Cisco 7304 Router Modular Services Card and Shared Port Adapter Software Configuration Guide

March 2005

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

Text Part Number: OL-4807-02

CONTENTS

Preface

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

Objectives

This document describes the configuration and troubleshooting of modular services cards (MSCs) and shared port adapters (SPAs) that are supported on the Cisco 7304 router.

Organization

This document contains the following chapters:

Chapter	Title	Description
Chapter 1	Using Cisco IOS Software	Provides an introduction to accessing the command-line interface (CLI) and using the Cisco IOS software and related tools.
Chapter 2	Carrier Card and SPA Product Overview	Provides a brief introduction to the MSC and SPA products including compatibility information on Cisco Systems routers.
Chapter 3	Troubleshooting an MSC	Provides information for basic MSC troubleshooting.
Chapter 4	Command Summary for the MSC	Provides summary of commands for the MSC.

Chapter	Title	Description
Chapter 3	Overview of the Fast Ethernet SPA and Gigabit Ethernet SPA	Describes release history, feature and Management Information Base (MIB) support, and an introduction to the SPA architecture for the Fast Ethernet and Gigabit Ethernet SPAs.
Chapter 4	Configuring the Fast Ethernet SPA and Gigabit Ethernet SPA	Describes how to configure the 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA.
Chapter 6	Troubleshooting the Fast Ethernet SPA and Gigabit Ethernet SPA	Provides information about symptoms and recommended actions when investigating errors on the 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA.
Chapter 8	Command Summary for Fast Ethernet and Gigabit Ethernet SPAs	Provides a summary of the commands used to configure and monitor the Fast Ethernet and Gigabit Ethernet SPAs.
Chapter 9	Overview of the POS SPAs	Describes release history, feature and Management Information Base (MIB) support, and an introduction to the SPA architecture for the POS SPAs.
Chapter 10	Configuring the POS SPAs	Describes how to configure the POS SPAs.
Chapter 11	Command Summary for POS SPAs	Provides a summary of the commands used to configure and monitor the POS SPAs.
Chapter 12	Overview of the Serial SPAs	Describes release history, feature and Management Information Base (MIB) support, and an introduction to the SPA architecture for the Serial SPAs.
Chapter 13	Configuring the 2-Port and 4-Port T3/E3 SPAs	Describes how to configure the T3/E3 Serial SPAs.
Chapter 14	Troubleshooting the Serial Interface SPAs	Provides information about symptoms and recommended actions when investigating errors on the Serial SPAs.
Chapter 15	Command Summary for the Serial SPAs	Provides a summary of the commands used to configure and monitor the Serial SPAs.
Chapter 5	Upgrading Field-Programmable Devices	Provides information about upgrading FPD on SPAs and Field-Programmable Gate Array (FPGA) on the Cisco 7304 MSC-100.
Chapter 17	Command Summary for FPDs	Provides a summary of the commands used to configure and monitor FPD.
Chapter 8	Command Reference	Describes Cisco IOS software command reference information including syntax, usage guidelines, and examples for all new and modified commands for the SPAs on the Cisco 7304 Router.

Related Documentation

This section refers you to other documentation that also might be useful as you configure your Cisco 7304 router. The documentation listed below is available online.

Cisco 7304 Router Documentation

As you configure MSCs and SPAs on your Cisco 7304 router, you should also refer to the following companion publication for important hardware installation information:

- *Cisco 7304 Router Modular Services Card and Shared Port Adapter Hardware Installation Guide*

Some of the other Cisco 7304 router publications might be useful to you as you configure your Cisco 7304 router. The following documents can be found at this URL:

http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/

- *Cisco 7304 Router Installation and Configuration Guide*
- *Cisco 7304 Quick Start Guide*
- *Cisco 7300 Series Platform-Specific Commands*
- *Cisco 7304 FPGA Bundling and Update*
- *Cisco 7304 Router MIB Specifications Guide*

Several other publications are also related to the Cisco 7304 router. For a complete reference of related documentation, refer to the *Cisco 7304 Internet Router Documentation Roadmap* located at the following URL:

http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/3515.htm

Cisco IOS Software Publications

Your router, switch, or gateway and the Cisco IOS software running on it contain extensive features. You can find documentation for Cisco IOS software features at the following URL:

http://www.cisco.com/univercd/cc/td/doc/product/software/index.htm

Cisco IOS Release 12.2S Software Publications

Documentation for Cisco IOS Release 12.2S, including release notes and system error messages, can be found at the following URL:

http://www.cisco.com/univercd/cc/td/doc/product/software/ios122s/index.htm

Document Conventions

Within the MSC and SPA software configuration guide, the term *router* is generally used to refer to a variety of Cisco products (for example, routers, access servers, and switches). Routers, access servers, and other networking devices that support Cisco IOS software are shown interchangeably within examples. These products are used only for illustrative purposes; that is, an example that shows one product does not necessarily indicate that other products are not supported.

This documentation uses the following conventions:

Convention	Description
^ or Ctrl	The ^ and Ctrl symbols represent the Control key. For example, the key combination ^D or Ctrl-D means hold down the Control key while you press the D key. Keys are indicated in capital letters but are not case sensitive.
string	A string is a nonquoted set of characters shown in italics. For example, when setting an SNMP *community* string to *public*, do not use quotation marks around the string or the string will include the quotation marks.

Command syntax descriptions use the following conventions:

<table>
<tr><th>Convention</th><th>Description</th></tr>
<tr><td>bold</td><td>Bold text indicates commands and keywords that you enter literally as shown.</td></tr>
<tr><td>italics</td><td>Italic text indicates arguments for which you supply values.</td></tr>
<tr><td>[x]</td><td>Square brackets enclose an optional element (keyword or argument).</td></tr>
<tr><td>|</td><td>A vertical line indicates a choice within an optional or required set of keywords or arguments.</td></tr>
<tr><td>[x | y]</td><td>Square brackets enclosing keywords or arguments separated by a vertical line indicate an optional choice.</td></tr>
<tr><td>{x | y}</td><td>Braces enclosing keywords or arguments separated by a vertical line indicate a required choice.</td></tr>
</table>

Nested sets of square brackets or braces indicate optional or required choices within optional or required elements. For example:

<table>
<tr><th>Convention</th><th>Description</th></tr>
<tr><td>[x {y | z}]</td><td>Braces and a vertical line within square brackets indicate a required choice within an optional element.</td></tr>
</table>

Examples use the following conventions:

Convention	Description
`screen`	Examples of information displayed on the screen are set in Courier font.
`bold screen`	Examples of text that you must enter are set in Courier bold font.
< >	Angle brackets enclose text that is not printed to the screen, such as passwords.
!	An exclamation point at the beginning of a line indicates a comment line. (Exclamation points are also displayed by the Cisco IOS software for certain processes.)
[ ]	Square brackets enclose default responses to system prompts.

The following conventions are used to attract the attention of the reader:

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Note Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Obtaining Documentation

Cisco documentation and additional literature are available on Cisco.com. Cisco also provides several ways to obtain technical assistance and other technical resources. These sections explain how to obtain technical information from Cisco Systems.

Cisco.com

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

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

You can access the Cisco website at this URL:

http://www.cisco.com

You can access international Cisco websites at this URL:

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

Documentation DVD

Cisco documentation and additional literature are available in a Documentation DVD package, which may have shipped with your product. The Documentation DVD is updated regularly and may be more current than printed documentation. The Documentation DVD package is available as a single unit.

Registered Cisco.com users (Cisco direct customers) can order a Cisco Documentation DVD (product number DOC-DOCDVD=) from the Ordering tool or Cisco Marketplace.

Cisco Ordering tool:

http://www.cisco.com/en/US/partner/ordering/

Cisco Marketplace:

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

Ordering Documentation

You can find instructions for ordering documentation at this URL:

http://www.cisco.com/univercd/cc/td/doc/es_inpck/pdi.htm

You can order Cisco documentation in these ways:

- Registered Cisco.com users (Cisco direct customers) can order Cisco product documentation from the Ordering tool:

  http://www.cisco.com/en/US/partner/ordering/

- Nonregistered Cisco.com users can order documentation through a local account representative by calling Cisco Systems Corporate Headquarters (California, USA) at 408 526-7208 or, elsewhere in North America, by calling 1 800 553-NETS (6387).

Documentation Feedback

You can send comments about technical documentation to bug-doc@cisco.com.

You can submit comments by using the response card (if present) behind the front cover of your document or by writing to the following address:

Cisco Systems
Attn: Customer Document Ordering
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Cisco Product Security Overview

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

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

From this site, you can perform these tasks:

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

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

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

If you prefer to see advisories and notices as they are updated in real time, you can access a Product Security Incident Response Team Really Simple Syndication (PSIRT RSS) feed from this URL:

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

Reporting Security Problems in Cisco Products

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

- Emergencies—security-alert@cisco.com
- Nonemergencies—psirt@cisco.com

Tip We encourage you to use Pretty Good Privacy (PGP) or a compatible product to encrypt any sensitive information that you send to Cisco. PSIRT can work from encrypted information that is compatible with PGP versions 2.*x* through 8.*x*.

Never use a revoked or an expired encryption key. The correct public key to use in your correspondence with PSIRT is the one that has the most recent creation date in this public key server list:

http://pgp.mit.edu:11371/pks/lookup?search=psirt%40cisco.com&op=index&exact=on

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

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

Obtaining Technical Assistance

For all customers, partners, resellers, and distributors who hold valid Cisco service contracts, Cisco Technical Support provides 24-hour-a-day, award-winning technical assistance. The Cisco Technical Support Website on Cisco.com features extensive online support resources. In addition, Cisco Technical Assistance Center (TAC) engineers provide telephone support. If you do not hold a valid Cisco service contract, contact your reseller.

Cisco Technical Support Website

The Cisco Technical Support Website provides online documents and tools for troubleshooting and resolving technical issues with Cisco products and technologies. The website is available 24 hours a day, 365 days a year, at this URL:

http://www.cisco.com/techsupport

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

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

Note Use the Cisco Product Identification (CPI) tool to locate your product serial number before submitting a web or phone request for service. You can access the CPI tool from the Cisco Technical Support Website by clicking the **Tools & Resources** link under Documentation & Tools. Choose **Cisco Product Identification Tool** from the Alphabetical Index drop-down list, or click the **Cisco Product Identification Tool** link under Alerts & RMAs. The CPI tool offers three search options: by product ID or model name; by tree view; or for certain products, by copying and pasting **show** command output. Search results show an illustration of your product with the serial number label location highlighted. Locate the serial number label on your product and record the information before placing a service call.

Submitting a Service Request

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

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

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

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

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

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

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

Definitions of Service Request Severity

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

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

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

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

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

Obtaining Additional Publications and Information

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

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

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

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

  http://www.ciscopress.com

- *Packet* magazine is the Cisco Systems technical user magazine for maximizing Internet and networking investments. Each quarter, Packet delivers coverage of the latest industry trends, technology breakthroughs, and Cisco products and solutions, as well as network deployment and troubleshooting tips, configuration examples, customer case studies, certification and training information, and links to scores of in-depth online resources. You can access Packet magazine at this URL:

  http://www.cisco.com/packet

- *iQ Magazine* is the quarterly publication from Cisco Systems designed to help growing companies learn how they can use technology to increase revenue, streamline their business, and expand services. The publication identifies the challenges facing these companies and the technologies to help solve them, using real-world case studies and business strategies to help readers make sound technology investment decisions. You can access iQ Magazine at this URL:

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

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

  http://www.cisco.com/ipj

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

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

Using Cisco IOS Software

This chapter provides useful information as you prepare to configure a Cisco 7304 Shared Port Adapter (SPA) using the Cisco IOS software. It includes the following sections:

Accessing the CLI Using a Router Console

This section describes how to access the command-line interface (CLI) using a directly-connected console, using Telnet, or by using a modem to obtain a remote console:

For more detailed information about configuring and accessing a router through various services, refer to the *Cisco IOS Terminal Services Configuration Guide* and *Cisco IOS Terminal Services Command Reference* publications.

For more information about making the console cable connections, refer to the *Cisco 7304 Router Installation and Configuration Guide*.

Accessing the CLI Using a Directly-Connected Console

This section describes how to connect to the console port on the router and use the console interface to access the CLI.

Connecting to the Console Port

Before you can use the console interface on the router using a terminal or PC, perform the following steps:

Step 1 Configure your terminal emulation software with the following settings:

- 9600 bits per second (bps)
- 8 data bits
- No parity
- 2 stop bits

Note These are the default serial communication parameters on the router. For information about how to change those defaults to meet the requirements of your terminal or host, refer to the *Cisco IOS Terminal Services Configuration Guide*.

Step 2 Connect a terminal or PC to the console port using a rollover cable.

To make this connection, attach one end of an RJ-45 to RJ-45 rollover cable to the router console port. Attach the other end of the cable to an ASCII terminal or a PC running terminal emulation software. The ASCII terminal or PC port might require an RJ-45-to-DB-9 or an RJ-45-to-DB-25 adapter.

Using the Console Interface

To access the CLI using the console interface, complete the following steps:

Step 1 Attach the terminal hardware to the console port on the router (after you configure your terminal emulation software with the proper settings), and verify that the following prompt appears:

```
Press Return for Console prompt
```

Step 2 Press **Return** to enter user EXEC configuration mode. The following prompt appears:

```
Router>
```

Step 3 From user EXEC configuration mode, enter the **enable** command as shown in the following example:

```
Router> enable
```

Step 4 At the password prompt, enter your system password. The following example shows entry of the password called "enablepass":

```
Password: enablepass
```

Step 5 When the enable password is accepted, verify that the privileged EXEC configuration mode prompt appears:

```
Router#
```

Step 6 You now have access to the CLI in privileged EXEC configuration mode. Enter the necessary commands to complete your desired tasks.

Step 7 To exit the console session, enter the **quit** command as shown in the following example:

```
Router# quit
```

Accessing the CLI from a Remote Console Using Telnet

This section describes how to connect to the console interface on a router using Telnet to access the CLI.

Preparing to Connect to the Router Console Using Telnet

Before you can access the router remotely using Telnet from a TCP/IP network, you must configure the router to support virtual terminal lines (vtys) using the **line vty** global configuration command. You also should configure the vtys to require login and specify a password.

Note To prevent disabling login on the line, be careful that you specify a password with the **password** command when you configure the **login** line configuration command. If you are using authentication, authorization, and accounting (AAA), you should configure the **login authentication** line configuration command. To prevent disabling login on the line for AAA when you configure a list with the **login authentication** command, you must also configure that list using the **aaa authentication login** global configuration command. For more information about AAA services, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications.

In addition, before you can make a Telnet connection to the router, you must have a valid host name for the router or have an IP address configured on the router. For more information about requirements for connecting to the router using Telnet, information about customizing your Telnet services, and using Telnet key sequences, refer to the *Cisco IOS Terminal Services Configuration Guide.*

Using Telnet to Access a Console Interface

To access a console interface using Telnet, complete the following steps:

Step 1 From your terminal or PC, enter one of the following commands:

- **connect** *host* [*port*] [*keyword*]
- **telnet** *host* [*port*] [*keyword*]

where *host* is the router host name or an IP address, *port* is a decimal port number (23 is the default), and *keyword* is a supported keyword. For more information, refer to the *Cisco IOS Terminal Services Command Reference*.

Note If you are using an access server, you also will need to specify a valid port number with the host name or IP address, such as **telnet 172.20.52.40 2003**.

The following example shows the **telnet** command to connect to the router named “Router”:

```
unix_host% telnet Router
Trying 172.20.52.40...
Connected to 172.20.52.40.
Escape character is '^]'.
unix_host% connect
```

Step 2 At the password prompt, enter your login password. The following example shows entry of the password called “mypass”:

```
User Access Verification

Password: mypass
```

> **Note** If no password has been configured, press **Return**.

Step 3 From user EXEC configuration mode, enter the **enable** command as shown in the following example:

```
Router> enable
```

Step 4 At the password prompt, enter your system password. The following example shows entry of the password called “enablepass”:

```
Password: enablepass
```

Step 5 When the enable password is accepted, verify that the privileged EXEC configuration mode prompt appears:

```
Router#
```

Step 6 You now have access to the CLI in privileged EXEC configuration mode. Enter the necessary commands to complete your desired tasks.

Step 7 To exit the Telnet session, use the **exit** or **logout** command as shown in the following example:

```
Router# logout
```

Accessing the CLI from a Remote Console Using a Modem

To access the router remotely using a modem through an asynchronous connection, you need to configure the auxiliary (AUX) port and attach a modem to it.

For more information about making a modem connection using the AUX port on the Cisco 7304 router, refer to the *Cisco 7304 Router Installation and Configuration Guide*.

For detailed guidelines on making a connection to the router using a modem, and using reverse Telnet, refer to *Configuring a Modem on the AUX Port for EXEC Dialin Connectivity* located at the following URL:

http://www.cisco.com/warp/public/471/mod-aux-exec.html

Using Keyboard Shortcuts

Commands are not case-sensitive. You can abbreviate commands and parameters if the abbreviations contain enough letters to be different from any other currently available commands or parameters. You can scroll through the last 20 commands stored in the history buffer, and enter or edit the command at the prompt.

Table 1-1 lists the keyboard shortcuts for entering and editing commands.

Table 1-1 Keyboard Shortcuts

Keystrokes	Purpose
Ctrl-B or the **Left Arrow** key[1]	Move the cursor back one character
Ctrl-F or the **Right Arrow** key[1]	Move the cursor forward one character
Ctrl-A	Move the cursor to the beginning of the command line
Ctrl-E	Move the cursor to the end of the command line
Esc B	Move the cursor back one word
Esc F	Move the cursor forward one word

1. The arrow keys function only on ANSI-compatible terminals such as VT100s.

Using the History Buffer to Recall Commands

The history buffer stores the last 20 commands you entered. History substitution allows you to access these commands without retyping them, by using special abbreviated commands.

Table 1-2 lists the history substitution commands.

Table 1-2 History Substitution Commands

Keystroke or Command	Purpose
Ctrl-P or the **Up Arrow** key[1]	Recall commands in the history buffer, beginning with the most recent command. Repeat the key sequence to recall successively older commands.
Ctrl-N or the **Down Arrow** key[1]	Return to more recent commands in the history buffer after recalling commands with **Ctrl-P** or the **Up Arrow** key. Repeat the key sequence to recall successively more recent commands.
`Router# show history`	While in EXEC mode, list the last several commands you have just entered.

1. The arrow keys function only on ANSI-compatible terminals such as VT100s.

Understanding Command Modes

You use the CLI to access Cisco IOS software. Because the CLI is divided into many different modes, the commands available to you at any given time depend on the mode that you are currently in. Entering a question mark (**?**) at the CLI prompt allows you to obtain a list of commands available for each command mode.

When you log in to the CLI, you are in user EXEC mode. User EXEC mode contains only a limited subset of commands. To have access to all commands, you must enter privileged EXEC mode, normally by using a password. From privileged EXEC mode, you can issue any EXEC command—user or privileged mode—or you can enter global configuration mode. Most EXEC commands are one-time commands. For example, **show** commands show important status information, and **clear** commands clear counters or interfaces. The EXEC commands are not saved when the software reboots.

Configuration modes allow you to make changes to the running configuration. If you later save the running configuration to the startup configuration, these changed commands are stored when the software is rebooted. To enter specific configuration modes, you must start at global configuration mode. From global configuration mode, you can enter interface configuration mode and a variety of other modes, such as protocol-specific modes.

ROM monitor mode is a separate mode used when the Cisco IOS software cannot load properly. If a valid software image is not found when the software boots or if the configuration file is corrupted at startup, the software might enter ROM monitor mode.

Table 1-3 describes how to access and exit various common command modes of the Cisco IOS software. It also shows examples of the prompts displayed for each mode.

Table 1-3 Accessing and Exiting Command Modes

Command Mode	Access Method	Prompt	Exit Method
User EXEC	Log in.	`Router>`	Use the **logout** command.
Privileged EXEC	From user EXEC mode, use the **enable** EXEC command.	`Router#`	To return to user EXEC mode, use the **disable** command.
Global configuration	From privileged EXEC mode, use the **configure terminal** privileged EXEC command.	`Router(config)#`	To return to privileged EXEC mode from global configuration mode, use the **exit** or **end** command.
Interface configuration	From global configuration mode, specify an interface using an **interface** command.	`Router(config-if)#`	To return to global configuration mode, use the **exit** command. To return to privileged EXEC mode, use the **end** command.
ROM monitor	From privileged EXEC mode, use the **reload** EXEC command. Press the **Break** key during the first 60 seconds while the system is booting.	`>`	To exit ROM monitor mode, use the **continue** command.

For more information on command modes, refer to the "Using the Command-Line Interface" chapter in the *Cisco IOS Configuration Fundamentals and Network Management Configuration Guide*.

