 Make sure that the bandwidth points are evenly distributed between the left (odd-numbered slots) and right (even-numbered slots) buses. Include the I/O controller in your determination of balance for the left odd-numbered slots. Fill the slots in the following order: 2, 1, 4, 3, 6, 5.

Step 6 Check your Cisco IOS release and port adapter SDRAM memory requirements as detailed in Chapter 2.

You are finished calculating your port adapter configuration.

Note Dual-width port adapters occupy two horizontally aligned port adapter slots when installed in a Cisco 7200 series router; however, dual-width port adapters do not use both PCI bus mb1 (left bus) and PCI bus mb2 (right bus) when operating in the router.

The dual-width PA-A2 port adapter uses only PCI bus mb2 (right bus) when installed in a Cisco 7200 series router.

The dual-width PA-12E/2FE port adapter autoselects PCI bus mb1 (left bus) or PCI bus mb2 (right bus) based on bandwidth availability—the port adapter selects the PCI bus that has the most available bandwidth. Therefore, do not include the bandwidth points for the PA-12E/2FE when calculating the combined bandwidth point total for a combination of installed port adapters in PCI bus mb1 (left bus) and PCI bus mb2 (right bus). Instead, add the bandwidth points for the PA-12E/2FE to the PCI bus that has the most PCI bus bandwidth availability (the PCI bus the PA-12E/2FE will autoselect) after completing the initial calculation.

Sample Bandwidth Configuration for the NPE-400, NPE-300, and NSE-1

This sample configuration is for a Cisco 7200 VXR chassis with an NPE-400 installed. The maximum points allowed for each PCI bus is 600 points. The I/O controller is considered a port adapter in bandwidth point calculation.

Table 1-3 Valid Configuration—Cisco 7200 VXR Router with NPE-400

Left Bus	Bandwidth Points	Right Bus	Bandwidth Points
Port Adapters:		**Port Adapters:**	
PA-E3	90	PA-E3	90
PA-E3	90	PA-2E3	180
PA-4E1G/120	0	PA-2E3	180
I/O Controller:			
C7200-I/O-2FE/E	400		
Total points left bus:	**580**	**Total points right bus:**	**450**

NPE-225, NPE-200, NPE-175, NPE-150, and NPE-100 Bandwidth Calculation and Configuration Instructions

Step 1 For the I/O controller and each port adapter in your system, check the footnotes in Table 1-6 to see if any apply to your system.

Step 2 If you have any dual-width port adapters in your system, carefully read the port adapter configuration document to see what special conditions apply to these port adapters.

Step 3 Calculate the bandwidth resource requirements. For the I/O controller and each port adapter in your system, go to Table 1-6 and write down the bandwidth resource requirements. Use the blank Bandwidth Calculation Table, page 1-22, to record your requirements.

a. High-bandwidth port adapter determination:
   - For the NPE-225, NPE-200, NPE-175, and NPE-150, make sure you have no more than three high-bandwidth port adapters.
   - For an NPE-100, make sure you have no more than two high-bandwidth port adapters.

b. High- and medium-bandwidth port adapter determination:
   - For the NPE-225, NPE-200, NPE-175, and NPE-150, make sure you have no more than five high- and medium-bandwidth port adapters.
   - For an NPE-100, make sure you have no more than four high- and medium-bandwidth port adapters.

Step 4 Calculate the bandwidth points requirements. For the I/O controller and each port adapter in your system, go to Table 1-6 and write down the bandwidth points requirements. Make sure the total number of bandwidth points is less than or equal to 800.

Step 5 Assign each port adapter in your system to a chassis slot. Make sure that the bandwidth points are evenly distributed between the left (odd-numbered slots) and right (even-numbered slots) buses. Include the I/O controller in your determination of balance. Fill the slots in the following order: 2, 1, 4, 3, 6, 5.

Step 6 Check your Cisco IOS release and port adapter SDRAM memory requirements as detailed in Chapter 2, "Memory Requirements."

You are finished calculating your port adapter configuration.

Note Dual-width port adapters occupy two horizontally aligned port adapter slots when installed in a Cisco 7200 series router; however, dual-width port adapters do not use both PCI bus mb1 (left bus) and PCI bus mb2 (right bus) when operating in the router.

The dual-width PA-A2 port adapter uses only PCI bus mb2 (right bus) when installed in a Cisco 7200 series router.

The dual-width PA-12E/2FE port adapter autoselects PCI bus mb1 (left bus) or PCI bus mb2 (right bus) based on bandwidth availability—the port adapter selects the PCI bus that has the most available bandwidth. Therefore, do not include the bandwidth points for the PA-12E/2FE when calculating the combined bandwidth point total for a combination of installed port adapters in PCI bus mb1 (left bus) and PCI bus mb2 (right bus). Instead, add the bandwidth points for the PA-12E/2FE to the PCI bus that has the most PCI bus bandwidth availability (the PCI bus the PA-12E/2FE will autoselect) after completing the initial calculation.

Sample Bandwidth Configuration for the NPE-225, NPE-200, NPE-175, and NPE-150

The following sample configurations are for a Cisco 7200 series router with an I/O controller and NPE-225 installed. The maximum points allowed is 800 points per chassis.