Getting Help

Entering a question mark (**?**) at the CLI prompt displays a list of commands available for each command mode. You can also get a list of keywords and arguments associated with any command by using the context-sensitive help feature.

To get help specific to a command mode, a command, a keyword, or an argument, use one of the following commands:

Command	Purpose
help	Provides a brief description of the help system in any command mode.
*abbreviated-command-entry***?**	Provides a list of commands that begin with a particular character string. (No space between command and question mark.)
abbreviated-command-entry<**Tab**>	Completes a partial command name.
?	Lists all commands available for a particular command mode.
command **?**	Lists the keywords or arguments that you must enter next on the command line. (Space between command and question mark.)

Finding Command Options Example

This section provides an example of how to display syntax for a command. The syntax can consist of optional or required keywords and arguments. To display keywords and arguments for a command, enter a question mark (**?**) at the configuration prompt or after entering part of a command followed by a space. The Cisco IOS software displays a list and brief description of available keywords and arguments. For example, if you were in global configuration mode and wanted to see all the keywords or arguments for the **arap** command, you would type **arap ?**.

The <cr> symbol in command help output stands for "carriage return." On older keyboards, the carriage return key is the **Return** key. On most modern keyboards, the carriage return key is the **Enter** key. The <cr> symbol at the end of command help output indicates that you have the option to press **Enter** to complete the command and that the arguments and keywords in the list preceding the <cr> symbol are optional. The <cr> symbol by itself indicates that no more arguments or keywords are available and that you must press **Enter** to complete the command.

Table 1-4 shows examples of how you can use the question mark (**?**) to assist you in entering commands. The table steps you through configuring an IP address on a serial interface on a Cisco 7206 router that is running Cisco IOS Release 12.0(3).

Table 1-4 Finding Command Options

Command	Comment
Router> **enable** Password: *<password>* Router#	Enter the **enable** command and password to access privileged EXEC commands. You are in privileged EXEC mode when the prompt changes to Router#.
Router# **configure terminal** Enter configuration commands, one per line. End with CNTL/Z. Router(config)#	Enter the **configure terminal** privileged EXEC command to enter global configuration mode. You are in global configuration mode when the prompt changes to Router(config)#.
Router(config)# **interface serial ?** <0-6> Serial interface number Router(config)# **interface serial 4 ?** / Router(config)# **interface serial 4/ ?** <0-3> Serial interface number Router(config)# **interface serial 4/0 ?** <cr> Router(config)# **interface serial 4/0** Router(config-if)#	Enter interface configuration mode by specifying the serial interface that you want to configure using the **interface serial** global configuration command. Enter **?** to display what you must enter next on the command line. In this example, you must enter the serial interface slot number and port number, separated by a forward slash. When the <cr> symbol is displayed, you can press **Enter** to complete the command. You are in interface configuration mode when the prompt changes to Router(config-if)#.

Table 1-4 Finding Command Options (continued)

<table>
<tr><th>Command</th><th>Comment</th></tr>
<tr><td><pre>Router(config-if)# ?
Interface configuration commands:
  .
  .
  .
  ip   Interface Internet Protocol config commands
  keepalive   Enable keepalive
  lan-name   LAN Name command
  llc2   LLC2 Interface Subcommands
  load-interval   Specify interval for load calculation for an
                      interface
  locaddr-priority   Assign a priority group
  logging   Configure logging for interface
  loopback   Configure internal loopback on an interface
  mac-address   Manually set interface MAC address
  mls   mls router sub/interface commands
  mpoa   MPOA interface configuration commands
  mtu   Set the interface Maximum Transmission Unit (MTU)
  netbios   Use a defined NETBIOS access list or enable
                      name-caching
  no   Negate a command or set its defaults
  nrzi-encoding   Enable use of NRZI encoding
  ntp   Configure NTP
  .
  .
  .
Router(config-if)#</pre></td><td>Enter ? to display a list of all the interface configuration commands available for the serial interface. This example shows only some of the available interface configuration commands.</td></tr>
<tr><td><pre>Router(config-if)# ip ?
Interface IP configuration subcommands:
  access-group   Specify access control for packets
  accounting   Enable IP accounting on this interface
  address   Set the IP address of an interface
  authentication   authentication subcommands
  bandwidth-percent   Set EIGRP bandwidth limit
  broadcast-address   Set the broadcast address of an interface
  cgmp   Enable/disable CGMP
  directed-broadcast Enable forwarding of directed broadcasts
  dvmrp   DVMRP interface commands
  hello-interval   Configures IP-EIGRP hello interval
  helper-address   Specify a destination address for UDP broadcasts
  hold-time   Configures IP-EIGRP hold time
  .
  .
  .
Router(config-if)# ip</pre></td><td>Enter the command that you want to configure for the interface. This example uses the ip command.

Enter ? to display what you must enter next on the command line. This example shows only some of the available interface IP configuration commands.</td></tr>
</table>

Table 1-4 Finding Command Options (continued)

Command	Comment

`Router(config-if)# ip address ?`
`  A.B.C.D            IP address`
`  negotiated         IP Address negotiated over PPP`
`Router(config-if)# ip address`
	Enter the command that you want to configure for the interface. This example uses the **ip address** command.
	Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP address or the **negotiated** keyword.
	A carriage return (<cr>) is not displayed; therefore, you must enter additional keywords or arguments to complete the command.

`Router(config-if)# ip address 172.16.0.1 ?`
`  A.B.C.D            IP subnet mask`
`Router(config-if)# ip address 172.16.0.1`
	Enter the keyword or argument that you want to use. This example uses the 172.16.0.1 IP address.
	Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP subnet mask.
	A <cr> is not displayed; therefore, you must enter additional keywords or arguments to complete the command.

`Router(config-if)# ip address 172.16.0.1 255.255.255.0 ?`
`  secondary          Make this IP address a secondary address`
`  <cr>`
`Router(config-if)# ip address 172.16.0.1 255.255.255.0`
	Enter the IP subnet mask. This example uses the 255.255.255.0 IP subnet mask.
	Enter **?** to display what you must enter next on the command line. In this example, you can enter the **secondary** keyword, or you can press **Enter**.
	A <cr> is displayed; you can press **Enter** to complete the command, or you can enter another keyword.

`Router(config-if)# ip address 172.16.0.1 255.255.255.0` `Router(config-if)#`	In this example, **Enter** is pressed to complete the command.

Using the no and default Forms of Commands

Almost every configuration command has a **no** form. In general, use the **no** form to disable a function. Use the command without the **no** keyword to reenable a disabled function or to enable a function that is disabled by default. For example, IP routing is enabled by default. To disable IP routing, use the **no ip routing** command; to reenable IP routing, use the **ip routing** command. The Cisco IOS software command reference publications provide the complete syntax for the configuration commands and describe what the **no** form of a command does.

Configuration commands can also have a **default** form, which returns the command settings to the default values. Most commands are disabled by default, so in such cases using the **default** form has the same result as using the **no** form of the command. However, some commands are enabled by default and have variables set to certain default values. In these cases, the **default** form of the command enables the command and sets the variables to their default values. The Cisco IOS software command reference publications describe the effect of the **default** form of a command if the command functions differently than the **no** form.

Saving Configuration Changes

Use the **copy system:running-config nvram:startup-config** command to save your configuration changes to the startup configuration so that the changes will not be lost if the software reloads or a power outage occurs. For example:

```
Router# copy system:running-config nvram:startup-config
Building configuration...
```

It might take a minute or two to save the configuration. After the configuration has been saved, the following output appears:

```
[OK]
Router#
```

On most platforms, this task saves the configuration to NVRAM. On the Class A Flash file system platforms, this task saves the configuration to the location specified by the CONFIG_FILE environment variable. The CONFIG_FILE variable defaults to NVRAM.

Filtering Output from the show and more Commands

You can search and filter the output of **show** and **more** commands. This functionality is useful if you need to sort through large amounts of output or if you want to exclude output that you need not see.

To use this functionality, enter a **show** or **more** command followed by the “pipe” character (|); one of the keywords **begin**, **include**, or **exclude**; and a regular expression on which you want to search or filter (the expression is case-sensitive):

command | {**begin** | **include** | **exclude**} *regular-expression*

The output matches certain lines of information in the configuration file. The following example illustrates how to use output modifiers with the **show interface** command when you want the output to include only lines in which the expression “protocol” appears:

```
Router# show interface | include protocol

FastEthernet0/0 is up, line protocol is up
Serial4/0 is up, line protocol is up
Serial4/1 is up, line protocol is up
Serial4/2 is administratively down, line protocol is down
Serial4/3 is administratively down, line protocol is down
```

For more information on the search and filter functionality, refer to the “Using the Command-Line Interface” chapter in the *Cisco IOS Configuration Fundamentals and Network Management Configuration Guide*.

Finding Support Information for Platforms and Cisco IOS Software Images

Cisco IOS software is packaged in feature sets consisting of software images that support specific platforms. The feature sets available for a specific platform depend on which Cisco IOS software images are included in a release. To identify the set of software images available in a specific release or to find out if a feature is available in a given Cisco IOS software image, you can use Cisco Feature Navigator or the software release notes.

Using Cisco Feature Navigator

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://tools.cisco.com/ITDIT/CFN/jsp/index.jsp. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

Using Software Advisor

To see if a feature is supported by a Cisco IOS release, to locate the software document for that feature, or 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 at http://www.cisco.com/cgi-bin/Support/CompNav/Index.pl

You must be a registered user on Cisco.com to access this tool.

Using Software Release Notes

Cisco IOS software releases include release notes that provide the following information:

- Platform support information
- Memory recommendations
- New feature information
- Open and resolved severity 1 and 2 caveats for all platforms

Release notes are intended to be release-specific for the most current release, and the information provided in these documents may not be cumulative in providing information about features that first appeared in previous releases. Refer to Cisco Feature Navigator for cumulative feature information.

Carrier Card and SPA Product Overview

This chapter provides an introduction to the modular services cards (MSCs) and shared port adapters (SPAs). It contains the following sections:

For more hardware details about the specific carrier cards and SPAs supported that are supported on the Cisco 7304 router, refer to the *Cisco 7304 Router Modular Services Card and Shared Port Adapter Hardware Installation Guide*.

Release History

Table 2-1 provides the release and modification history for all MSC- and SPA- related features on the Cisco 7304 router.

Table 2-1f Release History

Release	Modification
Cisco IOS Release 12.2(25)S3	Support for the following SPAs was introduced on the Cisco 7304 router: • 2-Port OC-3c/STM-1 POS SPA (SPA-2XOC3-POS) • 4-Port OC-3c/STM-1 POS SPA (SPA-4XOC3-POS) • 1-Port OC-12c/STM-4 POS SPA (SPA-1OC12-POS) • 2-Port T3/E3 Serial SPA (SPA-2XT3/E3) • 4-Port T3/E3 Serial SPA (SPA-4XT3/E3) The following enhancements to the **hw-module subslot** command were introduced: • The **powered** and **unpowered** options were added to the **hw-module subslot** *slot*/*subslot* **shutdown** command. • The **reload** option was added to the **hw-module subslot** [**start** | **stop**] command. The following FPD-related changes were introduced: • By default, the router automatically reloaded after a manual FPD upgrade. This behavior was changed. By default, the router is no longer reloaded automatically after a manual FPD upgrade. • The **force** option was removed from the **hw-module subslot** *slot*/*subslot* **file** *file-url* **force** command and replaced by the **reload** option. With the **reload** option, the user now has the option of configuring the router to reload or to not reload after an FPD upgrade.
Cisco IOS Release 12.2(20)S6	The **show upgrade** commands used to monitor SPA FPD behavior (**show upgrade file**, **show upgrade package default**, **show upgrade progress**, and **show upgrade table**) have been changed to add the **fpd** keyword. The output previously generated with the aforementioned commands can now be generated by entering the appropriate **show upgrade fpd** command (**show upgrade fpd file**, **show upgrade fpd package default**, **show upgrade fpd progress**, and **show upgrade fpd table**).
Cisco IOS Release 12.2(20)S5	The **test hw-module subslot pause** command, which is useful for technical support purposes only, was introduced.
Cisco IOS Release 12.2(20)S3	The Stateful Switchover/Non-Stop Forwarding feature was introduced for the MSC-100 and the available SPAs.
Cisco IOS Release 12.2(20)S2	Support for the following hardware was introduced on the Cisco 7304 router: • Cisco 7304 Modular Services Card 100 (Cisco 7304 MSC-100) • 4-Port 10/100 Fast Ethernet SPA (SPA-4FE-7304) • 2-Port 10/100/1000 Gigabit Ethernet SPA (SPA-2GE-7304)

Introduction to MSCs and SPAs

MSCs and SPAs are a carrier card and port adapter architecture to increase modularity, flexibility, and density across Cisco System routers for network connectivity. This section describes the MSCs and SPAs and provides some guidelines for their use.

Modular Service Cards

The following lists describes some of the general characteristics of an MSC:

- An MSC is a carrier card that inserts into a router slot like a line card. It provides no network connectivity on its own.

Note The MSC-100 is the only carrier card currently available for SPAs on the Cisco 7304 router. However, SPAs can be inserted into other carrier cards on other router platforms. For information on carrier cards on other platforms, see the documentation for that platform.

- The only MSC currently available is the MSC-100, which contains two subslots used to house SPAs. The SPA provides interface ports for network connectivity.

Figure 2-1 SPA Sizes for the Cisco 7304 Router

- During normal operation, the MSC should reside in the router fully populated either with functional SPAs in all subslots, or with a blank filler plate inserted in any empty subslots.
- An MSC supports online insertion and removal (OIR) with SPAs inserted in it's subslots.

Shared Port Adapters

The following list describes some of the general characteristics of a SPA:

- A SPA is a modular type of port adapter that inserts into a subslot of a compatible MSC carrier card to provide network connectivity and increased interface port density.
- Each SPA provides a certain number of connectors, or ports, that are the interfaces to one or more networks. These interfaces can be individually configured using the Cisco IOS command-line interface (CLI).
- Either a blank filler plate or a functional SPA should reside in every subslot of an MSC during normal operation.
- SPAs support online insertion and removal (OIR). They can be inserted or removed independently from the MSC. MSCs also support online insertion and removal (OIR) with SPAs inserted in their subslots.

MSC and SPA Compatibility

The MSCs that are supported on the Cisco 7304 router are shown in Table 2-2. This table also shows the shared port adapters (SPAs) that are supported on each MSC.

Table 2-2 MSC and SPA Compatibility on the Cisco 7304 Router

SPA	MSC-100
4-port 10/100 Fast Ethernet SPA (SPA-4FE-7304)	Yes
2-port 10/100/1000 Gigabit Ethernet SPA (SPA-2GE-7304)	Yes
2-Port OC-3c/STM-1 POS SPA (SPA-2XOC3-POS)	Yes
4-Port OC-3c/STM-1 POS SPA (SPA-4XOC3-POS)	Yes
1-Port OC-12c/STM-4 POS SPA (SPA-1XOC12-POS)	Yes
2-Port T3/E3 Serial SPA (SPA-2XT3/E3)	Yes
4-Port T3/E3 Serial SPA (SPA-4XT3/E3)	Yes

Modular Optics Compatibility

Some SPAs implement small form-factor pluggable (SFP) optical transceivers to provide network connectivity. An SFP module is a fiber optic receptacle device that mounts flush with the front panel to provide network connectivity.

Cisco Systems qualifies the SFP modules that can be used with SPAs.

Note The SPAs will only accept the SFP modules listed as supported in this document. An SFP check is run every time an SFP module is inserted into a SPA and only SFP modules that pass this check will be usable.

Table 2-3 shows the types of optics modules that have been qualified for use with a SPA:

Table 2-3 SPA Optics Compatibility

SPA	Qualified Optics Modules
2-Port Gigabit Ethernet SPA	• SFP-FCGE-S • SFP-FCGE-L • SFP-GE-Z

Table 2-3 SPA Optics Compatibility

SPA	Qualified Optics Modules
2-Port and 4-Port OC-3c/STM-1 POS SPA	• SFP-OC3-MM • SFP-OC3-SR • SFP-OC3-IR1 • SFP-OC3-LR1 • SFP-OC3-LR2
1-Port OC-12c/STM-4 POS SPA	• SFP-OC12-MM • SFP-OC12-SR • SFP-OC12-IR1 • SFP-OC12-LR1 • SFP-OC12-LR2

MSC Summary

Summary descriptions of the MSCs that are supported on the Cisco 7304 router are shown in Table 2-4.

Table 2-4 MSC Summary

MSC	Product Number	Description	Number of SPAs	Minimum Cisco IOS Release
MSC-100	7304-MSC-100	Modular Services Card 100	2	Release 12.2(20)S2

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 MSCs or SPAs within a system are compatible, but it does provide the minimum Cisco IOS requirements for individual hardware modules or components.

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

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

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

CHAPTER 3

Overview of the Fast Ethernet SPA and Gigabit Ethernet SPA

This chapter provides an overview of the release history, and feature and Management Information Base (MIB) support for the Cisco 7304 MSC-100 with the 4-Port 10/100 Fast Ethernet SPA, and the 2-Port 10/100/1000 Gigabit Ethernet SPA.

This chapter includes the following sections:

Release History

Table 3-1 provides the release and modification history for Ethernet SPA-related features and enhancements on the Cisco 7304 router.

Table 3-1 Release History for Ethernet SPAs

Release	Modification
Cisco IOS Release 12.2(20)S3	The Stateful Switchover/Non-Stop Forwarding feature was introduced for the MSC-100 and the available SPAs.
Cisco IOS Release 12.2(20)S2	Support for the following hardware was introduced on the Cisco 7304 router: • Cisco 7304 Modular Services Card 100 (Cisco 7304 MSC-100) • 4-Port 10/100 Fast Ethernet SPA (SPA-4FE-7304) • 2-Port 10/100/1000 Gigabit Ethernet SPA (SPA-2GE-7304)

Supported Features

This section provides a list of some of the primary features supported with the MSC and SPA hardware and software.

4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA Features

The following is a list of some of the significant hardware and software features supported by both the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA:

- Autonegotiation of speed, duplex, and IEEE 802.3x flow control (pause frames) when using both copper (RJ45) and fiber (SFP) media types. In copper mode, 10/100/1000 speeds and full/half duplex are advertised during autonegotiation. In fiber mode, only 1000-Mbps speed and full duplex are advertised. The Ethernet pause frame capability is also advertised.
- IEEE 802.3x flow control and asymmetric flow control
- Local (internal) and external loopback
- Auto-sensing of straight-through and Medium Dependent Interface Crossover (MDIX) cables
- Jumbo frames (up to 9216 bytes), plus Layer 2 header bytes
- Frame padding for frames smaller than minimum packet size (64 bytes)
- 2048 total MAC destination address entries per SPA, with the following number of entries supported per interface:
  - For the 4-Port 10/100 Fast Ethernet SPA—512 MAC destination addresses per interface
  - For the 2-Port 10/100/1000 Gigabit Ethernet SPA—1024 MAC destination addresses per interface
- 4096 total VLAN entries per SPA, with the following number of entries supported per interface:
  - For the 4-Port 10/100 Fast Ethernet SPA—1024 VLANs per interface
  - For the 2-Port 10/100/1000 Gigabit Ethernet SPA—2048 VLANs per interface
- Command-line interface (CLI)-controlled OIR independent of the MSC-100, or with the MSC-100
- Per interface port counters for policy drops, oversubscription drops, cyclic redundancy check (CRC) error drops, packet sizes, unicast, multicast, and broadcast packets
- Parity and cyclic redundancy check (CRC) detection for application-specific integrated circuit (ASIC) and discrete memory errors
- Field Programmable Gate Array (FPGA) upgrade support

  For more information about FPGA support, see Chapter 5, "Upgrading Field-Programmable Devices."