Table 1-4 Valid Configuration—Cisco 7200 Series Router with NPE-225

Left Bus	Bandwidth Resource Requirement	Bandwidth Points		Right Bus	Bandwidth Resource Requirement	Bandwidth Points
Port Adapters:				**Port Adapters:**		
PA-MC-8T1	Low	0		PA-A3-T3	High	90
PA-MC-8T1	Low	0		PA-A3-T3	High	90
PA-8E	Medium	80		PA-8E	Medium	80
I/O Controller:						
C7200-I/O-2FE/E	High	400				
Total points left bus:		**480**		**Total points right bus:**		**260**
Total high, medium, and low port adapters: 3 high, 2 medium, 2 low						
Total points per chassis: 740						

The sample configuration in Table 1-4 follows the rule of keeping below the 800 maximum bandwidth points, and having no more than three high-bandwidth port adapters, and having no more than five high- and medium-bandwidth port adapters in a chassis with an NPE-225. All three rules must be followed for a configuration to be valid. The I/O controller is considered a port adapter in point calculation.

Table 1-5 Invalid Configuration—Cisco 7200 Series Router with NPE-225

Left Bus	Bandwidth Resource Requirement	Bandwidth Points		Right Bus	Bandwidth Resource Requirement	Bandwidth Points
Port Adapters:				**Port Adapters:**		
PA-FE-TX	High	200		PA-A3-T3	High	90
PA-MC-8T1	Low	0		PA-A3-T3	High	90
PA-MC-8T1	Low	0		PA-MC-8T1	Low	0
I/O Controller:						
C7200-I/O-2FE/E	High	400				
Total points left bus:		**600**		**Total points right bus:**		**180**
Total high, medium, and low port adapters: 4 high, 3 low						
Total points per chassis: 780						

The configuration in Table 1-5 is invalid because, although the bandwidth points are less than 800, there are four high-bandwidth port adapters installed, not three high-bandwidth port adapters as the rules allow. All three rules (no more than 800 bandwidth points, no more than three high-bandwidth port adapters, and no more than five high- and medium-bandwidth port adapters in a chassis with an NPE-225) must be followed for the configuration to be valid. The I/O controller is considered a port adapter in point calculation.

Bandwidth and Bandwidth Point Requirements

Port adapters use various types of resources from the chassis and the NPE or NSE. Bandwidth is a term that describes port adapter resource requirements. Bandwidth includes variables such as speed, memory, CPU requirements, and PCI bus bandwidth. Because of changes in architecture in the network processing engines over the years, two methods were developed to describe port adapter bandwidth requirements. The methods are reflected in the Bandwidth Resource Requirement column and the Bandwidth Points column of Table 1-6. However, the information in these columns must be considered with the information in the following sections:

- NPE-G1 or NPE-G2 Bandwidth Calculation and Configuration Instructions, page 1-8
- NPE-G1 or NPE-G2 with a Port Adapter Jacket Card—Bandwidth Calculation and Configuration Instructions, page 1-9
- NPE-400, NPE-300, and NSE-1 Bandwidth Calculation and Configuration Instructions, page 1-9
- NPE-225, NPE-200, NPE-175, NPE-150, and NPE-100 Bandwidth Calculation and Configuration Instructions, page 1-11

Table 1-6 lists port adapter types, bandwidth resource requirements and bandwidth points, and processor memory requirements.

Requirements Summary

This section provides a summary of bandwidth and bandwidth point requirements for each processing engine.

Port Adapter Jacket Card

PCI bus mb0 has a 600 point maximum. The Port Adapter Jacket Card accepts one port adapter which can use a maximum of 600 bandwidth points. PCI bus mb0 with a Port Adapter Jacket Card installed is designated as port adapter slot 5 in a Cisco 7204VXR router, or slot 7 in a Cisco 7206VXR router.

NPE-G1 or NPE-G2

- Left side, bus 1 (slots 1, 3, and 5) and I/O controller (slot 0) has a 600 point maximum.
- Right side, bus 2 (slots 2, 4, and 6) has a 600 point maximum.
- Distribute port adapter bandwidth points evenly across both left and right system slots (buses).
- Do not calculate bandwidth points for an I/O controller if an I/O controller is installed with the NPE-G1 or NPE-G2.
- The NPE-G1 or NPE-G2 Gigabit Ethernet interfaces do not use bandwidth points.

NPE-400, NPE-300, NSE-1

- Left side, bus 1 (slots 1, 3, and 5) and I/O controller (slot 0) has a 600 point maximum.
- Right side, bus 2 (slots 2, 4, and 6) has a 600 point maximum.
- Distribute port adapter bandwidth points evenly across both left and right system slots (buses).

NPE-225, NPE-200, NPE-175, NPE-150

- Port adapters are labeled as high, medium, and low.
- Bandwidth point rules:
  - No more than three high-bandwidth port adapters, and
  - No more than five total medium- and high-bandwidth port adapters, and
  - No more than 800 total bandwidth points per system
- Distribute port adapter bandwidth points evenly across both left and right system slots (buses).

NPE-100

- Port adapters are labeled as high, medium, and low.
- Bandwidth point rules:
  - No more than two high-bandwidth port adapters, and
  - No more than four total medium- and high-bandwidth port adapters, and
  - No more than 800 total bandwidth points per system
- Distribute port adapter bandwidth points evenly across both left and right system slots (buses).

Bandwidth Table

Use the table below to determine the bandwidth points for your port adapter and I/O controller.

Table 1-6 Bandwidth, Bandwidth Points, and Processor Memory Requirements

Port Adapter Type	Product Number	Bandwidth Resource Requirement	Bandwidth Points	Processor Memory Required[1]	Additional Requirements
Acceleration Module					
VPN Service Adapter (VSA)	C7200 VSA	Because the VSA installs only in the I/O slot of the Cisco 7200 VXR chassis, no bandwidth point calculations are required.		9 MB	—
ATM					
1-port multimode	PA-A1-OC3MM	High	300	0.10 MB	—[2]
1-port single-mode intermediate reach	PA-A1-OC3SMI				
Circuit emulation services (CES)	PA-A2-4E1XC-OC3SM	High	300	1.20 MB	—
	PA-A2-4E1XC-E3ATM		90		
	PA-A2-4E1YC-OC3SM		300		
	PA-A2-4E1YC-E3ATM		90		
	PA-A2-4T1C-OC3SM		300		
	PA-A2-4T1C-T3ATM		90		
Enhanced	PA-A3-T3	High	90	1.00 MB	—
	PA-A3-E3				
	PA-A3-OC3MM		300	1.00 MB	—
	PA-A3-OC3SMI				
	PA-A3-OC3SML				
Inverse multiplexing over ATM	PA-A3-8T1IMA	Low	0	4.3 MB	—
	PA-A3-8E1IMA		0		—
1-port OC3-multimode	PA-A6-OC3MM	High	300	2 MB	—
1-port OC3-single mode intermediate reach	PA-A6-OC3SMI	High	300	2 MB	—
1-port OC3-single mode long reach	PA-A6-OC3SML	High	300	2 MB	—
Channel					
1-port Enterprise System Connection (ESCON) channel	PA-1C-E	High	100	0.05 MB	0.36 MB
1-port parallel channel	PA-1C-P	Low[3]	0	0.15 MB	0.36 MB
1-port Enterprise System Connection (ESCON) channel	PA-4C-E	High	100	0.15 MB	0.36 MB
1-port GB fiber channel interface	PA-FC-1G	High	400	3.1 MB	—
Dynamic Packet Transport					
Multimode fiber	PA-SRP-OC12MM	High	150 + 150[4]	0.40 MB	—

Table 1-6 Bandwidth, Bandwidth Points, and Processor Memory Requirements (continued)

Port Adapter Type	Product Number	Bandwidth Resource Requirement	Bandwidth Points	Processor Memory Required[1]	Additional Requirements
Single-mode fiber, intermediate reach	PA-SRP-OC12SMI	High	300[4]	0.40 MB	—
Single-mode fiber, long reach	PA-SRP-SML	High	300[4]	0.40 MB	—
Single-mode fiber, extended reach	PA-SRP-SMX	High	300[4]	0.40 MB	—
Ethernet/Fast Ethernet/Gigabit Ethernet					
2-port Fast Ethernet (FX)	PA-2FE-FX	High	400	2.4 MB	—
1 port use of 2-port Fast Ethernet (RX)	*PA-2FE-FX*[5]	*High*	*200*	*2.4 MB*	—
2-port Fast Ethernet (TX)	PA-2FE-TX	High	400	2.4 MB	—
1 port use of 2-port Fast Ethernet (TX)	*PA-2FE-TX*[5]	*High*	*200*	*2.4 MB*	—
14-port Ethernet switch 10/100BASETX	PA-12E/2FE	High	300	0.17 MB	—
8-port Ethernet 10BASET	PA-8E	Medium	80	0.40 MB	—
5-port Ethernet 10BASEFL	PA-5EFL		50	0.25 MB	—
4-port Ethernet 10BASET	PA-4E		40		—
2-port Fast Ethernet/ISL 100BASETX	PA-2FEISL-TX	High	300	0.68 MB	—
2-port Fast Ethernet/ISL 100BASEFX	PA-2FEISL-FX		300	0.68 MB	—
1-port Fast Ethernet 100BASETX	PA-FE-TX	High	200	0.10 MB	—
1-port Fast Ethernet 100BASEFX	PA-FE-FX	High	200	0.10 MB	—
1-port 100VG-AnyLAN	PA-100VG	High	200	0.10 MB	—
1-port dial shelf interconnect[6]	PA-DSIC	High	200	0.10 MB	—
1-port full-duplex Gigabit Ethernet	PA-GE	Not supported	400	0.24 MB	—
I/O Controllers					
1-port Gigabit Ethernet plus Ethernet I/O controller	C7200-I/O-GE+E[7]	High	400	0.11 MB	
2-port Fast Ethernet/Ethernet I/O controller	C7200-I/O-2FE/E[8]	High	400	0.10 MB	—
1 port use of 2-port Fast Ethernet/Ethernet I/O controller	*C7200-I/O-2FE/E*[9]	*High*	*200*	*0.10 MB*	—
1-port Fast Ethernet I/O controller (2 connectors: RJ-45 and MII)	C7200-I/O-FE[10]	High	200	0.10 MB	—

Table 1-6 Bandwidth, Bandwidth Points, and Processor Memory Requirements (continued)