Restrictions

As of Cisco IOS Release 12.2(20)S2, the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA do not support the following features:

- EtherChannel—802.1AD link aggregation
- Ethernet Automatic Protection Switching (APS)
- Inter-Switch Link (ISL) encapsulation
- Universal Transport Interface (UTI)

Supported MIBs

The following MIBs are supported in Cisco IOS Release 12.2(20)S2 for the 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router:

- CISCO-ENTITY-ALARM-MIB
- CISCO-CLASS-BASED-QOS-MIB
- CISCO-ENVMON-MIB (For NPEs, NSEs, line cards, and MSCs only)
- CISCO-ENTITY-ASSET-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-ENTITY-SENSOR-MIB
- ENTITY-MIB
- ETHERLIKE-MIB
- IF-MIB
- RMON-MIB
- MPLS-LDP-MIB
- MPLS-LSR-MIB
- MPLS-TE-MIB
- MPLS-VPN-MIB

For more information about MIB support on the Cisco 7304 router, refer to the *Cisco 7304 Router MIB Specifications Guide* found at the following URL:

http://www.cisco.com/univercd/cc/td/doc/product/core/cis7300/7304mibs/

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

http://tools.cisco.com/ITDIT/MIBS/servlet/index

If Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download MIBs from the Cisco MIBs page at the following URL:

http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml

To access Cisco MIB Locator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com. An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

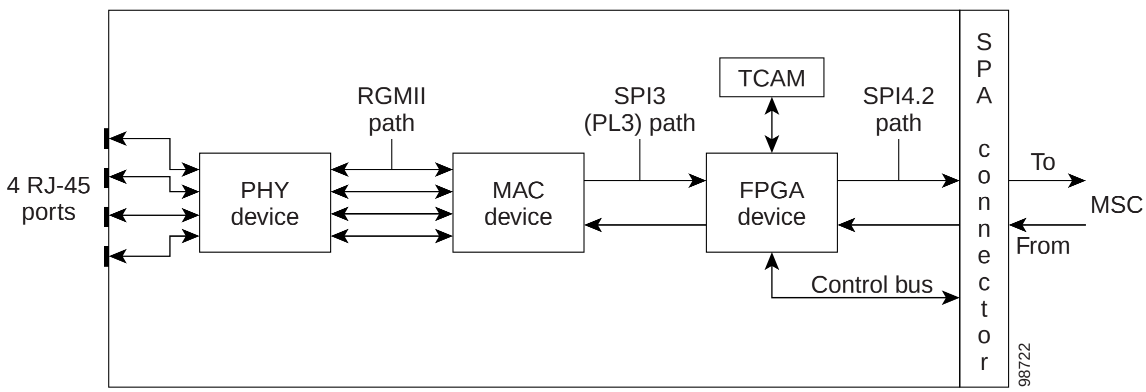
http://www.cisco.com/register

SPA Architecture

This section provides an overview of the architecture of the 4-Port 10/100 Fast Ethernet SPA and describes the path of a packet in the ingress and egress directions. Some of these areas of the architecture are referenced in the SPA software and can be helpful to understand when troubleshooting or interpreting some of the SPA CLI and **show** command output.

Figure 3-1 identifies some of the hardware devices that are part of the 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA architecture. The figure shows the four RJ-45 ports that are supported by the Fast Ethernet SPA only.

Figure 3-1 4-Port 10/100 Fast Ethernet SPA Architecture



Every incoming and outgoing packet on the 4-Port 10/100 Fast Ethernet SPA goes through the physical (PHY), Media Access Control (MAC), and field-programmable gate array (FPGA) devices.

Path of a Packet in the Ingress Direction

The following steps describe the path of an ingress packet through the 4-Port 10/100 Fast Ethernet SPA:

1. The PHY device receives incoming frames on a per-port basis from one of the four RJ-45 interface connectors.
2. The PHY device processes the frame and sends it over the RGMII path to the MAC device.
3. The MAC device receives the frame into a per-port first-in, first-out (FIFO) receive buffer and performs MAC-level processing of the frame. The CRC is not removed from the frame by the MAC device.
4. After validating received frames, the MAC device forwards the frames to the FPGA device.
5. The FPGA device receives the frame into a per-port FIFO receive buffer.

6. The FPGA device performs filtering based on whether or not the interface is operating in promiscuous mode. If the interface is operating in promiscuous mode, no filtering occurs and the FPGA device passes all frames for further processing.

   If the interface is not operating in promiscuous mode, then the FPGA device performs two Ternary Content Addressable Memory (TCAM) table lookups to filter the received frame based on the MAC destination address and virtual LAN (VLAN) identifier. The allowable MAC destination addresses and VLAN IDs are based on the supported router configuration.

   For more information about TCAM processing, see the "TCAM Filtering" section on page 3-5.

7. When the frame passes the TCAM filter processing, the FPGA strips the Layer 2 CRC and forwards the frame over the SPI4.2 path to the MSC.
8. The Cisco 7304 MSC-100 receives the frame and stores it in a per-port receive buffer. Once the MSC receives the entire frame, it is sent to the network services engine (NSE) or network processor engine (NPE) for further processing.

Path of a Packet in the Egress Direction

The following steps describe the path of an egress packet from the Cisco 7304 MSC-100 through the 4-Port 10/100 Fast Ethernet SPA:

1. The Cisco 7304 MSC-100 receives frames from the NSE or NPE, strips the egress link header and stores the frames in a per-port transmit buffer.
2. After the Cisco 7304 MSC-100 receives a complete frame, it forwards the frame to the SPA FPGA device in interleaved mode.
3. The FPGA device pads the frame (as required), adds the Layer 2 CRC, and sends the frame to the MAC device.
4. The MAC device receives the frame into a per-port first-in, first-out (FIFO) transmit buffer and performs MAC-level processing of the frame.
5. After the MAC device receives a complete frame, it forwards the frame to the PHY device.
6. The PHY device encodes and serializes the frame and transmits the frame through the physical interface (one of the four RJ-45 interface connectors for the 4-Port 10/100 Fast Ethernet SPA).

TCAM Filtering

The 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA support two TCAM regions per interface. One region is for MAC destination address filtering (2048 total entries, with 512 entries per interface on the Fast Ethernet SPA and 1024 entries per interface on the Gigabit Ethernet SPA), and the other is for VLAN ID filtering (4096 total entries, with 1024 entries per interface on the Fast Ethernet SPA and 2048 entries per interface on the Gigabit Ethernet SPA). Filtering is enabled by default when the interface is not operating in promiscuous mode. If the interface is operating in promiscuous mode, or if the TCAM table is full, then no filtering occurs. Otherwise, enabling and disabling of filtering is not user-configurable.

The TCAM entries support permit filtering only. For example, if a MAC destination address is not in the TCAM table for the interface, the frame is dropped. The MAC destination address entries are added to the TCAM for such things as multicast addresses of routing protocols. Unicast addresses do not typically appear in the table. By default when the router reloads, three destination addresses are added to the TCAM table: the local interface address, the Ethernet broadcast address, and the Ethernet multicast address.

For VLAN filtering, two default VLAN ID 0 entries always appear in the table and represent the local interface port for handling of promiscuous mode and non-VLAN packets. Additional VLAN IDs appear in the table based on your interface configuration.

To display the status of the TCAM tables on an interface, use the **show controllers fastethernet** command or **show controllers gigabitethernet** command.

Displaying the SPA Hardware Type

To verify the SPA hardware type that is installed in your Cisco 7304 router, you can use the **show interfaces** command or the **show controllers** command. There are several other commands on the Cisco 7304 router that also provide SPA hardware information, including the **show c7300** and the **show diag** commands. For more information about these commands, see Chapter 8, "Command Reference."

Table 3-2 shows the hardware description that appears in the **show** command output for each type of SPA that is supported on the Cisco 7304 router.

Table 3-2 SPA Hardware Descriptions in show Commands

SPA	Description in show interfaces and show controllers commands
4-Port 10/100 Fast Ethernet SPA	Hardware is SPA-4FE-7304
2-Port 10/100/1000 Gigabit Ethernet SPA	Hardware is SPA-2GE-7304

Example of the show interfaces Command

The following example shows output from the **show interfaces fastethernet** command on a Cisco 7304 router with a 4-Port 10/100 Fast Ethernet SPA installed in slot 4:

```
Router# show interfaces fastethernet 4/0/0
FastEthernet4/0/0 is up, line protocol is up
  Hardware is SPA-4FE-7304, address is 00b0.64ff.5d80 (bia 00b0.64ff.5d80)
  Internet address is 192.168.50.1/24
.
.
.
```

Example of the show controllers Command

The following example shows output from the **show controllers fastethernet** command on a Cisco 7304 router with a 4-Port 10/100 Fast Ethernet SPA installed in slot 4:

```
Router# show controllers fastethernet 4/0/0
Interface FastEthernet4/0/0
  Hardware is SPA-4FE-7304
  Connection mode is auto-negotiation
  Interface state is up, link is up
  Configuration is Auto Speed, Auto Duplex
  Selected media-type is RJ45
.
.
.
```

Configuring the Fast Ethernet SPA and Gigabit Ethernet SPA

This chapter provides information about configuring the 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router. It includes the following sections:

For information about managing your system images and configuration files, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide, Release 12.2* and *Cisco IOS Configuration Fundamentals Command Reference, Release 12.2* publications.

For more information about the commands used in this chapter, first see Chapter 8, “Command Reference,” which documents new and modified commands, and the *Cisco 7300 Series Platform-Specific Commands.* Also refer to the related Cisco IOS Release 12.2 software command reference and master index publications. For more information about accessing these publications, see the “Related Documentation” section on page x.

Configuration Tasks

This section describes how to configure the 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA and includes information about verifying the configuration.

It includes the following topics:

- Saving the Configuration, page 4-16
- Shutting Down and Restarting an Interface on a SPA, page 4-16

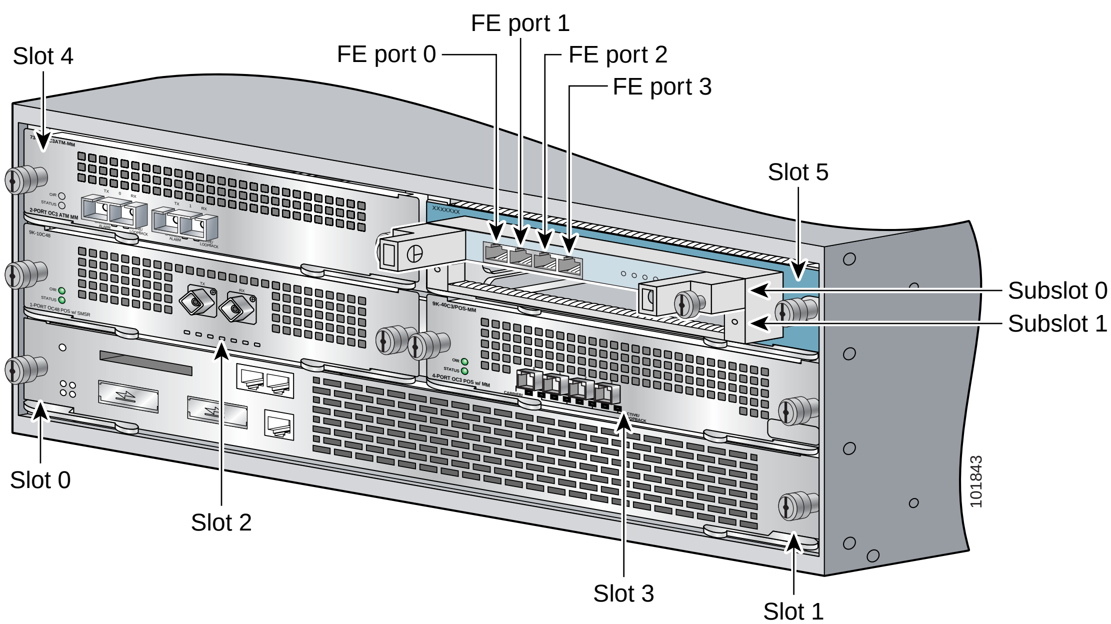
Specifying the Interface Address

The implementation of SPAs on the Cisco 7304 router introduces a new addressing format to specify the physical location of the MSC, SPA, and interface. The interface address format is *slot*/*subslot*/*port*:

- *slot*—Specifies the slot number (2 through 5) in the Cisco 7304 router in which the MSC that contains the SPA is installed.
- *subslot*—Specifies the secondary slot (top [0] or bottom [1]) on the MSC where the SPA that you want to select is installed. The MSC-100 can contain up to two SPAs.
- *port*—Specifies the interface number that you want to select on the SPA:
  - For the 4-Port 10/100 Fast Ethernet SPA—0 through 3
  - For the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1

Figure 4-1 shows the slot, subslot, and interface port locations of the 4-Port 10/100 Fast Ethernet SPA in an MSC-100 on the Cisco 7304 router.

Figure 4-1 Slot, Subslot, and Port Locations for the 4-Port 10/100 Fast Ethernet SPA



For more information about the installation of SPAs on the Cisco 7304 router, refer to the *Cisco 7304 Router Modular Services Card and Shared Port Adapter Hardware Installation Guide*.

Required Configuration Tasks

This section lists the required configuration steps to configure the Fast Ethernet and Gigabit Ethernet SPAs. Some of the required configuration commands implement default values that might be appropriate for your network. If the default value is correct for your network, then you do not need to configure the command. These commands are indicated by "(As Required)" in the Purpose column.

Required Configuration Tasks for the Fast Ethernet SPA

To configure the 4-Port 10/100 Fast Ethernet SPA, complete the following steps:

	Command	Purpose
Step 1	Router# **configure terminal**	Enters global configuration mode.
Step 2	Router(config)# **interface fastethernet** *slot*/*subslot*/*port*[**.***subinterface-number*]	Specifies the Fast Ethernet interface to configure, where: • *slot*/*subslot*/*port*—Specifies the location of the interface. See the "Specifying the Interface Address" section on page 4-2. • **.***subinterface-number*—(Optional) Specifies a secondary interface (subinterface) number.
Step 3	Router(config-if)# **ip address** *ip-address mask* [**secondary**]	Sets a primary or secondary IP address for an interface, where: • *ip-address*—Specifies the IP address for the interface. • *mask*—Specifies the mask for the associated IP subnet. • **secondary**—(Optional) Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.
Step 4	Router(config-if)# **duplex** {**full** | **half** | **auto**}	(As Required) Configures the duplex operation on an interface. The default is **auto**—Enables advertisement of both duplex modes and enables autonegotiation.
Step 5	Router(config-if)# **speed** {**10** | **100** | **auto**}	(As Required) Configures the speed of an interface (Mbps). The default is **auto**—Enables advertisement of all speed modes and enables autonegotiation.
Step 6	Router(config-if)# **mtu** *bytes*	(As Required) Specifies the maximum packet size for an interface, where: • *bytes*—Specifies the maximum number of bytes for a packet. The default is 1500 bytes.
Step 7	Router(config-if)# **no shutdown**	Enables the interface.

Required Configuration Tasks for the Gigabit Ethernet SPA

To configure the 2-Port 10/100/1000 Gigabit Ethernet SPA, complete the following steps:

	Command	Purpose
Step 1	Router# **configure terminal**	Enters global configuration mode.
Step 2	Router(config)# **interface gigabitethernet** *slot*/*subslot*/*port*[**.***subinterface-number*]	Specifies the Gigabit Ethernet interface to configure, where: • *slot*/*subslot*/*port*—Specifies the location of the interface. See the "Specifying the Interface Address" section on page 4-2. • **.***subinterface-number*—(Optional) Specifies a secondary interface (subinterface) number.
Step 3	Router(config-if)# **ip address** *ip-address mask* [**secondary**]	Sets a primary or secondary IP address for an interface, where: • *ip-address*—Specifies the IP address for the interface. • *mask*—Specifies the mask for the associated IP subnet. • **secondary**—(Optional) Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.
Step 4	Router(config-if)# **media-type** {**gbic** | **rj45**}	(As Required) Specifies the type of media used to make the network connection on the router, where: • **gbic**—Gigabit Interface Converter (GBIC). Specifies that the interface supports fiber media using a small form-factor pluggable (SFP) optical transceiver. **Note** When you configure the **gbic** media type, the interface advertises full duplex and 1000 Mbps only during autonegotiation. • **rj45**—Specifies that the interface supports RJ-45 media. The default is **rj45**. **Note** If you connect both RJ-45 and fiber media to the same interface on the Gigabit Ethernet SPA, be sure that you configure the **media-type** command to specify whether you want to use the copper (RJ-45) or fiber media.

	Command	Purpose
Step 5	Router(config-if)# **duplex** {**full** | **half** | **auto**}	(As Required for RJ-45 Media) Configures the duplex operation on an interface. The default is **auto**—Enables advertisement of both modes and autonegotiation. **Note** When using fiber media, the 2-Port 10/100/1000 Gigabit Ethernet SPA only advertises and negotiates full-duplex mode when the **negotiation auto** command is enabled (default).
Step 6	Router(config-if)# **speed** {**10** | **100** | **1000** | **auto**}	(As Required for RJ-45 Media) Configures the speed of an interface (Mbps). The default is **auto**—Enables advertisement of all speed modes and enables autonegotiation. **Note** When using fiber media, the 2-Port 10/100/1000 Gigabit Ethernet SPA only advertises and negotiates 1000 Mbps speed when the **negotiation auto** command is enabled (default).
Step 7	Router(config-if)# **mtu** *bytes*	(As Required) Configures the maximum packet size for an interface, where: • *bytes*—Specifies the maximum number of bytes for a packet. The default is 1500 bytes.
Step 8	Router(config-if)# **no shutdown**	Enables the interface.

Modifying the Media Type

RJ-45 is the only supported media type for copper interfaces on the 4-Port 10/100 Fast Ethernet SPA. Therefore, you do not need to configure the **media-type** command on the Fast Ethernet SPA.

However, if you are using fiber connections on the 2-Port 10/100/1000 Gigabit Ethernet SPA, you must configure the **media-type** command to change the default value. If you connect both RJ-45 and fiber media to the same interface on the Gigabit Ethernet SPA, be sure that you configure the **media-type** command to specify the media type.

To modify the default media type of an interface from RJ-45 for Gigabit Ethernet SPAs, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **media-type gbic**	Specifies the interface supports fiber media using an SFP optical transceiver.

For a list of the compatible SFP modules for the 2-Port 10/100/1000 Gigabit Ethernet SPA, refer to the *Cisco 7304 Router Modular Services Card and Shared Port Adapter Hardware Installation Guide*.

Verifying the Media Type

To verify the media type for an interface, use the **show interfaces fastethernet** or **show interfaces gigabitethernet** privileged EXEC command and observe the value shown in the "media type" field.

The following example shows that the media type is SX for interface port 0 (the first port) on the SPA installed in the bottom subslot (1) of the MSC that is located in slot 4 of the Cisco 7304 router:

```
Router# show interfaces gigabitethernet 4/1/0
GigabitEthernet4/1/0 is up, line protocol is up
  Hardware is SPA-2GE-7304, address is 0007.0ed3.ba88 (bia 0007.0ed3.ba88)
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 1000Mb/s, link type is auto, media type is SX
.
.
.
```

You also can use the **show controllers gigabitethernet** privileged EXEC command to verify the media type. The following example shows that the GBIC type is 1000BaseSX for interface port 0 (the first port) on the SPA installed in the bottom subslot (1) of the MSC that is located in slot 4 of the Cisco 7304 router:

```
Router# show controllers gigabitethernet 4/1/0
Interface GigabitEthernet4/1/0
  Hardware is SPA-2GE-7304
  Connection mode is auto-negotiation
  Interface state is up, link is up
  Configuration is Auto Speed, Auto Duplex
  Selected media-type is GBIC, GBIC type is 1000BaseSX
.
.
.
```

Modifying the MAC Address on the Interface

The 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA use a default MAC address for each port that is derived from the base address that is stored in the electrically erasable programmable read-only memory (EEPROM) on the backplane of the Cisco 7304 router.

To modify the default MAC address of an interface to some user-defined address, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **mac-address** *ieee-address*	Modifies the default MAC address of an interface to a user-defined address, where: • *ieee-address*—Specifies the 48-bit Institute of Electrical and Electronics Engineers (IEEE) MAC address written as a dotted triple of four-digit hexadecimal numbers (*xxxx.yyyy.zzzz*).

To return to the default MAC address on the interface, use the **no** form of the command.

Verifying the MAC Address

To verify the MAC address of an interface, use the **show interfaces fastethernet** or **show interfaces gigabitethernet** privileged EXEC command and observe the value shown in the "address is" field.

The following example shows that the MAC address is 00b0.64ff.5d80 for interface port 0 (the first port) on the SPA installed in the top subslot (0) of the MSC that is located in slot 4 of the Cisco 7304 router:

```
Router# show interfaces fastethernet 4/0/0
FastEthernet4/0/0 is up, line protocol is up
  Hardware is SPA-4FE-7304, address is 00b0.64ff.5d80 (bia 00b0.64ff.5d80)
  Internet address is 192.168.50.1/24
  MTU 9216 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
.
.
.
```

Modifying the Interface MTU Size

The Cisco IOS software supports three different types of configurable maximum transmission unit (MTU) options at different levels of the protocol stack:

- Interface MTU—Checked by the SPA on traffic coming in from the network. Different interface types support different interface MTU sizes and defaults. The interface MTU defines the maximum packet size allowable (in bytes) for an interface before drops occur. If the frame is smaller than the interface MTU size, but is not smaller than the minimum frame size for the interface type (such as 64 bytes for Ethernet), then the frame continues to process.
- IP MTU—Can be configured on a subinterface and is used by the Cisco IOS software to determine whether fragmentation of a packet takes place. If an IP packet exceeds the IP MTU size, then the packet is fragmented.
- Tag or Multiprotocol Label Switching (MPLS) MTU—Can be configured on a subinterface and allows up to six different labels, or tag headers, to be attached to a packet. The maximum number of labels is dependent on your Cisco IOS software release.

Different encapsulation methods and the number of MPLS MTU labels add additional overhead to a packet. For example, Subnetwork Access Protocol (SNAP) encapsulation adds an 8-byte header, dot1q encapsulation adds a 2-byte header, and each MPLS label adds a 4-byte header (*n* labels x 4 bytes).

For the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA, the default MTU size is 1500 bytes. The maximum configurable MTU is 9216 bytes. The SPA automatically adds an additional 36 bytes to the configured MTU size to accommodate some of the additional overhead.

The MTU size on a SPA interface affects the recording of the "giants" statistic in the **show interfaces fastethernet** and **show interfaces gigabitethernet** commands. When using the default MTU size of 1500 bytes, the giants counter increments when the interface receives a packet that is greater than 1536 bytes.

Interface MTU Configuration Guidelines

When configuring the interface MTU size on a 4-Port 10/100 Fast Ethernet SPA or 2-Port 10/100/1000 Gigabit Ethernet SPA, consider the following guidelines:

- If you change the interface MTU size, the giants counter increments when the interface receives a packet that exceeds the MTU size that you configured, plus an additional 36 bytes. For example, with a maximum MTU size of 9216 bytes, the giants counter increments when receiving packets larger than 9252 bytes, or (9216 + 36) bytes.
- The default interface MTU size accommodates a 1500-byte packet, plus 36 additional bytes to cover the following additional overhead:
  - Layer 2 header—14 bytes
  - SNAP header—8 bytes
  - Dot1q header—2 bytes
  - 2 MPLS labels—8 bytes
  - CRC—4 bytes

Note Depending on your Cisco IOS software release, a certain maximum number of MPLS labels are supported. If you need to support more than two MPLS labels, then you should increase the default interface MTU size on the SPA interface.

- If you are using MPLS, be sure that the **mpls mtu** command is configured for a value less than or equal to the interface MTU.
- If you are using MPLS labels, then you should increase the default interface MTU size to accommodate the number of MPLS labels. Each MPLS label adds 4 bytes of overhead to a packet.

Interface MTU Configuration Task

To modify the MTU size on an interface, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **mtu** *bytes*	Configures the maximum packet size for an interface, where: • *bytes*—Specifies the maximum number of bytes for a packet. The default is 1500 bytes.

To return to the default MTU size, use the **no** form of the command.

Verifying the MTU Size

To verify the MTU size for an interface, use the **show interfaces fastethernet** or **show interfaces gigabitethernet** privileged EXEC command and observe the value shown in the “MTU” field.

The following example shows an MTU size of 9216 bytes for interface port 0 (the first port) on the SPA installed in the top subslot (0) of the MSC that is located in slot 4 of the Cisco 7304 router:

```
Router# show interfaces fastethernet 4/0/0
FastEthernet4/0/0 is up, line protocol is up
```

```
  Hardware is SPA-4FE-7304, address is 00b0.64ff.5d80 (bia 00b0.64ff.5d80)
  Internet address is 192.168.50.1/24
  MTU 9216 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
.
.
.
```

Configuring the Encapsulation Type

By default, the interfaces on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA support Advanced Research Projects Agency (ARPA) encapsulation. They do not support configuration of service access point (SAP) or SNAP encapsulation for transmission of frames; however, the interfaces will properly receive frames that use SAP and SNAP encapsulation.

The only other encapsulation supported by the SPA interfaces is IEEE 802.1Q encapsulation for virtual LANs (VLANs).

Configuring a Subinterface on a VLAN

You can configure subinterfaces on the the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on a VLAN using IEEE 802.1Q encapsulation.

Note The 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA do not support Inter-Switch Link (ISL) encapsulation.

To configure a SPA subinterface on a VLAN, use the following commands beginning in interface configuration mode:

	Command	Purpose
Step 1	Router(config)# **interface fastethernet** *slot*/*subslot*/*port***.***subinterface-number*	Specifies the Fast Ethernet interface to configure, where: • *slot*/*subslot*/*port*—Specifies the location of the interface. See the "Specifying the Interface Address" section on page 4-2. • **.***subinterface-number*—Specifies a secondary interface (subinterface) number.
Step 2	Router(config-subif)# **encapsulation dot1q** *vlan-id*	Defines the encapsulation format as IEEE 802.1Q (**dot1q**), where *vlan-id* is the number of the VLAN (1–4095).
Step 3	Router(config-if)# **ip address** *ip-address mask* [**secondary**]	Sets a primary or secondary IP address for an interface, where: • *ip-address*—Specifies the IP address for the interface. • *mask*—Specifies the mask for the associated IP subnet. • **secondary**—(Optional) Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.

Verifying Subinterface Configuration on a VLAN

To verify the configuration of a subinterface and its status on the VLAN, use the **show vlans** privileged EXEC command.

The following example shows the status of subinterface number 268 on port 2 (third port) on the SPA in VLAN number 269:

```
Router# show vlans 269

Virtual LAN ID:  269 (IEEE 802.1Q Encapsulation)

   vLAN Trunk Interface:   FastEthernet4/1/2.268

   Protocols Configured:   Address:              Received:        Transmitted:
           PXF:FastEthernet4/1/2.268               941668                   0
           RP Switched:
           IP              10.1.13.1                    5                   0
```

Configuring Autonegotiation on an Interface

Fast Ethernet and Gigabit Ethernet interfaces use a connection-setup algorithm called *autonegotiation.* Autonegotiation allows the local and remote devices to configure compatible settings for communication over the link. Using autonegotiation, each device advertises its transmission capabilities and then agrees upon the settings to be used for the link.

If autonegotiation fails for some reason, the Fast Ethernet or Gigabit Ethernet interface is configured for half-duplex mode and automatically senses the speed on the link. For Gigabit Ethernet interfaces using fiber media, full-duplex mode and 1000-Mbps speed only is supported.

By default, the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA support autonegotiation of the speed and duplex settings. The SPA automatically implements flow control (transmission of pause frames), which is advertised, but is not negotiable. For more information about flow control configuration requirements if you disable autonegotiation, see the "Configuring Flow Control Support on the Link" section on page 4-15.

Note Autonegotiation is recommended to ensure compatibility of transmission settings. If you do not use autonegotiation, be sure that your interface configuration matches the configuration supported by the remote device on the link.

Autonegotiation configuration varies slightly depending on the media type that you are using. The following sections describe these configuration differences:

- Configuring Autonegotiation on RJ-45 Interfaces, page 4-11
- Configuring Autonegotiation on Fiber Interfaces, page 4-13

Configuring Autonegotiation on RJ-45 Interfaces

The 4-Port 10/100 Fast Ethernet SPA only supports RJ-45 media for its interfaces. The 2-Port 10/100/1000 Gigabit Ethernet SPA supports both RJ-45 and fiber media for its interfaces.

When using the RJ-45 media type, the interface enables autonegotiation when either the **speed** or **duplex** interface configuration commands are configured to **auto**. By default, both the **speed** and **duplex** commands are set to **auto**, which means that the interface advertises that it can support either 10-Mbps or 100-Mbps operation for Fast Ethernet interfaces, or 10-Mbps, 100-Mbps, or 1000-Mbps operation for Gigabit Ethernet interfaces, and that it can also support half-duplex or full-duplex mode on the link, in any combination as follows:

- 10 Mbps and half duplex
- 10 Mbps and full duplex
- 100 Mbps and half duplex
- 100 Mbps and full duplex
- 1000 Mbps and half duplex—Gigabit Ethernet only
- 1000 Mbps and full duplex—Gigabit Ethernet only (This is also the only advertisement supported when using fiber media. For more information, see the "Configuring Autonegotiation on Fiber Interfaces" section on page 4-13.)

Note Flow control support is always advertised when autonegotiation is enabled.

If you want to force a particular speed or duplex setting, while still enabling autonegotiation, then you can specify a value for that parameter while leaving the other parameter configured for **auto**.

For more information, see the following sections:

- Specifying the Speed with Autonegotiation of the Duplex Mode Only on RJ-45 Interfaces, page 4-12
- Specifying the Duplex Mode with Autonegotiation of the Speed Only on RJ-45 Interfaces, page 4-12
- Disabling Autonegotiation on RJ-45 Interfaces, page 4-13

Specifying the Speed with Autonegotiation of the Duplex Mode Only on RJ-45 Interfaces

To configure an interface using RJ-45 media on the 4-Port 10/100 Fast Ethernet SPA or 2-Port 10/100/1000 Gigabit Ethernet SPA for a specific speed, but also advertise support of either full-duplex or half-duplex operation, use the following commands beginning in interface configuration mode:

	Command	Purpose
Step 1	Router(config-if)# **speed 10** or Router(config-if)# **speed 100** or Router(config-if)# **speed 1000**	Specifies that the interface advertises 10-Mbps support only. or Specifies that the interface advertises 100-Mbps support only. or Specifies that the interface advertises 1000-Mbps support only. This speed is supported only by Gigabit Ethernet interfaces.
Step 2	Router(config-if)# **duplex auto**	Specifies that the interface advertises support of either half-duplex or full-duplex operation. The default is **auto**.

Specifying the Duplex Mode with Autonegotiation of the Speed Only on RJ-45 Interfaces

To configure an interface using RJ-45 media on the 4-Port 10/100 Fast Ethernet SPA or 2-Port 10/100/1000 Gigabit Ethernet SPA for a specific duplex mode, but also advertise support of either 10-Mbps, 100-Mbps, or 1000-Mbps operation, use the following commands beginning in interface configuration mode:

	Command	Purpose
Step 1	Router(config-if)# **speed auto**	Specifies that the interface advertises support of either 10-Mbps or 100-Mbps operation for Fast Ethernet interfaces, or 10-Mbps, 100-Mbps, or 1000-Mbps operation for Gigabit Ethernet interfaces. The default is **auto**.
Step 2	Router(config-if)# **duplex full** or Router(config-if)# **duplex half**	Specifies that the interface advertises full-duplex support only. or Specifies that the interface advertises half-duplex support only.

Disabling Autonegotiation on RJ-45 Interfaces

When you specify a particular value for both the **duplex** and **speed** commands when using RJ-45 media, you disable autonegotiation on the link. Therefore, the interface does not advertise its capabilities to the remote device and it forces operation of the interface port according to the settings that you configured.

Note If you need to force an interface port to operate with certain settings and therefore disable autonegotiation, you must be sure that the remote link is configured with compatible link settings for proper transmission. This includes support of flow control on the link. For information about how disabling autonegotiation affects the configuration of flow control, see the "Configuring Flow Control Support on the Link" section on page 4-15.

To disable autonegotiation on an interface using RJ-45 media and configure it for a specific duplex mode and speed, use the following commands beginning in interface configuration mode:

	Command	Purpose
Step 1	Router(config-if)# **speed 10**	Forces the interface to operate at 10 Mbps.
	or	or
	Router(config-if)# **speed 100**	Forces the interface to operate at 100 Mbps.
	or	or
	Router(config-if)# **speed 1000**	Forces the interface to operate at 1000 Mbps. This speed is supported only by Gigabit Ethernet interfaces.
Step 2	Router(config-if)# **duplex full**	Forces the interface to operate in full-duplex mode only.
	or	or
	Router(config-if)# **duplex half**	Forces the interface to operate in half-duplex mode only.

Note The interface forces the settings for the **speed** and **duplex** commands without advertisement when you specify a value for the commands and do not configure either of them with the **auto** keyword.

Configuring Autonegotiation on Fiber Interfaces

The 4-Port 10/100 Fast Ethernet SPA only supports RJ-45 media for its interfaces. The 2-Port 10/100/1000 Gigabit Ethernet SPA supports both RJ-45 and fiber media for its interfaces. To configure autonegotiation for interfaces using RJ-45 media, see the "Configuring Autonegotiation on RJ-45 Interfaces" section on page 4-11.

When using SFP media on the 2-Port 10/100/1000 Gigabit Ethernet SPA, use the instructions in this section to configure autonegotiation.

Disabling Autonegotiation on Fiber Interfaces

Autonegotiation is automatically enabled. During autonegotiation on fiber interfaces, advertisement and configuration of full-duplex mode and 1000-Mbps speed occurs. Flow control support is also advertised. When you disable autonegotiation on a Gigabit Ethernet SPA interface that uses fiber media, the interface no longer advertises but automatically configures itself for full-duplex mode and 1000-Mbps speed.

To disable autonegotiation on a Gigabit Ethernet interface using fiber media, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **no negotiation auto**	Disables autonegotiation on Gigabit Ethernet SPA interfaces that are using fiber media. No advertisement of duplex, speed, or flow control occurs.

Enabling Autonegotiation on Fiber Interfaces

Autonegotiation is automatically enabled. During autonegotiation on fiber interfaces, advertisement and configuration of full-duplex mode and 1000-Mbps speed occurs. Flow control support is also advertised. To re-enable autonegotiation on a Gigabit Ethernet interface using fiber media, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **negotiation auto**	Enables autonegotiation on Gigabit Ethernet SPA interfaces that are using fiber media. Advertisement of full duplex, 1000 Mbps, and flow control occurs.

Verifying Autonegotiation Status

To verify the status of autonegotiation on a Fast Ethernet or Gigabit Ethernet interface on a SPA, use the **show controllers fastethernet** or **show controllers gigabitethernet** privileged EXEC command.

The following example shows that the connection mode is autonegotiation for interface port 0 (the first port) on the SPA located in the top subslot (0) of the MSC that is installed in slot 4 of the Cisco 7304 router, and that autonegotiation is enabled and complete.

The settings established on the link are 100-Mbps operation with full-duplex support. The output also displays the advertised capabilities of both the local interface (beside “Advertised capabilities”) and the remote device (beside “Partner capabilities”):

```
Router# show controllers fastethernet 4/0/0
Interface FastEthernet4/0/0
  Hardware is SPA-4FE-7304
  Connection mode is auto-negotiation
  Interface state is up, link is up
  Configuration is Auto Speed, Auto Duplex
  Selected media-type is RJ45
  Promiscuous mode is off, VLAN filtering is enabled
  MDI crossover status: MDI
  Auto-negotiation configuration and status:
    Auto-negotiation is enabled and is completed
```

```
    Speed/duplex is resolved to 100 Mbps, full duplex
    Advertised capabilities: 10M/HD 10M/FD 100M/HD 100M/FD
    Partner capabilities: 10M/HD 10M/FD 100M/HD 100M/FD
.
.
.
```

Configuring Flow Control Support on the Link

The 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA automatically support transmission of pause frames to stop packet flow when the per-port MSC buffer is full. You can not disable flow control on the 4-Port 10/100 Fast Ethernet SPA or 2-Port 10/100/1000 Gigabit Ethernet SPA.

Therefore, flow control support on the 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA is not configurable, but it is advertised during autonegotiation.

Verifying Flow Control Status

To verify the status of flow control on a Fast Ethernet interface on a SPA, use the **show controllers fastethernet** privileged EXEC command and view the "Total pause frames" counters in the "MAC counters" section of the output.

The following example shows that zero pause frames have been transmitted and received by the MAC device for interface port 0 (the first port) on the SPA located in the top subslot (0) of the MSC that is installed in slot 4 of the Cisco 7304 router:

```
Router# show controllers fastethernet 4/0/0
Interface FastEthernet4/0/0
  Hardware is SPA-4FE-7304
  Connection mode is auto-negotiation
  Interface state is up, link is up
  Configuration is Auto Speed, Auto Duplex
  Selected media-type is RJ45
  Promiscuous mode is off, VLAN filtering is enabled
  MDI crossover status: MDI
  Auto-negotiation configuration and status:
    Auto-negotiation is enabled and is completed
    Speed/duplex is resolved to 100 Mbps, full duplex
    Advertised capabilities: 10M/HD 10M/FD 100M/HD 100M/FD
    Partner capabilities: 10M/HD 10M/FD 100M/HD 100M/FD
MAC counters:
  Input: packets = 15, bytes = 1776
         FIFO full/reset removed = 0, error drop = 0
  Output: packets = 18, bytes = 2622
          FIFO full/reset removed = 0, error drop = 0
  Total pause frames: transmitted = 0, received = 0
FPGA counters:
  Input: Total (good & bad) packets: 15, TCAM drops: 4
         Satisfy (host-backpressure) drops: 0, CRC drops: 0
         PL3 RERRs: 0
  Output: EOP (SPI4) errors: 0
SPA carrier card counters:
  Input: packets = 11, bytes = 1476, drops = 0
  Output: packets = 18, bytes = 2550, drops = 0
  Egress flow control status: XON
  Per bay counters:
  General errors: input = 0, output = 0
  SPI4 errors: ingress dip4 = 0, egress dip2 = 0
```

```
MAC destination address filtering table:
  Table entries: Total = 512, Used = 4, Available = 508
  Index MAC destination address       Mask
  ----- ----------------------  --------------
  1     0007.0ed3.ba80           ffff.ffff.ffff
  2     ffff.ffff.ffff           ffff.ffff.ffff
  3     0100.0000.0000           0100.0000.0000
  4     0100.0ccc.cccc           ffff.ffff.ffff
VLAN filtering table:
  Number of VLANs configured on this interface = 0
  Table entries: Total = 1024, Used = 2, Available = 1022
  Index  VLAN identifier  Enabled  Tunnel
  -----  ---------------  -------  ------
  1           0             No      No
  2           0             Yes     No
Platform details:
  PXF tif number: 0x10
```

Saving the Configuration

To save your running configuration to nonvolatile random-access memory (NVRAM), use the following command in privileged EXEC configuration mode:

Command	Purpose
Router# **copy running-config startup-config**	Writes the new configuration to NVRAM.

For more information about managing configuration files, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide, Release 12.2* and *Cisco IOS Configuration Fundamentals Command Reference, Release 12.2* publications.

Shutting Down and Restarting an Interface on a SPA

You can shut down and restart any of the interface ports on a SPA independently of each other. Shutting down an interface stops traffic and enters the interface into an "administratively down" state.

If you are preparing for an OIR of a SPA, it is not necessary to independently shut down each of the interfaces prior to deactivation of the SPA. The **hw-module subslot stop** command automatically stops traffic on the interfaces and deactivates them along with the SPA in preparation for OIR.

In similar fashion, you do not need to independently restart any interfaces on a SPA after OIR of a SPA or MSC. For more information about performing an OIR for a SPA, see the "Preparing for Online Insertion and Removal of MSCs and SPAs on the Cisco 7304 Router" section on page 3-8.

To shut down an interface on a SPA, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **shutdown**	Disables an interface.

To restart an interface on a SPA, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# **no shutdown**	Restarts a disabled interface.

Verifying the Interface Configuration

Besides using the **show running-configuration** command to display your Cisco 7304 router configuration settings, you can use the **show interfaces fastethernet** command and **show interfaces gigabitethernet** command, and the **show controllers fastethernet** command and **show controllers gigabitethernet** command to get detailed information on a per-port basis for your 4-Port 10/100 Fast Ethernet SPA or 2-Port 10/100/1000 Gigabit Ethernet SPA.

Verifying Per-Port Interface Status

To find detailed interface information on a per-port basis for the 4-Port 10/100 Fast Ethernet SPA, use the **show interfaces fastethernet** command. For a description of the command output, see Chapter 8, "Command Reference."

The following example provides sample output for interface port 1 (the second port), on the SPA located in the bottom subslot (1), of the MSC that is installed in slot 2 of the Cisco 7304 router:

```
Router# show interfaces fastethernet 2/1/1
FastEthernet2/1/1 is up, line protocol is up
  Hardware is SPA-4FE-7304, address is 00b0.64ff.5d80 (bia 00b0.64ff.5d80)
  Internet address is 192.168.50.1/24
  MTU 9216 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:22, output 00:00:02, 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
     5 packets input, 320 bytes
     Received 1 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog
     0 input packets with dribble condition detected
     8 packets output, 529 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets
     0 babbles, 0 late collision, 0 deferred
     2 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
```

Monitoring Per-Port Interface Statistics

To find detailed status and statistical information on a per-port basis for the 4-Port 10/100 Fast Ethernet SPA, use the **show controllers fastethernet** command. For a description of the command output, see Chapter 8, "Command Reference."