Port Adapter Type	Product Number	Bandwidth Resource Requirement	Bandwidth Points	Processor Memory Required[1]	Additional Requirements
1-port Fast Ethernet I/O controller (MII connector)	C7200-I/O-FE-MII[10]	High	200	0.10 MB	—
No Ethernet port I/O controller	C7200-I/O	None	0	—	—
Fiber Distributed Data Interface (FDDI)					
Multimode	PA-F-MM[11]	High	100[11]	0.10 MB	—
Single-mode	PA-F-SM[11]		100[11]		
Full-duplex multimode FDDI	PA-F/FD-MM[11]		200[11]		
Full-duplex single-mode FDDI	PA-F/FD-SM[11]		200[11]		
High Speed Serial					
1-port high-speed serial	PA-H (Rev. B)	High	100	0.10 MB	—
2-port high-speed serial	PA-2H (Rev. B)		200		
Multichannel Serial					
1-port channelized T3 dual-width	PA-CT3/4T1[11]	High	0[11]	0.80 MB	—
2-port channelized E1/Primary Rate Interface (PRI) ISDN	PA-2CE1/PRI-75[11]	Low	0[11]	1.80 MB	1.20 MB (when configured for ISDN)
	PA-2CE1/PRI-120[11]				
2-port channelized T1/PRI ISDN	PA-2CT1/PRI[11]	Low[3]	0	1.80 MB	1.20 MB (when configured for ISDN)
8-port multichannel T1/E1 PRI	PA-MC-8TE1+	Low[3]	0	10 MB	
1-port multichannel E3	PA-MC-E3	High	90	3.00 MB	With 2 interfaces configured for PPP encapsulation
				6.40 MB	With 128 interfaces configured for PPP encapsulation
1-port multichannel E1 STM1	PA-MC-STM-1SMI	High	250	10 MB	—
1-port multichannel E1 STM1	PA-MC-STM-1MM	High	250	10 MB	—

Table 1-6 Bandwidth, Bandwidth Points, and Processor Memory Requirements (continued)

Port Adapter Type	Product Number	Bandwidth Resource Requirement	Bandwidth Points	Processor Memory Required[1]	Additional Requirements
1-port multichannel T3	PA-MC-T3	High	90	3.00 MB	With 2 interfaces configured for PPP encapsulation
				6.40 MB	With 128 interfaces configured for PPP encapsulation
Multichannel Serial (continued)					
2-port multichannel T3	PA-MC-2T3+	High	180	3.00 MB	With 2 interfaces configured for PPP encapsulation
				6.40 MB	With 128 interfaces configured for PPP encapsulation
2- and 8-port multichannel E1/PRI	PA-MC-2E1/120	Low[3]	0	3.50 MB	—
	PA-MC-8E1/120				
2-, 4- and 8-port multichannel DS1/PRI	PA-MC-2T1	Low[3]	0	2.50 MB	—
	PA-MC-4T1				
	PA-MC-8T1			3.10 MB	
	PA-MC-8DSX1				
1-port multichannel T3	PA-MC-T3-EC	Supported only on Cisco 7200 VXR chassis with an NPE-G1 or NPE-G2	90	2.71 MB	
2-port-multichannel T3	PA-MC-2T3-EC		180	2.71 MB	
4- and 8-port Basic Rate Interface (BRI) ISDN	PA-4B-U	Low[3]	0	0.40 MB	1.20 MB
8 BRI ISDN	PA-8B-T	Low[3]	0	0.40 MB	1.20 MB

Table 1-6 Bandwidth, Bandwidth Points, and Processor Memory Requirements (continued)

Port Adapter Type	Product Number	Bandwidth Resource Requirement	Bandwidth Points	Processor Memory Required[1]	Additional Requirements
SONET					
2-port function as either dual independent OC-3c/STM-1 ports or a single port with automatic switchover	PA-POS-2OC3	High	600	0.34 MB	—
1-port SFP module-based OC-3c/STM-1	PA-POS-1OC3	High	300	0.34 MB	—
1-port multimode	PA-POS-OC3-MM	High	300	0.15 MB	—
1-port single-mode intermediate reach	PA-POS-OC3SMI				
1-port single-mode long reach	PA-POS-OC3SML				
Serial					
1-port E3 high-speed serial	PA-E3	High	90	0.07 MB	—
2-port E3 high-speed serial	PA-2E3	High	180	0.10 MB	—
1-port T3 high-speed serial	PA-T3	High	90	0.07 MB	—
2-port T3 high-speed serial	PA-2T3	High	180	0.10 MB	—
1-port T3+ high-speed serial	PA-T3+	High	90	0.07 MB	—
2-port T3+ high-speed serial	PA-2T3+	High	180	0.10 MB	—
1-port T3/E3 high-speed serial	PA-T3/E3-EC		90	2.71 MB	—
2-port T3/E3 high-speed serial	PA-2T3/E3-EC		180	2.71 MB	—
4-port E1-G.703/704 serial	PA-4E1G-75	Low[3]	0	0.10 MB	—
	PA-4E1G-120	Low[3]	0	0.10 MB	—
8-port synchronous serial (X.21)	PA-8T-X21	Low[3]	0	0.35 MB	—
8-port synchronous serial (V.35)	PA-8T-V35				
8-port synchronous serial (EIA/TIA-232)	PA-8T-232				
4-port synchronous serial	PA-4T	Low[3]	0	0.20 MB	—
4-port synchronous serial, enhanced	PA-4T+				
Service					
Data encryption service adapter	SA-Encrypt	Medium	60	0.03 MB	—
Compression service adapter	SA-Comp/1[11]	Low[3]	0	0.10 MB	—
	SA-Comp/4[11]				
Integrated Service Adapter[12]	SA-ISA/DES	High	200	3 MB	—
	SA-ISA/3DES	High	200	3 MB	—

Table 1-6 Bandwidth, Bandwidth Points, and Processor Memory Requirements (continued)

Port Adapter Type	Product Number	Bandwidth Resource Requirement	Bandwidth Points	Processor Memory Required[1]	Additional Requirements
Virtual Private Network Acceleration Module[13]	SA-VAM	High on NPE-225 Not supported on NPE-150, NPE-175, NPE-200	300	0.26 MB	—
Virtual Private Network Acceleration Module 2[13]	SA-VAM2	High on NPE-225 Not supported on NPE-150, NPE-175, NPE-200	600	0.26 MB	—
Virtual Private Network Acceleration Module 2+[13]	SA-VAM2+	High on NPE-225 Not supported on NPE-150, NPE-175, NPE-200 NPE-300	600	0.26 MB	—
VPN Service Adapter (VSA)	See Acceleration Module, page 1-15.				
Token Ring					
4-port Token Ring half-duplex	PA-4R[11]	Medium	60[11]	0.30 MB	—
4-port Token Ring full-duplex	PA-4R-FDX[11]	High	120[11]	0.30 MB	—
4-port dedicated Token Ring	PA-4R-DTR		120		
Voice					
2-, 4-, and 8-port multichannel T1/E1	PA-MCX-2TE1	Low	0	10 MB	—
	PA-MCX-4TE1				
	PA-MCX-8TE1	Low	0	10 MB	
	PA-MCX-8TE1+[14]	Low	0	10 MB	—
Single-port low capacity	PA-VXA-1TE1-24+	Low	0	2 MB	—
	PA-VXA-1TE1-30+	Low	0	2 MB	—
2-port moderate capacity	PA-VXB-2TE1	Low	0	2 MB	—
2-port high capacity	PA-VXC-2TE1	Low	0	2 MB	—

Table 1-6 Bandwidth, Bandwidth Points, and Processor Memory Requirements (continued)

Port Adapter Type	Product Number	Bandwidth Resource Requirement	Bandwidth Points	Processor Memory Required[1]	Additional Requirements
Enhanced 2-port moderate capacity	PA-VXB-2TE1+	Low	0	2 MB	—
Enhanced 2-port high capacity	PA-VXC-2TE1+	Low	0	2 MB	—

1. Processor memory requirements are used when you determine port adapter installation guidelines for a Cisco 7200 series router.
2. Not applicable.
3. Bandwidth points for low-bandwidth port adapters are not required when you determine port adapter installation guidelines for a Cisco 7200 VXR router that has an NPE-400, NPE-300, or NSE-1 installed; that is, low bandwidth means 0 bandwidth points.
4. The PA-SRP-OC12 port adapters connect to both PCI buses; therefore, the total bandwidth points (300) are divided equally between the two buses. You must calculate the total bandwidth points by adding 150 bandwidth points to each bus.
5. When using only 1 port of the two ports available, the PA-2FE (TX) uses only 200 bandwidth points, and is an allowed usage. See also the "Messages for One Port Use of Specific Port Adapters and an I/O Controller" section on page 1-22 for information on supported Cisco IOS releases and an error message.
6. For use only in Cisco 7206 or Cisco 7206VXR router shelves in a Cisco AS5800 Universal Access Server.
7. The I/O controller with a Gigabit Ethernet port and an Ethernet port (C7200-I/O-GE+E) operates only in Cisco 7204VXR and Cisco 7206VXR chassis with the following network processing engines: NPE-400 and later network processing engines or the network services engine.
8. The I/O controller with two autosensing Fast Ethernet/Ethernet ports (C7200-I/O-2FE/E) operate only in Cisco 7204VXR and Cisco 7206VXR chassis and with the following network processing engines: NPE-225 and later network processing engines or the network services engine.
9. When using only 1 port of the two ports available, this I/O controller uses only 200 bandwidth points, and is an allowed usage. See also the "Messages for One Port Use of Specific Port Adapters and an I/O Controller" section on page 1-22 for information on supported Cisco IOS releases and an error message.
10. The Fast Ethernet port on the I/O controller (C7200-I/O-FE) does not operate in a Cisco 7202 router.
11. This port adapter is not supported in Cisco 7200 VXR routers.
12. See the *Integrated Service Adapter and Integrated Service Module Installation and Configuration* documentation for information on compatibility with the VPN Acceleration Module, as well as information on specific behaviors of these products when used with each other, and specific commands to use to enable or disable them
13. See the *VPN Acceleration Module Installation and Configuration* documentation for information on compatibility with Cisco ISA Service Adapter and Cisco ISM service adapter, as well as information on specific behaviors of these products when used with each other, and specific commands to use to enable or disable them.
14. For use with Cisco 7200 VXR routers only until release of Cisco IOS Release 12.2(2)T.

Note You can use a Cisco 7200 series router with a port adapter configuration that exceeds the preceding guidelines; for example, if you have a redundant port adapter installed that is not in use. However, to prevent anomalies from occurring while the router is in use, we strongly recommend restricting the port adapter types installed in the router according to the guidelines listed above.

Additionally, your port adapter configuration must be within the above guidelines before the Cisco Technical Support Services will troubleshoot anomalies that are occurring in your Cisco 7200 series router.

For information on system memory requirements and Cisco IOS memory requirements, see Chapter 2, "Memory Requirements."

Bandwidth Calculation Table

Use Table 1-7 to calculate the bandwidth points for your router.

Table 1-7 Calculating the Bandwidth Points for Your Router

Left Bus	Bandwidth Points	Right Bus	Bandwidth Points
Port Adapters:		**Port Adapters:**	
I/O Controller:			
Total points left bus:		**Total points right bus:**	

Messages for One Port Use of Specific Port Adapters and an I/O Controller

For the PA-2FE-FX, PA-2FE-TX, PA-POS-2OC3, and I/O controller c7200-I/O-2FE/E using only one port—with what would normally be oversubscription of bandwidth points but is allowed because of the strict use of only one port—the following messages appear in these Cisco IOS releases: Cisco IOS Release 12.3(9), Cisco IOS Release 12.1(24)E, Cisco IOS Release 12.2(25)S, and Cisco IOS Release 12.0(29)S.