The following example provides sample output for interface port 0 (the first port), on the SPA located in the top subslot (0), of the MSC that is installed in slot 4 of the Cisco 7304 router:

```
Router# show controllers fastethernet 4/0/0
Interface FastEthernet4/0/0
  Hardware is SPA-4FE-7304
  Connection mode is auto-negotiation
  Interface state is up, link is up
  Configuration is Auto Speed, Auto Duplex
  Selected media-type is RJ45
  Promiscuous mode is off, VLAN filtering is enabled
  MDI crossover status: MDI
  Auto-negotiation configuration and status:
    Auto-negotiation is enabled and is completed
    Speed/duplex is resolved to 100 Mbps, full duplex
    Advertised capabilities: 10M/HD 10M/FD 100M/HD 100M/FD
    Partner capabilities: 10M/HD 10M/FD 100M/HD 100M/FD
MAC counters:
  Input: packets = 15, bytes = 1776
         FIFO full/reset removed = 0, error drop = 0
  Output: packets = 18, bytes = 2622
          FIFO full/reset removed = 0, error drop = 0
  Total pause frames: transmitted = 0, received = 0
FPGA counters:
  Input: Total (good & bad) packets: 15, TCAM drops: 4
         Satisfy (host-backpressure) drops: 0, CRC drops: 0
         PL3 RERRs: 0
  Output: EOP (SPI4) errors: 0
SPA carrier card counters:
  Input: packets = 11, bytes = 1476, drops = 0
  Output: packets = 18, bytes = 2550, drops = 0
  Egress flow control status: XON
  Per bay counters:
  General errors: input = 0, output = 0
  SPI4 errors: ingress dip4 = 0, egress dip2 = 0
MAC destination address filtering table:
  Table entries: Total = 512, Used = 4, Available = 508
  Index MAC destination address       Mask
  ----- ----------------------  --------------
  1     0007.0ed3.ba80           ffff.ffff.ffff
  2     ffff.ffff.ffff           ffff.ffff.ffff
  3     0100.0000.0000           0100.0000.0000
  4     0100.0ccc.cccc           ffff.ffff.ffff
VLAN filtering table:
  Number of VLANs configured on this interface = 0
  Table entries: Total = 1024, Used = 2, Available = 1022
  Index  VLAN identifier  Enabled  Tunnel
  -----  ---------------  -------  ------
  1          0              No      No
  2          0              Yes     No
Platform details:
  PXF tif number: 0x10
```

Configuration Examples

This section includes the following configuration examples:

Basic Interface Configuration Example

The following example shows how to enter global configuration mode to specify the interface that you want to configure, configure an IP address for the interface, and save the configuration. This example configures interface port 1 (the second port) on the SPA located in the bottom subslot (1) of the MSC that is installed in slot 2 of the Cisco 7304 router:

```
!Enter global configuration mode
!
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
!
! Specify the interface address
!
Router(config)# interface fastethernet 2/1/1
!
! Configure an IP address
!
Router(config-if)# ip address 192.168.50.1 255.255.255.0
!
! Start the interface
!
Router(config-if)# no shut
!
! Save the configuration to NVRAM
!
Router(config-if)# exit
Router# copy running-config startup-config
```

Media Type Configuration Example

The following example changes the default media type from RJ-45 to GBIC to support SFP module on the Gigabit Ethernet interface:

```
! Enter global configuration mode
!
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface gigabitethernet 4/1/0
!
! Configure the interface for fiber media
!
Router(config-if)# media-type gbic
```

MAC Address Configuration Example

The following example changes the default MAC address on the interface to 1111.2222.3333:

```
!Enter global configuration mode
!
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
!
! Specify the interface address
!
Router(config)# interface fastethernet 2/1/1
!
! Modify the MAC address
!
Router(config-if)# mac-address 1111.2222.3333
```

MTU Configuration Example

The following example sets the interface MTU to 9216 bytes:

Note The SPA automatically adds an additional 36 bytes to the configured interface MTU size.

```
!Enter global configuration mode
!
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
!
! Specify the interface address
!
Router(config)# interface fastethernet 2/1/1
!
! Configure the interface MTU
!
Router(config-if)# mtu 9216
```

VLAN Configuration Example

The following example creates a subinterface number 268 on SPA interface port 2 (the third port), and configures the subinterface on the VLAN with ID number 269 using IEEE 802.1Q encapsulation:

Note The SPA does not support ISL encapsulation.

```
!Enter global configuration mode
!
Router# configure terminal
```

```
Enter configuration commands, one per line. End with CNTL/Z.
!
! Specify the interface address
!
Router(config)# interface fastethernet 4/1/2.268
!
! Configure dot1Q encapsulation and specify the VLAN ID
!
Router(config-subif)# encapsulation dot1q 269
```

Autonegotiation Configuration Examples

This section provides several examples including combining configuration parameters to force a specific setting while enabling autonegotiation for another setting, and also disabling autonegotiation support:

- Forcing Half-Duplex Mode and Autonegotiation of the Speed Configuration Example, page 4-21
- Forcing 10-Mbps Speed and Autonegotiation of the Duplex Configuration Example, page 4-22
- Disabling Autonegotiation on RJ-45 Interfaces Configuration Example, page 4-22
- Disabling Autonegotiation on Fiber Interfaces Configuration Example, page 4-23
- Enabling Autonegotiation on Fiber Interfaces Configuration Example, page 4-23

Forcing Half-Duplex Mode and Autonegotiation of the Speed Configuration Example

For interface port 1 (the second port) of the SPA located in the bottom subslot (1) of the MSC that is installed in slot 2 of the Cisco 7304 router, the following example specifies advertisement of half-duplex support only, and either 10-Mbps or 100-Mbps capability during autonegotiation:

```
! Enter global configuration mode
!
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface fastethernet 2/1/1
!
! Enable autonegotiation of the speed
! (This is the default setting)
!
Router(config-if)# speed auto
!
! Configure half-duplex
!
Router(config-if)# duplex half
```

With this configuration, the 4-Port 10/100 Fast Ethernet SPA advertises the following capabilities during autonegotiation:

- 10 Mbps and half duplex
- 100 Mbps and half duplex

Note Flow control support is always advertised when autonegotiation is enabled.

Forcing 10-Mbps Speed and Autonegotiation of the Duplex Configuration Example

For interface port 1 (the second port) of the SPA located in the bottom subslot (1) of the MSC that is installed in slot 2 of the Cisco 7304 router, the following example specifies advertisement of 10-Mbps support only, and either half-duplex or full-duplex capability during autonegotiation:

```
! Enter global configuration mode
!
Router# configure terminal
Router(config)# interface fastethernet 2/1/1
!
! Configure 10 Mbps speed
!
Router(config-if)# speed 10
!
! Enable autonegotiation of the duplex mode
! (This is the default setting)
!
Router(config-if)# duplex auto
```

With this configuration, the 4-Port 10/100 Fast Ethernet SPA advertises the following capabilities during autonegotiation:

- 10 Mbps and half duplex
- 10 Mbps and full duplex

Note Flow control support is always advertised when autonegotiation is enabled.

Disabling Autonegotiation on RJ-45 Interfaces Configuration Example

The following example specifies that interface port 1 (the second port) of the SPA located in the bottom subslot (1) of the MSC that is installed in slot 2 of the Cisco 7304 router, implements only full-duplex and 100-Mbps operation.

By specifying a particular value for both the **duplex** and **speed** commands, autonegotiation is disabled over the link for this interface. Therefore, the capabilities of the interface are not advertised.

```
! Enter global configuration mode
!
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface fastethernet 2/1/1
!
! Disable autonegotiation of the speed
! Force 100 Mbps speed
!
Router(config-if)# speed 100
!
! Disable autonegotiation of the duplex mode
! Force full-duplex mode
!
Router(config-if)# duplex full
```

Disabling Autonegotiation on Fiber Interfaces Configuration Example

The following example disables autonegotiation on fiber interface port 0 (the first port) of the SPA located in the bottom subslot (1) of the MSC that is installed in slot 4 of the Cisco 7304 router.

The interface does not advertise duplex mode, speed, or flow control, but sets its configuration for full-duplex mode and 1000-Mbps speed.

```
! Enter global configuration mode
!
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface gigabitethernet 4/1/0
!
! Configure the interface for fiber media
!
Router(config-if)# media-type gbic
!
! Disable autonegotiation on a fiber interface
!
Router(config-if)# no negotiation auto
```

Enabling Autonegotiation on Fiber Interfaces Configuration Example

The following example enables autonegotiation on fiber interface port 0 (the first port) of the SPA located in the bottom subslot (1) of the MSC that is installed in slot 4 of the Cisco 7304 router.

The interface advertises full-duplex mode, 1000-Mbps speed, and flow control.

```
! Enter global configuration mode
!
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface gigabitethernet 4/1/0
!
! Configure the interface for fiber media
!
Router(config-if)# media-type gbic
!
! Disable autonegotiation on a fiber interface
!
Router(config-if)# negotiation auto
```

CHAPTER 5

Upgrading Field-Programmable Devices

In general terms, field-programmable devices (FPDs) are hardware devices implemented on router cards that support separate software upgrades. A field-programmable gate array (FPGA) is a type of programmable memory device that exists on most hardware components of a Cisco 7304 router. The term "FPD" has been introduced to collectively and generically describe any type of programmable hardware device on SPAs, including FPGAs. Cisco IOS Release 12.2(20)S2 introduces the Cisco FPD upgrade feature to manage the upgrade of FPD images on SPAs only. This feature does not upgrade images on an MSC.

This chapter describes the difference between upgrading FPGA versions on MSCs versus SPAs, and the information that you need to know to verify image versions and to perform an upgrade for MSC FPGA images and FPD images when incompatibilities arise.

This chapter includes the following sections:

Release History

Table 5-1 provides the release and modification history for all FPD-related features on the Cisco 7304 router.

Table 5-1f Release History

Release	Modification
Cisco IOS Release 12.2(25)S3	The following FPD-related changes were introduced: • By default, the SPA used to automatically reload before and after a manual FPD upgrade. This behavior was changed. By default, the SPA is no longer reloaded automatically before and after a manual FPD upgrade. • The **force** option was removed from the **hw-module subslot** *slot*/*subslot* **file** *file-url* **force** command and replaced by the **reload** option. With the **reload** option, the user now has the option of reloading or not reloading after an FPD upgrade. • The output of the **show upgrade fpd file** *file-url* command was changed to only display brief versioning information. The output generated from this command in previous Cisco IOS releases can still be generated in this release by entering the **show upgrade fpd** *file-url* **detail** command. • The multiple periods (“.....”) used to show an FPD procedure is being processed are no longer used starting with this release.
Cisco IOS Release 12.2(20)S6	The **show upgrade** commands used to monitor FPD behavior (**show upgrade file**, **show upgrade package default**, **show upgrade progress**, and **show upgrade table**) have been changed to add the **fpd** keyword. The output previously generated with the aforementioned commands can now be generated by entering the appropriate **show upgrade fpd** command (**show upgrade fpd file**, **show upgrade fpd package default**, **show upgrade fpd progress**, and **show upgrade fpd table**).
Cisco IOS Release 12.2(20)S2	SPAs and MSCs were introduced, as was the FPD upgrade process and all functions and features related to FPD.

SPA FPD Quick Upgrade

This section provides information if you simply want to upgrade FPD for SPAs as quickly as possible. These instructions are not always feasible for operating network environments and are not the only methods available for upgrading FPD. If you need more information on FPD upgrades, see the various other sections of this document for detailed information related to FPD upgrades.

This section addresses the following topics:

- FPD Quick Upgrade Before Upgrading your Cisco IOS Release (Recommended), page 5-3
- FPD Quick Upgrade After Upgrading your Cisco IOS Release, page 5-3

FPD Quick Upgrade Before Upgrading your Cisco IOS Release (Recommended)

Step 1 When getting your Cisco IOS image, download the FPD image package for the Cisco IOS release that you are upgrading to to the disk0: Flash disk before booting the new version of Cisco IOS. The FPD image package can be retrieved from the same site where you go to get your Cisco IOS image.

Step 2 Boot using the new version of Cisco IOS. When the new Cisco IOS boots, it by defaults searches for the FPD image package in disk0: and the FPD images will be updated automatically as part of the IOS boot process.

FPD Quick Upgrade After Upgrading your Cisco IOS Release

Step 1 Go to the cisco.com site where you downloaded your specific Cisco IOS software and locate the FPD image package, if you haven't already.

Step 2 Download this FPD image package to disk0:.

Do not change any FPD-related settings on your system (if **upgrade fpd auto** or **upgrade fpd path** has been changed, change the settings back to the default settings using the **no** form of the command). Reboot your Cisco IOS release software. When the new Cisco IOS boots, it by defaults searches for the FPD image package in disk0: and the FPD images will be updated automatically as part of the IOS boot process.

Overview of MSC FPGA Image and SPA FPD Image Upgrade Support

FPGA versions must be compatible with the Cisco IOS software that is running on the router; if an incompatibility exists between an FPGA version and the Cisco IOS software release running the router, the device with the FPGA will not operate properly until the incompatibility is resolved.

The Cisco 7304 router supports upgrades for FPGA devices on its MSCs and SPAs, but uses different methods to upgrade those images:

- Cisco 7304 MSC-100—FPGA images are bundled with the Cisco IOS software, like the FPGA bundles for other Cisco 7304 router hardware. The MSC-100 supports automatic upgrades only for its FPGA device.
- Shared Port Adapters—FPGA software upgrades are part of an FPD image package that corresponds to a Cisco IOS software release. The SPA supports automatic and manual upgrades for its FPGA device using the Cisco FPD upgrade feature that is further described in this chapter.

Overview of SPA FPD Images and Packages

An FPD image package is used to upgrade FPD images. Whenever a Cisco IOS image is released that supports SPAs, a companion SPA FPD image package is also released for that Cisco IOS software release. The SPA FPD image package is available from Cisco.com and is accessible from the Cisco Software Center page where you also go to download your Cisco IOS software image.

If you are running SPAs on your router and are upgrading your Cisco IOS image, you should download the FPD image package file before booting the router using the new Cisco IOS release. If the SPA requires an FPD upgrade and the Cisco IOS image is unable to locate an FPD image package, the system messages will indicate that the FPD image is incompatible and you will need to go to the Cisco Software Center on Cisco.com to download the FPD image package for your Cisco IOS software release.

Note The FPD automatic upgrade feature only searches for the FPD image package file that is the same version number as the Cisco IOS release being used by the system. For example, if the Cisco IOS release being used is Cisco IOS Release 12.2(20)S2, then the system will search for the FPD image package file that supports the specific Cisco IOS release (spa_fpd.122-20.S2.pkg). Therefore, ensure the FPD image package file on your system is compatible with your Cisco IOS release and do not change the name of the FPD image package file.

Upgrading MSC FPGA Images

On the Cisco 7304 router, automatic FPGA version checking and updating is performed during every system startup for all line cards, NSEs, NPEs, MSCs, and the 7300-CC-PA in the system. However, the Cisco 7304 MSC-100 FPGA version cannot be updated manually.

For more information about FPGA upgrade processes that apply to the Cisco 7304 MSC-100, refer to the *Cisco 7304 FPGA Bundling and Update* document at the URL:

http://www.cisco.com/univercd/cc/td/doc/product/software/ios121/121newft/121limit/121ex/121ex10/73fpga.htm

Verifying the FPGA Version on an MSC

To verify FPGA version information on MSCs, you can use the following commands on the Cisco 7304 router:

- **show diag**—Displays current software and hardware FPGA versions for MSCs and SPAs.
- **show c7300**—Displays FPGA status for NPEs, NSEs, line cards, and MSCs.

Verifying Current FPGA Versions Using the show diag Command

To verify the FPGA version on the Cisco 7304 MSC-100 and on all of the SPAs in its subslots, use the **show diag** command and specify only the slot number of the MSC.

The following example shows output from the **show diag** command for a Cisco 7304 MSC-100 located in slot number 4 and a 4-Port 10/100 Fast Ethernet SPA located in subslot 0. The FPGA version information appears at the end of the output for each card:

```
Router# show diag 4
Slot 4:
```

```
        7304-MSC-100 SPA Carrier Card Line Card
        Line Card state: Active
        Insertion time: 2d19h ago
        Bandwidth points: 400000
        EEPROM contents at hardware discovery:
        Hardware Revision         : 0.18
        Boot Time out             : 0000
        PCB Serial Number         : CSJ0714YZC8
        Part Number               : 73-8789-01
        Board Revision            : A0
        Fab Version               : 02
        RMA Test History          : 00
        RMA Number                : 0-0-0-0
        RMA History               : 00
        Deviation Number          : 0-0
        Product Number            : 7304-MSC-100
        Top Assy. Part Number     : 68-1163-04
        Manufacturing Test Data   : 00 00 00 00 00 00 00 00
        Field Diagnostics Data    : 00 00 00 00 00 00 00 00
        Calibration Data          : Minimum: 0 dBmV, Maximum: 0 dBmV
              Calibration values :
        EEPROM format version 4
.
.
.
        FPGA information:
          Current FPGA version     : 00.23
          IOS bundled FPGA version : 00.23
        CPLD version      : 01.02

Subslot 4/0:
        Shared port adapter: SPA-4FE-7304, 4 ports
        Info: hw-ver=0x100, sw-ver=0x0 fpga-ver=0x0
        State: ok
        Insertion time: 23:17:47 ago
        Bandwidth: 400000 kbps
        EEPROM contents:
        Hardware Revision         : 1.0
        Boot Time out             : 0190
        PCB Serial Number         : JAB073204G5
        Part Number               : 73-8717-03
        73/68 Level Revision      : 01
        Fab Version               : 02
        RMA Test History          : 00
        RMA Number                : 0-0-0-0
        RMA History               : 00
        Deviation Number          : 0
        Product Number            : SPA-4FE-7304
        Product Version Id        : V01
        Top Assy. Part Number     : 68-2181-01
        73/68 Level Revision      : A0
        CLEI Code                 : CNS9420AAA
        Base MAC Address          : 0000.0000.0000
        MAC Address block size    : 1024
.
.
.
        FPGA version:
          Software version : 04.17
          Hardware version : 04.17

Subslot 4/1: Empty subslot
```

Verifying Current FPGA Versions Using the show c7300 Command

You can also use the **show c7300** command to verify the FPGA status for all of the NPEs, NSEs, line cards, and MSCs on the Cisco 7304 router. The following example shows that all FPGAs are current for the NSE-100 and the Cisco 7304 MSC-100 cards in slots 0 through 5:

```
Router# show c7300
Slot      Card Type           Status          Insertion time
----      ---------           ------          --------------
0,1       NSE100              Active          00:45:29 ago
2         7304-MSC-100        Active          00:44:36 ago
3         7304-MSC-100        Active          00:44:36 ago
4         7304-MSC-100        Active          00:44:36 ago
5         7304-MSC-100        Active          00:14:39 ago

The FPGA versions for the cards listed above are current
.
.
```

Upgrading SPA FPD Images

This section documents some of the common scenarios where FPD image updates are necessary. It discusses the following scenarios:

- Migrating to a Newer Cisco IOS Release, page 5-6
- Upgrading FPD Images for SPAs in a Production System, page 5-8

Migrating to a Newer Cisco IOS Release

This section discusses the following topics:

- Upgrading FPD Images Before Booting the New Cisco IOS Release (Recommended), page 5-6
- Upgrading FPD Images for SPAs in a Production System, page 5-8

Upgrading FPD Images Before Booting the New Cisco IOS Release (Recommended)

If you are still running your old Cisco IOS Release but are preparing to load a newer version of Cisco IOS, you can upgrade FPD for the new Cisco IOS Release one of the following ways:

- Placing FPD Image Package on Flash Disk Before Upgrading IOS (Recommended), page 5-6
- Online FPD Upgrade, page 5-7

Placing FPD Image Package on Flash Disk Before Upgrading IOS (Recommended)

Placing the FPD image package for the IOS release that you are upgrading to before upgrading IOS is the recommended method for upgrading FPD because it is the simple in addition to being fast. To perform this type of FPD upgrade, follow these steps:

Step 1 While still running the Cisco IOS release that will be upgraded, place the FPD image package for the new version of Cisco IOS onto disk0:. For instance, if you are running Cisco IOS Release 12.2(20)S5 and are upgrading to Cisco IOS Release 12.2(25)S3, place the FPD image package for Cisco IOS Release 12.2(25)S3 onto disk0: while still running Cisco IOS Release 12.2(20)S5. The FPD image package for a specific IOS release can be located on cisco.com from the same area where you download that Cisco IOS software image. Your router and SPAs should continue to operate normally since this action will have no impact on the current SPA FPDs.

Caution Do not change the filename of the FPD image package file. The Cisco IOS searches for the FPD image package file by filename, so the FPD image package file cannot be found if it has been renamed.

Step 2 Reboot your router using the new upgraded Cisco IOS image. As part of the bootup process, the router will search for the FPD image package. Since the default settings for the FPD image package search are to check for the FPD image package for the specific Cisco IOS Release in disk0:, the FPD image package will be located during the bootup procedure and all SPA FPDs that required upgrades will be upgraded.

Step 3 When the router has booted, verify the upgrade was successful by entering the **show hw-module subslot fpd** command.

Online FPD Upgrade

Note The Online FPD Upgrade was introduced in Cisco IOS Release 12.2(25)S3. The method of FPD upgrade cannot be used on routers running pre-Cisco IOS Release 12.2(25)S3 software.