NPE-400

The following messages appear in a system with an NPE-400 installed. To provide examples of the messaging, the following two sample hardware configurations are referred to in the example output message.

Example 1: Showing an acceptable configuration.

Slots 0, 1, 3 and 5: c7200-I/O-2FE/E, 2PA-FE

Slots 2, 4 and 6: PA-8E, PA-POS-2OC3

==========

```
PCI bus mb0_mb1 (Slots 0, 1, 3 and 5) has a capacity of 600 bandwidth points. Current
configuration on bus mb0_mb1 has a total of 600 bandwidth points. This configuration
is within the PCI bus capacity and is supported.

PCI bus mb2 (Slots 2, 4, 6) has a capacity of 600 bandwidth points. Current
configuration on bus mb2 has a total of 680 bandwidth points. The set of PA-2FE,
PA-POS-2OC3, and I/O-2FE qualify for "half bandwidth points" consideration, when full
bandwidth point counting results in oversubscription, under the condition that only
one of the two ports is used. With this adjustment, current configuration on bus mb2
has a total of 380 bandwidth points. This configuration is within the PCI bus capacity
and is supported under the above condition.

Please refer to the following document "Cisco 7200 Series Port Adapter Hardware
Configuration Guidelines" on Cisco.com <http://www.cisco.com>
for c7200 bandwidth points oversubscription and usage guidelines.
```

Example 2: Showing an oversubscribed configuration.

Slots 0, 1, 3 and 5: c7200-I/O-2FE/E, PA-POS-2OC3, PA-2FE

Slots 2, 4 and 6: PA-8E

==========

```
PCI bus mb0_mb1 (Slots 0, 1, 3 and 5) has a capacity of 600 bandwidth points. Current
configuration on bus mb0_mb1 has a total of 1200 bandwidth points. The set of PA-2FE,
PA-POS-2OC3, and I/O-2FE qualify for "half bandwidth points" consideration, when full
bandwidth point counting results in oversubscription, under the condition that only
one of the two ports is used. With this adjustment, current configuration on bus
mb0_mb1 has a total of 700 bandwidth points. This configuration has oversubscripted
the PCI bus and is not a supported configuration.

PCI bus mb2 (Slots 2, 4, 6) has a capacity of 600 bandwidth points. Current
configuration on bus mb2 has a total of 80 bandwidth points. This configuration is
within the PCI bus capacity and is supported.

Please refer to the following document "Cisco 7200 Series Port Adapter Hardware
Configuration Guidelines" on Cisco.com <http://www.cisco.com>
for c7200 bandwidth points oversubscription and usage guidelines.
```

NPE-G1 or NPE-G2

The following messages appear in a system with an NPE-G1 or NPE-G2 installed. To provide examples of the messaging, the following two sample hardware configurations are referred to in the example output message.

Example 1: Showing an acceptable configuration

Slots 1, 3 and 5: PA-POS-2OC3, PA-2FE

Slots 2, 4 and 6: PA-FE, PA-2H

==========

```
PCI bus mb1 (Slots 1, 3 and 5) has a capacity of 600 bandwidth points. Current
configuration on bus mb1 has a total of 1000 bandwidth points. The set of PA-2FE,
PA-POS-2OC3, and I/O-2FE qualify for "half bandwidth points" consideration, when full
bandwidth point counting results in oversubscription, under the condition that only
one of the two ports is used. With this adjustment, current configuration on bus mb1
has a total of 500 bandwidth points. This configuration is within the PCI bus capacity
and is supported under the above condition.

PCI bus mb2 (Slots 2, 4 and 6) has a capacity of 600 bandwidth points. Current
configuration on bus mb2 has a total of 400 bandwidth points. This configuration is
within the PCI bus capacity and is supported.

Please refer to the following document "Cisco 7200 Series Port Adapter Hardware
Configuration Guidelines" on Cisco.com <http://www.cisco.com>
for c7200 bandwidth points oversubscription and usage guidelines.
```

Example 2: Showing an oversubscribed configuration.

Slots 1, 3 and 5: PA-2FE

Slots 2, 4 and 6: PA-POS-2OC3, PA-FE, PA-2H

==========

```
PCI bus mb1 (Slots 1, 3 and 5) has a capacity of 600 bandwidth points.Current
configuration on bus mb1 has a total of 400 bandwidth points. This configuration is
within the PCI bus capacity and is supported.

PCI bus mb2 (Slots 2, 4 and 6) has a capacity of 600 bandwidth points. Current
configuration on bus mb2 has a total of 1000 bandwidth points. The set of PA-2FE,
PA-POS-2OC3, and I/O-2FE qualify for "half bandwidth points" consideration, when full
bandwidth point counting results in oversubscription, under the condition that only
one of the two ports is used. With this adjustment, current configuration on bus mb2
has a total of 700 bandwidth points. This configuration has oversubscripted the PCI
bus and is not a supported configuration.

Please refer to the following document "Cisco 7200 Series Port Adapter Hardware
Configuration Guidelines" on Cisco.com <http://www.cisco.com>
for c7200 bandwidth points oversubscription and usage guidelines.
```

Error Messages

The system prompts you with error messages if your port adapter configuration exceeds the guidelines in this document. Following are examples of the error messages:

- For a Cisco 7200 series router or Cisco 7200 VXR router that has an NPE-225, NPE-200, NPE-175, NPE-150, or NPE-100 installed, the following error messages are displayed when the bandwidth points exceed the system limit:

```
%C7200-3-PACONFIG:Exceeds 3 high speed port adapters
%C7200-3-PACONFIG:Exceeds 5 high/medium speed port adapters
%C7200-3-PACONFIG:Exceeds 800 aggregate port adapter bandwidth points
```