The online FPD upgrade allows users to upgrade FPD before a Cisco IOS release without having to reload the router. The online FPD upgrade is the fastest method of upgrading FPD and will keep the system online for the duration of the upgrade, but it is more complicated than the offline FPD upgrade. If you are not familiar with the FPD upgrade procedure, we recommend using the instructions in the "Placing FPD Image Package on Flash Disk Before Upgrading IOS (Recommended)" section on page 5-6 to perform the FPD upgrade.

To perform an online FPD upgrade, follow these steps:

Step 1 While still running the Cisco IOS release that will be upgraded, place the FPD image package for the new version of Cisco IOS onto the router's Flash Disk or on an accessible FTP or TFTP server. The FPD image package can be located on cisco.com from the same area where you download your Cisco IOS software image.

Step 2 Before proceeding, be aware of the following issues:

- If you enter the **upgrade hw-module subslot** command as specified in Step 3 and then need to reload the router using the non-upgraded IOS release for any reason, the SPA FPD information will be corrupted and a SPA FPD upgrade will need to be performed to restore FPD compatibility on these SPAs. Other router events, such as router reloads or SPA OIRs, will also have this effect. If you are going to use this method to perform an FPD upgrade, we strongly recommend entering the **upgrade hw-module subslot** command to make the upgrade as close to the time of the IOS upgrade as possible to avoid any potential complications.
- Do not use the **reload** option with the **upgrade hw-module subslot** command to perform an online upgrade.

Step 3 Before upgrading the Cisco IOS image, enter the **upgrade hw-module subslot** *file-url* command. The *file-url* command should direct users to the location of the FPD image package. For instance, if you had placed the FPD image package for Release 12.2(25)S3 on the TFTP server abrick/muck/myfolder, you would enter **upgrade hw-module subslot tftp://abrick/muck/myfolder/c7304-fpd.122-25.S3.pkg** to complete this step.

Step 4 Upgrade IOS on the router. When IOS is upgraded, FPD will be upgraded with minimal time needed to complete the upgrade.

Step 5 Verify the upgrade was successful by entering the **show hw-module subslot fpd** command.

Upgrade FPD Images after Booting the New Cisco IOS Release

The following steps explain how to upgrade FPD images if you have already upgraded your Cisco IOS release but haven't upgraded your FPD images.

To perform an FPD upgrade after the new Cisco release has been booted, follow these steps:

Step 1 If you are unsure if your FPD images are compatible with the SPAs in your carrier card, enter the **show hw-module subslot fpd** command.

Step 2 If an FPD upgrade is necessary, place the FPD image package for the new version of Cisco IOS onto the router's Flash Disk or on an accessible FTP or TFTP server. The FPD image package can be located on cisco.com from the same area where you downloaded your Cisco IOS software image.

Step 3 Enter the **upgrade hw-module subslot** *file-url* **reload** command. The *file-url* command should direct users to the location of the FPD image package. For instance, if you had placed the FPD image package for Release 12.2(25)S3 on the TFTP server abrick/muck/myfolder, you would enter **upgrade hw-module subslot tftp://abrick/muck/myfolder/c7304-fpd.122-25.S3.pkg** to complete this step.

Note that the **reload** option is used in this command. When this option is used the SPA will automatically be reloaded to complete the FPD upgrade.

Step 4 Verify the upgrade was successful by entering the **show hw-module subslot fpd** command.

Upgrading FPD Images for SPAs in a Production System

Adding a SPA to a production system presents the risk that the SPA may contain versions of FPD images that are incompatible with the Cisco IOS release currently running the router. In addition, the FPD upgrade operation is a very CPU-intensive operation and therefore the upgrade operation may take more time when it is performed on a production system. The performance impact will vary depending on various factors, including network traffic load, the type of processing engine used, and the type of service configured.

Because of the potential complications, we highly recommend that one of the following alternatives be used to perform the FPD upgrade on a production system if possible:

- Using a Non-Production System to Upgrade the SPA FPD Image, page 5-9
- Verifying System Compatibility First, page 5-9

Using a Non-Production System to Upgrade the SPA FPD Image

Before beginning the upgrade, ensure:

- The spare system is running the same version of the Cisco IOS software release that the target production system is running.
- The automatic upgrade feature is enabled on the spare system (the automatic upgrade feature is enabled by default. It can also be enabled using the **upgrade fpd auto** command).

Use the following procedure to perform an upgrade on a spare system:

Step 1 Download the FPD image package file to the router's flash file system or TFTP or FTP server accessible by the spare system. In most cases, it is preferable to place the file in disk0: since the router, by default, searches for the FPD image package in disk0:. If disk0: is full, use the **upgrade fpd path** command to direct the router to search for the FPD image package in the proper location.

Step 2 Insert the SPA into the spare system.

If an upgrade is required, the system will perform the necessary FPD image updates so that when this SPA is inserted to the target production system it will not trigger an FPD upgrade operation there.

Step 3 Remove the SPA from the spare system after the upgrade.

Step 4 Insert the SPA into the target production system.

Verifying System Compatibility First

If a spare system is not available to perform an upgrade, you can check for system compatibility by disabling the automatic upgrade feature before inserting the SPA.

- If the FPD images on the SPA are compatible with the system, you will only need to re-enable the automatic upgrade feature.
- If the FPD images on the SPA are not compatible with the system, the SPA is disabled but will not impact system performance by attempting to perform an automatic upgrade.

Use the following procedure to check the FPD images on the SPA for system compatibility:

Step 1 Disable the automatic upgrade feature using the **no upgrade fpd auto** global configuration command.

Step 2 Insert the SPA into the system.

If the FPD images are compatible, the SPA is up and running.

If the FPD images are not compatible, the SPA is disabled. At this point we recommend that you wait for a scheduled maintenance when the system is offline to manually perform the FPD upgrade using the **upgrade hw-module subslot** privileged EXEC command.

Step 3 Re-enable the automatic upgrade feature using the **upgrade fpd auto** global configuration command.

Optional FPD Procedures

This section provides information for optional FPD-related functions. None of the topics discussed in this section are necessary for completing FPD upgrades, but may be useful in some FPD-related scenarios. It covers the following topics:

- Manually Upgrading SPA FPD Images, page 5-10
- Upgrading FPD From an FTP or TFTP Server, page 5-10
- Modifying the Default Path for the FPD Image Package File Location, page 5-12
- Displaying Current and Minimum Required FPD Image Versions, page 5-13
- Displaying Information About the Default FPD Image Package, page 5-14
- Verifying the FPD Image Upgrade Progress, page 5-14

Manually Upgrading SPA FPD Images

To manually upgrade the current FPD version on a SPA card, use the following command:

```
Router# upgrade hw-module subslot slot-number/subslot-number file file-url [reload]
```

In this example, *slot-number* is the slot where the MSC is installed, *subslot-number* is the subslot number where the SPA is located, *file-url* is the location and name of the FPD image package file, and **reload** reloads the SPA to complete the FPD upgrade. By default, the SPA will not be reloaded to complete the FPD upgrade unless the **reload** option is entered. Reloading the SPA drops all traffic traversing that SPA's interfaces. If you would like to reload the SPA later to complete the upgrade, do not enter the reload option and OIR the SPA later to complete the FPD upgrade.

Note The default behavior for SPA automatic upgrades was changed in Cisco IOS Release 12.2(25)S3. If you are using a release prior to Release 12.2(25)S3, your SPA will automatically be reloaded after every FPD upgrade.
The **force** option was also removed in Release 12.2(25)S3 because it was no longer needed with the new behavior for this command.

Caution An image upgrade can require a long period of time to complete depending on the SPA.

Upgrading FPD From an FTP or TFTP Server

The generally recommended method to perform an FPD image upgrade is to download the FPD image package to Flash disk0: and use the FPD automatic upgrade. By default, the system searches disk0: for the FPD image package file when an FPD incompatibility is detected.

This default behavior of loading an FPD image from Flash can be changed using the **upgrade fpd path** global configuration command, which sets the path to search for the FPD image package file to a location other than the router's default Flash location.

For large deployments where all the systems are being upgraded to a specific Cisco IOS software release, we recommend that the FPD image package file be placed on an FTP or TFTP server that is accessible to all the affected systems, and then use the **upgrade fpd path** global configuration command to configure the routers to look for the FPD image package file from the FTP or TFTP server prior to the reloading of the system with the new Cisco IOS release.

Note This approach can also be used if there is not enough disk space on the system Flash card to hold the FPD image package file.

To download an FPD image package file to an FTP or TFTP server, use the following procedure:

Step 1 Copy the FPD image package file to the FTP or TFTP server.

Step 2 Access the router from a connection that does not use the SPA interface for access, if possible. We recommend not using the SPA interface as your connection to the router because an FPD incompatibility disables all interfaces on the SPA, making a manual FPD upgrade impossible through a SPA interface. If access through one of the SPA ports is the only access to the router you have, do not use the TFTP or FTP upgrade method. Instead, copy the FPD image package to your router's default Flash card before upgrading your Cisco IOS Release. This will allow the router to find the FPD image package during the first IOS bootup and upgrade FPD automatically.

Step 3 From global configuration mode, use the **upgrade fpd path** command to instruct the router to locate the FPD image package file from the FTP or TFTP server location.

For example, enter one of the following global configuration commands from the target system's console:

```
Router(config)# upgrade fpd path tftp://my_tftpserver/fpd_pkg_dir/
```

or

```
Router(config)# upgrade fpd path ftp://login:password@my_ftpserver/fpd_pkg_dir/
```

In these examples, *my_tftpserver* or *my_ftpserver* is the path to server name, *fpd_pkg_dir* is the directory on the TFTP server where the FPD image package is located, and *login:password* is your FTP login name and password.

Step 4 Make sure that the FPD automatic upgrade feature is enabled by examining the output of the **show running-config** command (look for the *upgrade fpd auto* configuration line in the output. If there are no upgrade commands in the output, then **upgrade fpd auto** is enabled because it is the default setting.) If automatic upgrades are disabled, use the **upgrade fpd auto** global configuration command to enable automatic FPD upgrades.

Step 5 Enter the **show upgrade fpd file** command to ensure your router is connecting properly to the default FPD image package. If you are able to generate output related to the FPD image package using this command, the upgrade should work properly.
In the following example, the router is able to generate FPD image package information for the FPD image package on the TFTP server.

```
Router# show upgrade fpd file tftp://mytftpserver/myname/myfpdpkg/c7304-fpd.122-25.S3.pkg
Loading myname/myfpdpkg/c7304-fpd.122-25.S3.pkg from 223.255.254.254 (via FastEthernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 1740288 bytes]

Cisco Field Programmable Device Image Package for IOS
C7304 FPD Image Package (c7304-fpd-pkg.122.pkg), Version 12.2(20050304:175718)
Copyright (c) 2004-2005 by cisco Systems, Inc.
Built Fri 04-Mar-2005 09:57 by yega


=============================== ================================================
                                        Bundled FPD Image Version Matrix
                                ================================================
```

```
                                                                   Min. Req.
Supported Card Types            ID  Image Name               Version  H/W Ver.
=============================== == ======================== ========= =========
4-port FastEthernet SPA          1 4xFE/2xGE SPA Data & I/O     4.18      0.0
------------------------------- -- ------------------------ --------- ---------
2-port GigabitEthernet SPA       1 4xFE/2xGE SPA Data & I/O     4.18      0.0
------------------------------- -- ------------------------ --------- ---------
2-port OC3 POS SPA               1 POS SPA IOFPGA P1            3.4       0.0
                                 1 POS SPA IOFPGA P2            3.4       0.200
------------------------------- -- ------------------------ --------- ---------
4-port OC3 POS SPA               1 POS SPA IOFPGA P1            3.4       0.0
                                 1 POS SPA IOFPGA P2            3.4       0.200
------------------------------- -- ------------------------ --------- ---------
1-port OC12 POS SPA              1 POS SPA IOFPGA P1            3.4       0.0
                                 1 POS SPA IOFPGA P2            3.4       0.200
------------------------------- -- ------------------------ --------- ---------
2-port OC12 POS SPA              1 POS SPA IOFPGA P1            3.4       0.0
                                 1 POS SPA IOFPGA P2            3.4       0.200
------------------------------- -- ------------------------ --------- ---------
2-port T3/E3 Serial SPA          1 T3E3 SPA ROMMON              2.12      0.0
                                 2 T3E3 SPA I/O FPGA            0.24      0.0
                                 3 T3E3 SPA E3 FPGA             0.6       0.0
                                 4 T3E3 SPA T3 FPGA             0.14      0.0
------------------------------- -- ------------------------ --------- ---------
4-port T3/E3 Serial SPA          1 T3E3 SPA ROMMON              2.12      0.0
                                 2 T3E3 SPA I/O FPGA            0.24      0.0
                                 3 T3E3 SPA E3 FPGA             0.6       0.0
                                 4 T3E3 SPA T3 FPGA             0.14      0.0
=============================== ================================================
```

Step 6 Save the configuration and reload the system with the new Cisco IOS release.

During the system startup after the reload, the necessary FPD image version check for all the SPAs will be performed and any upgrade operation will occur automatically if an upgrade is required. In each upgrade operation, the system extracts the necessary FPD images to the SPA from the FPD image package file located on the FTP or TFTP server.

Modifying the Default Path for the FPD Image Package File Location

By default, the Cisco IOS software looks for the FPD image package file on disk0: when performing an automatic FPD image upgrade.

Note Be sure there is enough space on disk0: to accommodate the FPD image package file.

Alternatively, you can store an FPD image package file in another file system. However, because the system looks on disk0: as the default, you need to change the FPD image package file location so that the system is directed to search the alternate location (such as in another file system on the router, or on an FTP or TFTP server) accessible by the Cisco IOS software, enter the **upgrade fpd path** *fpd-pkg-dir-url* global configuration command, where *fpd-pkg-dir-url* is the alternate location.

If the **upgrade fpd path** global configuration command has not been entered to direct the router to locate an FPD image package file in an alternate location, the system searches disk0: on the Cisco 7304 router for the FPD image package file.

Failure to locate an FPD image package file when an upgrade is required will disable the SPA. Because SPAs will not come online until FPD is compatible, the SPA will also be disabled if it requires an FPD upgrade and the automatic upgrade feature is disabled.

Displaying Current and Minimum Required FPD Image Versions

To display the current version of FPD images on the SPAs installed on your router, use the **show hw-module subslot** [*slot-number*/*subslot-number*] **fpd** command, where *slot-number* is the slot number where the MSC is installed, and *subslot-number* is the number of the MSC subslot where the target SPA is located.

Note This command can be used to identify information about FPDs on any SPA. If you enter the location of a line card that is not a SPA, the output displays information about any programmable devices on that line card.

The following examples show the output when using this **show** command.

The output display in this example shows that FPD versions on the SPAs in the system meet the minimum requirements:

```
Router# show hw-module subslot fpd

==== ====================== ====== =============================================
                             H/W   Field Programmable   Current   Min. Required
Slot Card Description        Ver.  Device:"ID-Name"     Version      Version
==== ====================== ====== ================== =========== ==============
 2/0 SPA-4FE-7304            0.32  1-Data & I/O FPGA      4.13        4.13
---- ---------------------- ------ ------------------ ----------- --------------
 2/1 SPA-2GE-7304            0.15  1-Data & I/O FPGA      4.13        4.13
==== ====================== ====== =============================================
```

This example shows the output when using the *slot-number*/*subslot-number* argument to identify a particular SPA:

```
Router# show hw-module subslot 2/1 fpd

==== ====================== ====== =============================================
                             H/W   Field Programmable   Current   Min. Required
Slot Card Description        Ver.  Device:"ID-Name"     Version      Version
==== ====================== ====== ================== =========== ==============
 2/1 SPA-2GE-7304            0.15  1-Data & I/O FPGA      4.13        4.13
==== ====================== ====== =============================================
```

The output display in this example shows that the SPA in slot 2/0 is disabled because one of the programmable devices on the SPA does not meet the minimum version requirements. The output also contains a “NOTES” section that provides the name of the FPD image package file needed to upgrade the disabled SPA’s FPD image.

```
Router# show hw-module subslot fpd

==== ====================== ====== =============================================
                             H/W   Field Programmable   Current   Min. Required
Slot Card Description        Ver.  Device:"ID-Name"     Version      Version
==== ====================== ====== ================== =========== ==============
 2/0 SPA-4FE-... <DISABLED>  0.32  1-Data & I/O FPGA      4.12        4.13    *
---- ---------------------- ------ ------------------ ----------- --------------
 2/1 SPA-2GE-7304            0.15  1-Data & I/O FPGA      4.13        4.13
==== ====================== ====== =============================================
 NOTES:
```

```
- FPD images that are required to be upgraded are indicated with a '*'
  character in the "Minimal Required Version" field.
- The following FPD image package files is required for the upgrade:
  "spa_fpd.122-20.S2.pkg"
```

Displaying Information About the Default FPD Image Package

You can use the **show upgrade fpd package default** command to find out which SPAs are supported with your current Cisco IOS release and which FPD image package you need for an automatic upgrade.

Note In Cisco IOS Releases 12.2(20)S2 through 12.2(20)S5, the **show upgrade fpd package default** command is not available. In these releases, enter the **show upgrade package default** command to gather this output.

```
Router# show upgrade fpd package default

*************************************************************************
This IOS release supports the following default FPD Image Package(s) for
automatic upgrade:
*************************************************************************

SPA FPD Image Package:spa_fpd.122-20.S6.pkg

        List of SPAs supported in this package:

                                        Minimal
                 No. SPA Name           HW Ver.
                ---- ----------------- -------
                  1) SPA-4FE-7304         0.0
                  2) SPA-2GE-7304         0.0
                ---- ----------------- -------
```

Verifying the FPD Image Upgrade Progress

You can use the **show upgrade fpd progress** command to view a “snapshot” of the upgrade progress while an FPD image upgrade is taking place. The following example shows the type of information this command displays:

Note In Cisco IOS Releases 12.2(20)S2 through 12.2(20)S5, the **show upgrade fpd progress** command is not available. In these releases, enter the **show upgrade progress** command to gather this output.

```
Router# show upgrade fpd progress

FPD Image Upgrade Progress Table:

 ==== =================== ====================================================
                          Field Programmable    Time
 Slot Card Description    Device :"ID-Name"    Needed   Time Left  State
 ==== =================== ================== ========= ========= ===========
  2/0 SPA-2GE-7304        1-4FE/2GE FPGA      00:06:00   00:05:17  Updating...
 ---- ------------------- ------------------ ----------- --------- -----------
```

```
 2/1 SPA-4FE-7304        1-4FE/2GE FPGA      --:--:--   --:--:--  Waiting...
==== ================== ====================================================
```

FPD Image Upgrade Examples

This section provides examples of automatic and manual FPD image upgrades. It includes the following examples:

- System Cannot Locate FPD Image Package File for an Automatic FPD Image Upgrade Example, page 5-15
- Automatic FPD Image Upgrade Example, page 5-15
- Downloading the FPD Image Package from a TFTP Server and Automatic FPD Image Upgrade from Flash Example, page 5-16
- Incompatible FPD Image Version Detection and Disabled Automatic FPD Image Upgrade Example, page 5-18
- Manual FPD Image Upgrade Example, page 5-19

System Cannot Locate FPD Image Package File for an Automatic FPD Image Upgrade Example

The following example displays the output when a SPA requires an FPD upgrade and the **upgrade fpd auto** command is *enabled*, but the system cannot find the FPD image package file.

```
*Jan 13 22:36:56:%FPD_MGMT-3-INCOMP_FPD_VER:Incompatible 4FE/2GE FPGA (FPD ID=1) image
version detected for SPA-4FE-7304 card in subslot 2/0. Detected version = 4.12, minimal
required version = 4.13. Current HW version = 0.32.
*Jan 13 22:36:56:%FPD_MGMT-5-FPD_UPGRADE_ATTEMPT:Attempting to automatically upgrade the
FPD image(s) for SPA-4FE-7304 card in subslot 2/0 ...
*Jan 13 22:36:56:%FPD_MGMT-6-BUNDLE_DOWNLOAD:Downloading FPD image bundle for SPA-4FE-7304
card in subslot 2/0 ...
*Jan 13 22:36:56:%FPD_MGMT-3-OPEN_FAILED:Failed to open disk0:/spa_fpd.122-20.S2.pkg (File
not found). Please make sure that the required file is in a valid path.
*Jan 13 22:36:56:%FPD_MGMT-5-CARD_DISABLED:SPA-4FE-7304 card in subslot 2/0 is being
disabled because of incompatible FPD image version. Note that the spa_fpd.122-20.S2.pkg
package will be required if you want to perform the upgrade operation with the "upgrade
hw-module ..." command.
```