- For a Cisco 7200 VXR router that has an NPE-400, NPE-300, or NSE-1 installed, the following error messages are displayed when the bandwidth points are exceeded on the buses:

```
%C7200-3-PACONFIG:Exceeds 600 bandwidth points for slots 0, 1, 3 & 5
%C7200-3-PACONFIG:Exceeds 600 bandwidth points for slots 2, 4 & 6
%C7200-3-PACONFIG:Exceeds 600 bandwidth points on both odd & even numbered slots
```

CHAPTER 2

Memory Requirements

Depending on the circumstances, you might need to determine the amount of main memory (DRAM or SDRAM) required by your Cisco 7200 series router to support a combination of installed port adapter types and a specific Cisco IOS software subset image.

Note The NPE-175, NPE-225, NPE-300, and NSE-1 use SDRAM DIMMs for main memory, whereas the NPE-100, NPE-150, and NPE-200 use DRAM SIMMs for main memory.

The NPE-400 uses a single SDRAM SODIMM for main memory.
The NPE-G1 uses two SDRAM SODIMMs for main memory.
The NPE-G2 uses a single SDRAM DIMM for main memory.

This chapter contains the following sections:

Determining Port Adapter and System Memory Requirements

Table 2-1 Initial Memory Requirement Guidelines

Question	Answer
What determines the amount of SDRAM or DRAM memory required?	The DRAM or SDRAM required by a Cisco 7200 series router to support a combination of installed port adapter types and a Cisco IOS software subset image is influenced by such variables as the features in the software you plan to use and the size of your network.
Where can I find Cisco IOS memory requirements?	Cisco IOS memory requirements are listed in the Cisco IOS Release Notes. The SDRAM column provides processor memory information. Flash memory recommendations are also included. For Cisco IOS Release Notes, see the documentation page for Cisco IOS Software Configuration. If you are a registered user on Cisco.com, you can access the Software Advisor at http://www.cisco.com/cgi-bin/Support/CompNav/Index.pl to get memory requirements.

Sample Configuration Showing Processor Memory Required

Use the example in Table 2-2 to familiarize yourself with the criteria for determining processor memory required for your configuration. Then use the worksheet in Table 2-3 to determine the processor memory required for your configuration.

Table 2-2 Sample Configuration (Cisco 7206 Router with an NPE-150 Installed)

Item	Processor Memory Required		
Cisco IOS software subset image			
Network Layer 3 Switching	11.5 MB[1]	or	22.0 MB[2]
Port adapters			
1 Fast Ethernet port on the I/O controller	0.10 MB[3]		
1 full-duplex multimode FDDI	0.10 MB[3]		
1 high-speed serial	0.10 MB[3]		
1 4-port Token Ring half-duplex	0.30 MB[3]		
2 2-port channelized T1/PRI ISDN	1.80 MB[3] 1.80 MB[3] 1.20 MB[3, 4]		
1 2-port channelized T1 PRI/ISDN	1.80 MB[3]		
Totals	18.7 MB	or	29.2 MB
Minimum DRAM required	32 MB	or	64 MB

1. Specific to Cisco IOS Release 11.1CA.
2. Specific to Cisco IOS Release 12.0T.
3. Specific to Cisco IOS Release 11.1CA, Release 11.1CC, Release 11.2P, Release 11.3T, Release 11.3AA, and Release 12.0 .
4. Additional processor memory required for ISDN functionality.

Table 2-3 Worksheet for Various Hardware and Software Memory Requirements

Item	Processor Memory Required	
Cisco IOS software subset image[1]		
Port adapters		
Totals	MB or	MB
Minimum DRAM required	MB or	MB

1. See Cisco IOS Release Notes (listed under specific Cisco IOS releases) for memory requirements,

Cisco IOS Software Memory Requirements

Cisco IOS memory requirements are listed in the Cisco IOS Release Notes. The SDRAM column provides processor memory information. Flash memory recommendations are also included. For Cisco IOS Release Notes, see the documentation page for Cisco IOS software configuration.

Step 1 Click the appropriate Cisco IOS release.

Step 2 Click **Release Notes**.

Step 3 Click the appropriate release.

Step 4 Locate your platform and memory requirements.

Determining DRAM or SDRAM Required If the Router Has Only 32 MB of Memory (NPE-100, NPE-150, and NPE-200)

This section is applicable only to the NPE-100, NPE-150, and NPE-200.

To determine the minimum amount of DRAM or SDRAM required by a Cisco 7200 series router to support a combination of installed port adapter types and a Cisco IOS software subset image, complete the following steps only if your Cisco 7200 series router has 32 MB of DRAM or SDRAM.

If your Cisco 7200 series router has 64 MB or more of DRAM or SDRAM installed, you have enough memory to support any combination of installed port adapter types and Cisco IOS software subset images.

Note For Cisco 7206 and Cisco 7206VXR router shelf memory requirements, refer to the Cisco AS5800 Universal Access Server documentation at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/as5800/index.htm.

Note The steps in this section assume that the port adapter hardware configuration of your Cisco 7200 series router follows the configuration guidelines explained in the "Configuration Guidelines and Requirements" section on page 1-4.

If you need assistance when determining DRAM or SDRAM requirements for your Cisco 7200 series router, contact the Cisco Technical Assistance Center (TAC). See the "Obtaining Documentation, Obtaining Support, and Security Guidelines" section on page vii for information on contacting TAC.