Automatic FPD Image Upgrade Example

The following example shows the output displayed when a SPA requires an FPD image upgrade and the **upgrade fpd auto** command is *enabled*. The required FPD image is automatically upgraded.

```
% Uncompressing the bundle ...  [OK]
*Jan 13 22:38:47:%FPD_MGMT-3-INCOMP_FPD_VER:Incompatible 4FE/2GE FPGA (FPD ID=1) image
version detected for SPA-4FE-7304 card in subslot 2/0. Detected version = 4.12, minimal
required version = 4.13. Current HW version = 0.32.
*Jan 13 22:38:47:%FPD_MGMT-5-FPD_UPGRADE_ATTEMPT:Attempting to automatically upgrade the
FPD image(s) for SPA-4FE-7304 card in subslot 2/0 ...

*Jan 13 22:38:47:%FPD_MGMT-6-BUNDLE_DOWNLOAD:Downloading FPD image bundle for SPA-4FE-7304
card in subslot 2/0 ...
*Jan 13 22:38:49:%FPD_MGMT-6-FPD_UPGRADE_TIME:Estimated total FPD image upgrade time for
SPA-4FE-7304 card in subslot 2/0 = 00:06:00.
```

```
*Jan 13 22:38:49:%FPD_MGMT-6-FPD_UPGRADE_START:4FE/2GE FPGA (FPD ID=1) image upgrade in
progress for SPA-4FE-7304 card in subslot 2/0. Updating to version 4.13. PLEASE DO NOT
INTERRUPT DURING THE UPGRADE PROCESS (estimated upgrade completion time = 00:06:00)
...[...............................................................................
(part of the output has been removed for brevity)
..........................................................................................
..........................................................................................
........]
SUCCESS - Completed XSVF execution.

*Jan 13 22:44:33:%FPD_MGMT-6-FPD_UPGRADE_PASSED:4FE/2GE FPGA (FPD ID=1) image upgrade for
SPA-4FE-7304 card in subslot 2/0 has PASSED. Upgrading time = 00:05:44.108
*Jan 13 22:44:33:%FPD_MGMT-6-OVERALL_FPD_UPGRADE:All the attempts to upgrade the required
FPD images have been completed for SPA-4FE-7304 card in subslot 2/0. Number of
successful/failure upgrade(s):1/0.
*Jan 13 22:44:33:%FPD_MGMT-5-CARD_POWER_CYCLE:SPA-4FE-7304 card in subslot 2/0 is being
power cycled for the FPD image upgrade to take effect.
```

Downloading the FPD Image Package from a TFTP Server and Automatic FPD Image Upgrade from Flash Example

In the following example, a Cisco IOS image (c7300-js-mz.122-20.S2.bin) and the FPD image package file that supports that particular Cisco IOS image (spa-fpd.122-20.S2.pkg) are loaded onto disk0: from a TFTP server. The router is then configured to boot using the new Cisco IOS image and reloaded. When the router reboots using the new Cisco IOS image, the FPD version check that occurs at bootup detects the FPD incompatibility and then initiates the FPD image upgrade process. The FPD image is then upgraded automatically. After the system messages indicate that the FPD upgrade was successful, the **show hw-module subslot fpd** command is entered to verify the procedure. The FPD messages are italicized in this example for emphasis.

```
Router# copy tftp://hostname/path/c7300-js-mz.122-20.S2.bin disk0:
Destination filename [c7300-js-mz.122-20.S2.bin]?
Accessing tftp://hostname/path/c7300-js-mz.122-20.S2.bin...
Loading path/c7300-js-mz.122-20.S2.bin from 223.255.254.254 (via
FastEthernet0):!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 22870596 bytes]

22870596 bytes copied in 133.476 secs (171346 bytes/sec)

Router# copy tftp://hostname/path/spa-fpd.122-20.S2.pkg disk0:
Destination filename [spa-fpd.122-20.S2.pkg]?
Accessing tftp://hostname/path/spa-fpd.122-20.S2.pkg...
Loading path/spa-fpd.122-20.S2.pkg from 223.255.254.254 (via
FastEthernet0):!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 703488 bytes]

703488 bytes copied in 3.672 secs (191582 bytes/sec)

Router# dir disk0:
Directory of disk0:/

    1  -rw-    22802060   Jan 3 2004 15:13:30 -08:00  c7300-js-mz.122-20.S1.bin
    2  -rw-    22870596   Apr 2 2004 09:02:50 -08:00  c7300-js-mz.122-20.S2.bin
    3  -rw-      703488   Apr 2 2004 09:07:02 -08:00  spa-fpd.122-20.S2.pkg

63706112 bytes total (17329152 bytes free)
```

```
Router# config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# boot system disk0:c7300-js-mz.122-20.S2.bin
Router(config)# end
Router#
Apr  2 17:09:22:%SYS-5-CONFIG_I:Configured from console by console

Router# reload

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

 *Apr  2 17:52:04:%SYS-5-RELOAD:Reload requested by console. Reload Reason:Reload Command.
System Bootstrap, Version 12.1(12r)EX1, RELEASE SOFTWARE (fc1)
TAC Support:http://www.cisco.com/tac
Copyright (c) 2002 by cisco Systems, Inc.

C7300 platform with 524288 Kbytes of main memory

Currently running ROMMON from ROM 0

Self decompressing the image
:###########################################################################################
############################################################################################
###### [OK]

(Note:Some output removed for brevity)

Press RETURN to get started!


00:00:18:%LINK-5-CHANGED:Interface FastEthernet0, changed state to reset
00:00:18:%LINK-3-UPDOWN:Interface GigabitEthernet0/0, changed state to down
00:00:18:%LINK-3-UPDOWN:Interface GigabitEthernet0/1, changed state to down
00:00:22:%LINK-3-UPDOWN:Interface FastEthernet0, changed state to up
*Apr  2 17:53:35:%SYS-5-CONFIG_I:Configured from memory by console
*Apr  2 17:53:35:%LINEPROTO-5-UPDOWN:Line protocol on Interface FastEthernet0, changed
state to down
*Apr  2 17:53:36:%SYS-5-RESTART:System restarted --
Cisco Internetwork Operating System Software
IOS (tm) 7300 Software (C7300-JS-M), Version 12.2(20)S2,  RELEASE SOFTWARE (fc2)
Technical Support:http://www.cisco.com/techsupport
Copyright (c) 1986-2004 by cisco Systems, Inc.
Compiled Mon 15-Mar-04 16:54 by ccai
*Apr  2 17:53:36:%FPD_MGMT-3-INCOMP_FPD_VER:Incompatible Data & I/O FPGA (FPD ID=1) image
version detected for SPA-4FE-7304 card in subslot 2/0. Detected version = 4.13, minimum
required version = 4.17. Current HW version = 0.32.
*Apr  2 17:53:36:%FPD_MGMT-5-FPD_UPGRADE_ATTEMPT:Attempting to automatically upgrade the
FPD image(s) for SPA-4FE-7304 card in subslot 2/0 ...
*Apr  2 17:53:36:%FPD_MGMT-6-BUNDLE_DOWNLOAD:Downloading FPD image bundle for SPA-4FE-7304
card in subslot 2/0 ...
*Apr  2 17:53:36:%LINK-5-CHANGED:Interface GigabitEthernet0/1, changed state to
administratively down
*Apr  2 17:53:38:%LINK-3-UPDOWN:Interface FastEthernet0, changed state to down
*Apr  2 17:53:38:%LINK-5-CHANGED:Interface GigabitEthernet0/0, changed state to
administratively down
*Apr  2 17:53:38:%LINK-5-CHANGED:Interface FastEthernet2/0/0, changed state to
administratively down
*Apr  2 17:53:38:%LINK-5-CHANGED:Interface FastEthernet2/0/1, changed state to
administratively down
*Apr  2 17:53:38:%LINK-5-CHANGED:Interface FastEthernet2/0/2, changed state to
administratively down
```

```
*Apr  2 17:53:38:%LINK-5-CHANGED:Interface FastEthernet2/0/3, changed state to
administratively down
*Apr  2 17:53:38:%LINEPROTO-5-UPDOWN:Line protocol on Interface GigabitEthernet0/1,
changed state to down
*Apr  2 17:53:38:%WS_ALARM-6-INFO:ASSERT INFO Gi0/0 Physical Port Administrative State
Down
*Apr  2 17:53:38:%WS_ALARM-6-INFO:ASSERT INFO Gi0/1 Physical Port Administrative State
Down
*Apr  2 17:53:39:%SYS-6-BOOTTIME:Time taken to reboot after reload =   95 seconds
*Apr  2 17:53:39:%LINEPROTO-5-UPDOWN:Line protocol on Interface GigabitEthernet0/0,
changed state to down
*Apr  2 17:53:39:%LINEPROTO-5-UPDOWN:Line protocol on Interface FastEthernet2/0/0, changed
state to down
*Apr  2 17:53:39:%LINEPROTO-5-UPDOWN:Line protocol on Interface FastEthernet2/0/1, changed
state to down
*Apr  2 17:53:39:%LINEPROTO-5-UPDOWN:Line protocol on Interface FastEthernet2/0/2, changed
state to down
*Apr  2 17:53:39:%LINEPROTO-5-UPDOWN:Line protocol on Interface FastEthernet2/0/3, changed
state to down
*Apr  2 17:53:39:%WS_ALARM-6-INFO:ASSERT CRITICAL GBIC Slot 0/1 GBIC is missing
*Apr  2 17:53:40:%LINK-3-UPDOWN:Interface FastEthernet0, changed state to up
*Apr  2 17:53:41:%LINEPROTO-5-UPDOWN:Line protocol on Interface FastEthernet0, changed
state to up
*Apr  2 17:53:50:%FPD_MGMT-6-FPD_UPGRADE_TIME:Estimated total FPD image upgrade time for
SPA-4FE-7304 card in subslot 2/0 = 00:07:00.
*Apr  2 17:53:50:%FPD_MGMT-6-FPD_UPGRADE_START:Data & I/O FPGA (FPD ID=1) image upgrade in
progress for SPA-4FE-7304 card in subslot 2/0. Updating to version 4.17. PLEASE DO NOT
INTERRUPT DURING THE UPGRADE PROCESS (estimated upgrade completion time = 00:07:00)
...[....................................................
(Note:Some output removed for brevity)
.........................]
SUCCESS - Completed XSVF execution.

*Apr  2 17:59:16:%FPD_MGMT-6-FPD_UPGRADE_PASSED:Data & I/O FPGA (FPD ID=1) image in the
SPA-4FE-7304 card in subslot 2/0 has been successfully updated from version 4.13 to
version 4.17. Upgrading time = 00:05:26.136
*Apr  2 17:59:16:%FPD_MGMT-6-OVERALL_FPD_UPGRADE:All the attempts to upgrade the required
FPD images have been completed for SPA-4FE-7304 card in subslot 2/0. Number of
successful/failure upgrade(s):1/0.
*Apr  2 17:59:16:%FPD_MGMT-5-CARD_POWER_CYCLE:SPA-4FE-7304 card in subslot 2/0 is being
power cycled for the FPD image upgrade to take effect.

Router> show hw-module subslot fpd

==== ====================== ====== =============================================
                             H/W   Field Programmable   Current   Min. Required
Slot Card Description        Ver.  Device:"ID-Name"    Version      Version
==== ====================== ====== ================== =========== ==============
 2/0 SPA-4FE-7304            0.32  1-Data & I/O FPGA      4.17        4.17
==== ====================== ====== =============================================
```

Incompatible FPD Image Version Detection and Disabled Automatic FPD Image Upgrade Example

The following example displays the output when a SPA requires an FPD upgrade, but the **upgrade fpd auto** command is *disabled*. The SPA is disabled after the OIR insertion or after the system boot and will remain disabled until the FPD incompatibility upgrade is addressed.

```
*Jan 13 22:30:30:%FPD_MGMT-3-INCOMP_FPD_VER:Incompatible 4FE/2GE FPGA (FPD ID=1) image
version detected for SPA-4FE-7304 card in subslot 2/0. Detected version = 4.12, minimal
required version = 4.13. Current HW version = 0.32.
*Jan 13 22:30:30:%FPD_MGMT-4-BYPASS_FPD_AUTO_UPGRADE:Automatic FPD image upgrade is not
enabled, bypassing the image upgrade for SPA-4FE-7304 card in subslot 2/0.
```

```
*Jan 13 22:30:30:%FPD_MGMT-5-CARD_DISABLED:SPA-4FE-7304 card in subslot 2/0 is being
disabled because of incompatible FPD image version. Note that the spa_fpd.122-20.S2.pkg
package will be required if you want to perform the upgrade operation with the "upgrade
hw-module ..." command.
```

Manual FPD Image Upgrade Example

The following example displays the output from the **upgrade hw-module subslot** command using the manual FPD image upgrade method. In this example, the the **hw-module subslot reload** command is then used to reload the router and complete the FPD image upgrade.

```
Router# upgrade hw-module subslot tftp://abrick/muck/luislu/c7304-fpd.122-25.S3.pkg
Loading muck/luislu/c7304-fpd.122-25.S3.pkg from 223.255.254.254 (via FastEthernet0):
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

% The following FPD(s) will be updated for SPA-4FE-7304 (H/W ver = 0.32) in subslot 5/1:

    ================== =========== =========== ============
    Field Programmable   Current     Upgrade   Estimated
    Device: "ID-Name"    Version     Version   Upgrade Time
    ================== =========== =========== ============
    1-Data & I/O FPGA      4.12        4.18      00:03:00
    ================== =========== =========== ============


% NOTES:
  - Use 'show upgrade fpd progress' command to view the progress of the FPD
    upgrade.
  - You must reload the card after the upgrade. The FPD upgrade is not
    finalized until the card is reloaded.
  - The output of 'show hw-module <target> fpd' will not reflect the
    upgraded FPD version until the card is reloaded to finalize the upgrade.

% Are you sure that you want to perform this operation? [no]: y
% Target card is already disabled, proceeding with upgrade operation without enabling the
card ...

Router#
*Mar 22 14:23:58: %FPD_MGMT-6-UPGRADE_TIME: Estimated total FPD image upgrade time for
SPA-4FE-7304 card in subslot 5/1 = 00:03:00.
*Mar 22 14:23:59: %FPD_MGMT-6-UPGRADE_START: Data & I/O FPGA (FPD ID=1) image upgrade in
progress for SPA-4FE-7304 card in subslot 5/1. Updating to version 4.18. PLEASE DO NOT
INTERRUPT DURING THE UPGRADE PROCESS (estimated upgrade completion time = 00:03:00) ...

*Mar 22 14:26:06: %FPD_MGMT-6-UPGRADE_PASSED: Data & I/O FPGA (FPD ID=1) image in the
SPA-4FE-7304 card in subslot 5/1 has been successfully updated from version 4.12 to
version 4.18. Upgrading time = 00:02:06.884
*Mar 22 14:26:06: %FPD_MGMT-6-OVERALL_UPGRADE: All the attempts to upgrade the required
FPD images have been completed for SPA-4FE-7304 card in subslot 5/1. Number of
successful/failure upgrade(s): 1/0.
Router#hw-module subslot 5/1 reload
Router#
*Mar 22 14:33:03: %WS_ALARM-6-INFO: ASSERT CRITICAL FastEthernet5/1/0 Physical Port Link
Down
*Mar 22 14:33:03: %WS_ALARM-6-INFO: ASSERT INFO FastEthernet5/1/1 Physical Port
Administrative State Down
*Mar 22 14:33:03: %WS_ALARM-6-INFO: ASSERT INFO FastEthernet5/1/2 Physical Port
Administrative State Down
*Mar 22 14:33:03: %WS_ALARM-6-INFO: ASSERT INFO FastEthernet5/1/3 Physical Port
Administrative State Down
```

Troubleshooting Problems with FPD Image Upgrades

This section contains information to help troubleshoot problems that can occur during the upgrade process.

Power Failure or Removal of a SPA During an FPD Image Upgrade

If the FPD upgrade operation is interrupted by a power failure or the removal of the SPA, it could corrupt the FPD image. This corruption of the FPD image file makes the SPA unusable by the router and the system will display the following messages when it tries to power up the SPA:

Note To find more information about FPD-related messages, check the system error messages guide for your Cisco IOS software release.

```
00:00:32:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 2/0:PWR_OK asserted, SPA_OK deasserted;
attempting recovery
00:00:47:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 2/0:PWR_OK asserted, SPA_OK deasserted;
attempting recovery
00:01:02:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 2/0:PWR_OK asserted, SPA_OK deasserted;
attempting recovery
00:01:22:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 2/0:PWR_OK asserted, SPA_OK deasserted;
attempting recovery
00:01:37:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 2/0:PWR_OK asserted, SPA_OK deasserted;
attempting recovery
00:01:52:%SPA_OIR-3-SPA_POWERED_OFF:subslot 2/0:SPA SPA-4FE-7304 powered off after 5
failures within 3600 seconds
00:01:52:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 2/0:PWR_OK deasserted, SPA_OK deasserted;
attempting recovery
```

The **show hw-module subslot fpd** command can be used to verify that the SPA is using a corrupted FPD image. The following example shows that the SPA in slot 2/0 is unable to identify the FPD image, indicating that the image is probably corrupt. At this point, the automatic upgrade procedure cannot correct the problem. Therefore, you will need to perform a recovery upgrade to the SPA.

```
Router# show hw-module subslot fpd

==== ====================== ====== =============================================
                            H/W    Field Programmable   Current   Min. Required
Slot Card Description       Ver.   Device:"ID-Name"     Version      Version
==== ====================== ====== ================== =========== ==============
 2/0 SPA-4FE-7304<DISABLED>  ?.?   ????????????          ?.?         ?.?
---- ---------------------- ------ ------------------ ----------- --------------
 2/1 SPA-2GE-7304            0.15  1-Data & I/O FPGA      4.13        4.13
==== ====================== ====== =============================================
```

Performing a FPD Recovery Upgrade

The recovery upgrade procedure can only be performed on a SPA that has been powered off by the system after it has failed all of the retries attempted to initialize the SPA.

The following example displays the output of an attempt to perform a recovery upgrade before all the initialization retries have been attempted for the SPA in slot 2/0.

```
Router#
07:23:54:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 2/0:PWR_OK asserted, SPA_OK deasserted;
attempting recovery
```

```
Router# upgrade hw-module subslot 2/0 file disk0:spa_fpd.122-20.S2.pkg

% Can not get FPD version information for version checking. If a previous upgrade attempt
has failed for the target card, then a recovery upgrade would be required to fix the
failure.

% Do you want to perform the recovery upgrade operation? [no]:y
% Uncompressing the bundle ...  [OK]

% The following FPD(s) will be upgraded for card in subslot 2/0 :

         ================== =========== =========== ============
         Field Programmable   Current     Upgrade   Estimated
         Device:"ID-Name"     Version     Version   Upgrade Time
         ================== =========== =========== ============
         1-Data & I/O FPGA     ?.?         4.13      00:06:30
         ================== =========== =========== ============


% Are you sure that you want to perform this operation? [no]:y
% Can not perform recovery upgrade operation because the target card is not in a failed
state. Please try again later.

Router#
07:24:09:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 2/0:PWR_OK asserted, SPA_OK deasserted;
attempting recovery
```

Once the following error message is displayed, you can perform the recovery upgrade:

Note You must wait to see this error message before you attempt the upgrade.

```
07:25:15:%SPA_OIR-3-SPA_POWERED_OFF:subslot 2/0:SPA SPA-4FE-7304 powered off after 5
failures within 3600 seconds
```

Perform the manual FPD image upgrade method using the **upgrade hw-module subslot** command to recover from a corrupted image after the SPA has been powered off by the system. In this command, *slot-number* is the slot where the MSC is installed, *subslot-number* is the subslot of the MSC where the SPA is located, and *file-url* is the location of the FPD image package file.

Note Before proceeding with this operation, make sure that the correct version of the FPD image package file has been obtained for the corresponding Cisco IOS release that the system is using.