Tip Use the worksheets in the "Sample Configuration Showing Processor Memory Required" section on page 2-2 to help calculate your system memory requirements if your router has 32 MB of memory.

Step 1 Add the processor memory requirements for all of the installed port adapter types and the Cisco IOS software subset image. (See Table 1-6 in Chapter 1, and Table 2-5 through Table 2-11 in this chapter.)

Table 1-6 lists the processor memory required for the port adapter types available for use in Cisco 7200 series routers. Port adapters available for use in Cisco 7200 series routers require a minimum amount of processor memory to function properly in the routers. The amount of processor memory required by a port adapter depends on the number of interfaces or channels the port adapter provides.

Note Some port adapters require additional processor memory to execute port adapter-specific Cisco IOS software functionality. Table 1-6 lists additional processor memory required for each port adapter type (where applicable).

For DRAM and Flash memory requirements for your Cisco IOS release and platform, see Cisco IOS Release Notes at Cisco IOS Software Information: http://www.cisco.com/univercd/cc/td/doc/product/software/index.htm.

The amount of processor memory listed in Table 2-5 through Table 2-11 is for the static size of the image and some default data memory the image requires at system startup.

Step 2 Compare the required processor memory identified in Step 1 with the amount of processor memory provided by each DRAM or SDRAM option listed in Table 2-5 through Table 2-11.

Table 2-5 through Table 2-11 list the processor and I/O memory provided by each DRAM or SDRAM option available for Cisco 7200 series routers. The DRAM and SDRAM options available for Cisco 7200 series routers are logically divided into processor memory (which is used by the system CPU for instruction and data storage) and I/O memory (which is used for packet buffering). The amount of processor memory available for each DRAM or SDRAM option determines the combination of installed port adapter types that a Cisco 7200 series router can support.

Note For a DRAM or SDRAM option to support the installed port adapter types and Cisco IOS software subset image, the required processor memory identified in Step 1 must not exceed the amount of processor memory provided by the DRAM or SDRAM options listed in Table 2-7 through Table 2-11.

Step 3 Choose a DRAM or SDRAM memory option.

This completes the procedure for determining the minimum amount of DRAM or SDRAM required by a Cisco 7200 series router to support a combination of installed port adapters and the Cisco IOS software subset image.

For a sample configuration of a Cisco 7206 router that has an installed NPE-150, an I/O controller with the Fast Ethernet port, and Cisco IOS software subset images for Cisco IOS Release 11.1CA and Cisco IOS Release 12.0T, see Table 2-2.

SDRAM and DRAM Options for NPEs and the NSE

The default memory allocation of total available memory between I/O memory and processor memory is 25% to I/O memory and 75% to processor memory. However, I/O memory may be allocated manually in amounts of 32 MB, 64 MB, 128 MB, or 256 MB, with the remainder going to processor memory.

Table 2-4 through Table 2-11 provide SDRAM and DRAM memory options for network processing engines and the network services engine. Not all possible processor and I/O memory options are listed.

Table 2-4 SDRAM Options for the NPE-G2

SDRAM Options	Processor Memory	I/O Memory
1 GB	992 MB	32 MB
	960 MB	64 MB
	896 MB	128 MB
	768 MB	256 MB
2 GB	2016 MB	32 MB
	1984 MB	64 MB
	1920 MB	128 MB
	1792 MB	256 MB

Table 2-5 SDRAM Options for the NPE-G1

SDRAM Options	Processor Memory	I/O Memory
256 MB	240 MB	16 MB
512 MB	480 MB	32 MB
1 GB	992 MB	32 MB

Table 2-6 SDRAM Options for the NSE-1

SDRAM Options	Processor Memory	I/O Memory
128 MB	116 MB	12 MB
256 MB	240 MB	16 MB

Table 2-7 SDRAM Options for the NPE-400

SDRAM Option	Processor Memory	I/O Memory
128 MB	112 MB	16 MB
256 MB	240 MB	16 MB
512 MB	480 MB	32 MB

Table 2-8 SDRAM Options for the NPE-300

SDRAM Option	Processor Memory	I/O Memory
64 MB	28 MB	36 MB
96 MB	60 MB	36 MB
160 MB	120 MB	40 MB
288 MB	248 MB	40 MB

Table 2-9 SDRAM Options for the NPE-225

SDRAM Options	Processor Memory	I/O Memory
64 MB	56 MB	8 MB
128 MB	116 MB	12 MB
256 MB	240 MB	16 MB

Table 2-10 SDRAM Options for the NPE-175

SDRAM Options	Processor Memory	I/O Memory
64 MB	56 MB	8 MB
128 MB	116 MB	12 MB

Table 2-11 DRAM Options for the NPE-100, NPE-150, and NPE-200

DRAM Option	NPE-100		NPE-150		NPE-200	
	Processor Memory	I/O Memory	Processor Memory	I/O Memory[1]	Processor Memory	I/O Memory[2]
32 MB	26 MB	6 MB	26 MB	7 MB	26 MB	10 MB
64 MB	56 MB	8 MB	56 MB	9 MB	56 MB	12 MB
128 MB	120 MB	8 MB	120 MB	9 MB	120 MB	12 MB[3]

1. The I/O memory for the NPE-150 DRAM options includes 1 MB of packet SRAM.
2. The I/O memory for the NPE-200 DRAM options includes 4 MB of packet SRAM.
3. For Cisco 7206 router shelf memory requirements, refer to the Cisco AS5800 Universal Access Server documentation at http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/as5800/index.htm.