The following example displays the console output of a recovery upgrade operation:

```
Router# upgrade hw-module subslot 2/0 file disk0:spa_fpd.122-20.S2.pkg

% Can not get FPD version information for version checking. If a previous upgrade attempt
has failed for the target card, then a recovery upgrade would be required to fix the
failure.

% Do you want to perform the recovery upgrade operation? [no]:y
% Uncompressing the bundle ...  [OK]


% The following FPD(s) will be upgraded for card in subslot 2/0 :
```

```
         ================== =========== =========== ============
         Field Programmable   Current     Upgrade   Estimated
         Device:"ID-Name"    Version     Version   Upgrade Time
         ================== =========== =========== ============
         1-Data & I/O FPGA     ?.?         4.13      00:06:30
         ================== =========== =========== ============


% Are you sure that you want to perform this operation? [no]:y
% Proceeding with recovery upgrade operation ...

Router#
07:28:42:%FPD_MGMT-6-FPD_UPGRADE_TIME:Estimated total FPD image upgrade time for
SPA-4FE-7304 card in subslot 2/0 = 00:03:30.
07:28:42:%FPD_MGMT-6-FPD_UPGRADE_START:Unknown FPD (FPD ID=1) image upgrade in progress
for SPA-4FE-7304 card in subslot 2/0. Updating to version 4.13. PLEASE DO NOT INTERRUPT
DURING THE UPGRADE PROCESS (estimated upgrade completion time = 00:03:30)
...[...................................
.............................................................................................
.......(part of the output has been removed for brevity)
....................................................]
SUCCESS - Completed XSVF execution.

07:34:25:%FPD_MGMT-6-FPD_UPGRADE_PASSED:Unknown FPD (FPD ID=1) image upgrade for
SPA-4FE-7304 card in subslot 2/0 has PASSED. Upgrading time = 00:05:42.692
07:34:25:%FPD_MGMT-6-OVERALL_FPD_UPGRADE:All the attempts to upgrade the required FPD
images have been completed for SPA-4FE-7304 card in subslot 2/0. Number of
successful/failure upgrade(s):1/0.
07:34:25:%FPD_MGMT-5-CARD_POWER_CYCLE:SPA-4FE-7304 card in subslot 2/0 is being power
cycled for the FPD image upgrade to take effect.
Router#
```

Verifying a Successful Upgrade

After the upgrade process is complete, you can use the **show hw-module subslot fpd** command to verify that the FPD image on the SPA has been successfully upgraded:

```
Router# show hw-module subslot fpd

==== ====================== ====== =============================================
                             H/W   Field Programmable   Current   Min. Required
Slot Card Description        Ver.  Device:"ID-Name"     Version      Version
==== ====================== ====== ================== =========== ==============
 2/0 SPA-4FE-7304            0.32  1-Data & I/O FPGA     4.13        4.13
---- ---------------------- ------ ------------------ ----------- --------------
 2/1 SPA-2GE-7304            0.15  1-Data & I/O FPGA     4.13        4.13
==== ====================== ====== =============================================
```

Troubleshooting the Fast Ethernet SPA and Gigabit Ethernet SPA

This chapter describes techniques that you can use to troubleshoot the operation of your Fast Ethernet and Gigabit Ethernet SPAs.

It includes the following sections:

The first section provides information about basic interface troubleshooting. If you are having a problem with your SPA, use the steps in the "Performing Basic Interface Troubleshooting" section to begin your investigation of a possible interface configuration problem.

To perform more advanced troubleshooting, see the other sections in this chapter.

General Troubleshooting Information

This section describes general information for troubleshooting MSCs and SPAs. It includes the following sections:

Interpreting Console Error Messages

To view the explanations and recommended actions for Cisco 7304 routers error messages, including messages related to Cisco 7304 routers MSCs and SPAs, refer to the following documents:

• *System Error Messages for Cisco 7304 Routers* (for error messages on Early Deployment trains)

• *System Error Messages for Cisco IOS Release 12.2 S* (for error messages in Release 12.2 S)

System error messages are organized in the documentation according to the particular system facility that produces the messages. The MSC and SPA error messages use the following facility names:

- Cisco 7304 MSC-100—MSC100_SPA_CC
- 4-Port 10/100 Fast Ethernet SPA—SPA_ETHER
- 2-Port 10/100/1000 Gigabit Ethernet SPA—SPA_ETHER

Using debug Commands

Along with the other **debug** commands supported on the Cisco 7304 routers, you can obtain specific debug information for SPAs on the Cisco 7304 routers using the **debug hw-module subslot** privileged exec command.

The **debug hw-module subslot** command is intended for use by Cisco Systems technical support personnel. For more information about the **debug hw-module subslot** command, see Chapter 8, "Command Reference."

Caution Because debugging output is assigned high priority in the CPU process, it can render the system unusable. For this reason, use **debug** commands only to troubleshoot specific problems or during troubleshooting sessions with Cisco technical support staff. Moreover, it is best to use **debug** commands during periods of lower network traffic and fewer users. Debugging during these periods decreases the likelihood that increased **debug** command processing overhead will affect system use.

For information about other **debug** commands supported on the Cisco 7304 routers, refer to the *Cisco IOS Debug Command Reference, Release 12.2* and any related feature documents for Cisco IOS Release 12.2 S.

Using test Commands

The SPAs on the Cisco 7304 routers also implement certain **test** commands.

Caution The **test hw-module subslot** commands are not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. This command can produce unexpected operation of your SPA.

For more information about the **test hw-module subslot** commands, see Chapter 8, "Command Reference"

Using show Commands

There are several **show** commands that you can use to monitor and troubleshoot the MSCs and SPAs on the Cisco 7304 routers. This chapter describes using the **show interfaces** and **show controllers** commands to perform troubleshooting of your SPA.

For more information about **show** commands to verify and monitor MSCs and SPAs, see the following chapters of this guide:

- Chapter 3, "Overview of the Fast Ethernet SPA and Gigabit Ethernet SPA"
- Chapter 8, "Command Summary for Fast Ethernet and Gigabit Ethernet SPAs"
- Chapter 8, "Command Reference"

Performing Basic Interface Troubleshooting

You can perform most of the basic interface troubleshooting using the **show interfaces fastethernet** or **show interfaces gigabitethernet** command and examining several areas of the output to determine how the interface is operating.

The following example shows output from the **show interfaces fastethernet** command with some of the significant areas of the output to observe shown in bold:

```
Router# show interfaces fastethernet 2/1/1
FastEthernet2/1/1 is up, line protocol is up
  Hardware is SPA-4FE-7304, address is 00b0.64ff.5d80 (bia 00b0.64ff.5d80)
  Internet address is 192.168.50.1/24
  MTU 9216 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:22, output 00:00:02, 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
     5 packets input, 320 bytes
     Received 1 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog
     0 input packets with dribble condition detected
     8 packets output, 529 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets
     0 babbles, 0 late collision, 0 deferred
     2 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
```

To verify that your interface is operating properly, complete the steps in Table 6-1:

Table 6-1 Basic Interface Troubleshooting Steps

	Action	Example
Step 1	From global configuration mode, enter the **show interfaces fastethernet** or **show interfaces gigabitethernet** command.	`Router# show interfaces fastethernet 2/1/1`
Step 2	Verify that the interface is up.	`Router# show interfaces fastethernet 2/1/1` `FastEthernet2/1/1 is up, line protocol is up`
Step 3	Verify that the line protocol is up.	`Router# show interfaces fastethernet 2/1/1` `FastEthernet2/1/1 is up, line protocol is up`

Step 4	Verify that the interface duplex mode matches the remote interface configuration.	The following example shows that the local interface is currently operating in full-duplex mode:
		`Router# show interfaces fastethernet 2/1/1`
		`[text omitted]`
		
		`  Keepalive set (10 sec)`
		`  Full-duplex, 100Mb/s, 100BaseTX/FX`

Step 5	Verify that the interface speed matches the speed on the remote interface.	The following example shows that the local interface is currently operating at 100 Mbps:
		`Router# show interfaces fastethernet 2/1/1`
		`.`
		`.`
		`.`
		`  Keepalive set (10 sec)`
		`  Full-duplex, 100Mb/s, 100BaseTX/FX`
		`.`
		`.`
		`.`

Step 6	Observe the output hang status on the interface.	`Router# show interfaces fastethernet 2/1/1`
		`.`
		`.`
		`.`
		`  ARP type: ARPA, ARP Timeout 04:00:00`
		`  Last input 00:00:22, output 00:00:02, output hang never`
		`.`
		`.`
		`.`

Step 7	Observe the CRC counter.	`Router# show interfaces fastethernet 2/1/1`
		`.`
		`.`
		`.`
		`     5 minute output rate 0 bits/sec, 0 packets/sec`
		`     5 packets input, 320 bytes`
		`     Received 1 broadcasts (0 IP multicast)`
		`     0 runts, 0 giants, 0 throttles`
		`     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored`
		`.`
		`.`
		`.`

Table 6-1 Basic Interface Troubleshooting Steps (continued)

	Action	Example

Step 8	Observe the late collision counter.	`Router# show interfaces fastethernet 2/1/1`
		`.`
		`.`
		`.`
		`     0 input packets with dribble condition detected`
		`     8 packets output, 529 bytes, 0 underruns`
		`     0 output errors, 0 collisions, 2 interface resets`
		`     0 babbles, 0 late collision, 0 deferred`
		`.`
		`.`
		`.`

Step 9	Observe the carrier signal counters.	`Router# show interfaces fastethernet 2/1/1`
		`.`
		`.`
		`.`
		`     0 output errors, 0 collisions, 2 interface resets`
		`     0 babbles, 0 late collision, 0 deferred`
		`     2 lost carrier, 0 no carrier`
		`.`
		`.`
		`.`

For more information about the verification steps in and possible responses to correct detected problems, see the following sections:

- Verifying the Interface Is Up, page 6-5
- Verifying the Line Protocol Is Up, page 6-6
- Verifying the Duplex Mode, page 6-6
- Verifying the Speed Mode, page 6-6
- Verifying Output Hang Status, page 6-6
- Verifying the CRC Counter, page 6-7
- Verifying Late Collisions, page 6-7
- Verifying the Carrier Signal, page 6-7

Verifying the Interface Is Up

In the output from the **show interfaces fastethernet** or **show interfaces gigabitethernet** command command, verify that the interface is up. If the interface is down, perform the following corrective actions:

- If the interface is *administratively down*, use the **no shutdown** interface configuration command to enable the interface.
- Be sure that the cable is fully connected.
- Verify that the cable is not bent or damaged. If the cable is bent or damaged, the signal will be degraded.

- Verify that a hardware failure has not occurred. Observe the LEDs and use the **show controllers** or **show hw-module subslot** commands to determine if a failure has occurred. See the other troubleshooting sections of this chapter, and refer to the *Cisco 7304 Router Modular Services Card and Shared Port Adapter Hardware Installation Guide*. If the hardware has failed, replace the SPA or cable as necessary.

Verifying the Line Protocol Is Up

In the output from the **show interfaces fastethernet** or **show interfaces gigabitethernet** command, verify that the line protocol is up. If the line protocol is down, the line protocol software processes have determined that the line is unusable.

Perform the following corrective actions:

- Replace the cable.
- Check the local and remote interface for misconfiguration.
- Verify that a hardware failure has not occurred. Observe the LEDs and use the **show controllers** or **show hw-module subslot** commands to determine if a failure has occurred. See the other troubleshooting sections of this chapter, and refer to the *Cisco 7304 Router Modular Services Card and Shared Port Adapter Hardware Installation Guide*. If the hardware has failed, replace the SPA as necessary.

Verifying the Duplex Mode

In the output from the **show interfaces fastethernet** or **show interfaces gigabitethernet** command, verify the current duplex mode of the local interface.

The local interface duplex mode configuration should match the remote interface configuration. Confirm that the duplex settings are the same on both ends of the connection.

Enabling autonegotiation for the duplex mode can avoid configuration mismatches. To enable autonegotiation for the duplex mode, use the **duplex auto** interface configuration command.

Verifying the Speed Mode

In the output from the **show interfaces fastethernet** or **show interfaces gigabitethernet** command, verify the current speed of the local interface.

The local interface speed should match the remote interface configuration. Confirm that the speed settings are the same on both ends of the connection.

Enabling autonegotiation for the interface speed can avoid configuration mismatches. To enable autonegotiation for the speed, use the **speed auto** interface configuration command.

Verifying Output Hang Status

In the output from the **show interfaces fastethernet** or **show interfaces gigabitethernet** command, observe the value of the output hang field.

The output hang provides the number of hours, minutes, and seconds since the last reset caused by a lengthy transmission. When the number of hours the field exceeds 24 hours, the number of days and hours is shown. If the field overflows, asterisks are printed. The field shows a value of *never* if no output hangs have occurred.

Verifying the CRC Counter

In the output from the **show interfaces fastethernet** or **show interfaces gigabitethernet** command, observe the value of the CRC counter. Excessive noise will cause high CRC errors accompanied by a low number of collisions.

Perform the following corrective actions if you encounter high CRC errors:

- Check the cables for damage.
- Verify that the correct cables are being used for the SPA interface.

Verifying Late Collisions

In the output from the **show interfaces fastethernet** or **show interfaces gigabitethernet** command command, observe the value of the late collision counter.

Perform the following corrective actions if you encounter late collisions on the interface:

- Verify that the duplex mode on the local and remote interface match. Late collisions occur when there is a duplex mode mismatch.
- Verify the length of the Ethernet cables. Late collisions result from cables that are too long.

Verifying the Carrier Signal

In the output from the **show interfaces fastethernet** or **show interfaces gigabitethernet** command command, observe the value of the carrier signal counters. The lost carrier counter shows the number of times that the carrier was lost during transmission. The no carrier counter shows the number of times that the carrier was not present during transmission.

Carrier signal resets can occur when an interface is in loopback mode or shut down.

Perform the following corrective actions if you observe the carrier signal counter incrementing outside of these conditions:

- Check the interface for a malfunction.
- Check for a cable problem.

Using the show controllers Command to Troubleshoot Problems

To display diagnostic information and verify the performance of the hardware devices on a SPA on the Cisco 7304 routers, you can use the **show controllers** and **show hw-module subslot** privileged EXEC commands.

The following is an example of the **show controllers fastethernet** command output for the 4-Port 10/100 Fast Ethernet SPA:

```
Router# show controllers fastethernet 4/0/0
Interface FastEthernet4/0/0
  Hardware is SPA-4FE-7304
  Connection mode is auto-negotiation
  Interface state is up, link is up
  Configuration is Auto Speed, Auto Duplex
  Selected media-type is RJ45
  Promiscuous mode is off, VLAN filtering is enabled
  MDI crossover status: MDI
  Auto-negotiation configuration and status:
    Auto-negotiation is enabled and is completed
    Speed/duplex is resolved to 100 Mbps, full duplex
    Advertised capabilities: 10M/HD 10M/FD 100M/HD 100M/FD
    Partner capabilities: 10M/HD 10M/FD 100M/HD 100M/FD
MAC counters:
  Input: packets = 15, bytes = 1776
         FIFO full/reset removed = 0, error drop = 0
  Output: packets = 18, bytes = 2622
          FIFO full/reset removed = 0, error drop = 0
  Total pause frames: transmitted = 0, received = 0
FPGA counters:
  Input: Total (good & bad) packets: 15, TCAM drops: 4
         Satisfy (host-backpressure) drops: 0, CRC drops: 0
         PL3 RERRs: 0
  Output: EOP (SPI4) errors: 0
SPA carrier card counters:
  Input: packets = 11, bytes = 1476, drops = 0
  Output: packets = 18, bytes = 2550, drops = 0
  Egress flow control status: XON
  Per bay counters:
  General errors: input = 0, output = 0
  SPI4 errors: ingress dip4 = 0, egress dip2 = 0
MAC destination address filtering table:
  Table entries: Total = 512, Used = 4, Available = 508
  Index MAC destination address       Mask
  ----- ----------------------  --------------
  1     0007.0ed3.ba80          ffff.ffff.ffff
  2     ffff.ffff.ffff          ffff.ffff.ffff
  3     0100.0000.0000          0100.0000.0000
  4     0100.0ccc.cccc          ffff.ffff.ffff
VLAN filtering table:
  Number of VLANs configured on this interface = 0
  Table entries: Total = 1024, Used = 2, Available = 1022
  Index  VLAN identifier  Enabled  Tunnel
  -----  ---------------  -------  ------
  1          0              No      No
  2          0              Yes     No
Platform details:
  PXF tif number: 0x10
```

Table 6-2 describes the significant fields of the **show controllers fastethernet** and **show controllers gigabitethernet** command that might require further action during troubleshooting.

Table 6-2 Significant Output Fields in show controllers Command for Troubleshooting

Output Field	Problem Description	Recommended Action
FPGA counters: Satisfy (host-backpressure) drops	Indicates back pressure from the Route Processor (RP), possibly due to higher bandwidth line cards on the router.	Use the **show c7300** and **show pxf accounting** commands to obtain more information. See the "Troubleshooting Oversubscription" section on page 6-9.
SPA carrier card counters: SPI4 errors: ingress dip4, egress dip2	Indicates 4-bit and 2-bit Diagonal Interleaved Parity (DIP) errors in the ingress direction on the SPI4 path from the field-programmable gate array FPGA to the SIP.	Unless these errors reach a certain threshold, no action is required. If the errors occur more than 25 times within 10 milliseconds, then the SPA automatically deactivates and reactivates itself. Error messages are logged on the console indicating the source of the error and the status of the recovery. If the errors persist, you might need to perform OIR of the SPA. See the "Understanding SPA Automatic Recovery" section on page 6-11.

Troubleshooting Oversubscription

When the "Satisfy (host-backpressure) drops" counter increments in the output of the **show controllers fastethernet** and **show controllers gigabitethernet** command, it indicates oversubscription on the RP.

To troubleshoot further, perform the following steps:

Step 1 Use the **show c7300** command to verify whether you have exceeded the maximum allowed aggregate throughput for any line cards or interfaces.

The following output shows an example of exceeding the aggregate throughput for the SPAs on a Cisco 7304 router with an NSE-100:

```
Router# show c7300
Slot      Card Type           Status          Insertion time
----      ---------           ------          --------------
0,1       NSE100              Active          00:45:29 ago
2         7304-MSC-100        Active          00:44:36 ago
3         7304-MSC-100        Active          00:44:36 ago
4         7304-MSC-100        Active          00:44:36 ago
5         7304-MSC-100        Active          00:14:39 ago

The FPGA versions for the cards listed above are current

Shared Port Adapter information:
Slot/Subslot  SPA Type            Status          Insertion time
------------  --------            ------          --------------
2/0           SPA-2GE-7304        ok              00:44:36 ago
2/1           SPA-2GE-7304        ok              00:44:36 ago
3/0           SPA-2GE-7304        ok              00:44:35 ago
3/1           not present         missing         never
4/0           SPA-2GE-7304        ok              00:44:35 ago
4/1           SPA-2GE-7304        ok              00:44:35 ago
```

```
5/0           SPA-4FE-7304        ok              00:14:36 ago
5/1           SPA-2GE-7304        ok              00:14:36 ago

%NOTE: Line cards present violate configuration guidelines for this NSE.

Maximum allowed aggregate throughput of the line cards
for a system with this NSE is 3200000 kbps
Maximum throughput for line cards in system
Slot      Card Type           Throughput (kbps)
----      ---------           -----------------
0,1       NSE100              0
2         7304-MSC-100        4000000
3         7304-MSC-100        2000000
4         7304-MSC-100        4000000
5         7304-MSC-100        2000000

Maximum throughput for SPAs in the system
Slot/Subslot  SPA Type            Throughput (kbps)
------------  --------            -----------------
2/0           SPA-2GE-7304        2000000
2/1           SPA-2GE-7304        2000000
3/0           SPA-2GE-7304        2000000
4/0           SPA-2GE-7304        2000000
4/1           SPA-2GE-7304        2000000
5/0           SPA-4FE-7304        0
5/1           SPA-2GE-7304        2000000

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

Step 2 To verify oversubscription on the NSE-100, use the **show pxf accounting** and **show pxf interface** commands.

Note For Parallel Express Forwarding (PXF) information for SPA interfaces on the 4-Port 10/100 Fast Ethernet SPA, you can use the **show pxf interface fastethernet** *slot/subslot/port* version of the command.

Step 3 To verify oversubscription on the NPE-G100, use the **show interfaces** command.

Understanding SPA Automatic Recovery

When the 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA and encounters thresholds for certain types of errors and identifies a fatal error, the SPA initiates an automatic recovery process.

You do not need to take any action unless the error counters reach a certain threshold, and multiple attempts for automatic recovery by the SPA fail.

The 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA might perform automatic recovery for the following types of errors:

- SPI4 TX/RX out of frame
- SPI4 TX train valid
- SPI4 TX DIP4
- SPI4 RX DIP2

Note These SPA error counters do not appear in the **show controllers fastethernet** and **show controllers gigabitethernet** command output until at least one SPI4 error occurs.

When Automatic Recovery Occurs

If the SPI4 errors occur more than 25 times within 10 milliseconds, the SPA automatically deactivates and reactivates itself. Error messages are logged on the console indicating the source of the error and the status of the recovery.

If Automatic Recovery Fails

If the SPA attempts automatic recovery more than five times in an hour, then the SPA deactivates itself and remains deactivated.

To troubleshoot automatic recovery failure for a SPA, perform the following steps:

Step 1 Use the **show c7300** command to verify the status of the SPA. The status is shown as “failed” if the SPA has been powered off due to five consecutive failures, as shown in the following example:

```
Router# show c7300
.
.
.
The FPGA versions for the cards listed above are current

Shared Port Adapter information:
Slot/Subslot  SPA Type            Status          Insertion time
------------  --------            ------          --------------
.
.
.
3/0           SPA-4FE-7304        failed          00:00:08 ago
.
.
.
```

Step 2 If you verify that automatic recovery has failed, perform OIR of the SPA. For information about performing an OIR, see the "Preparing for Online Insertion and Removal of a SPA" section on page 6-14.

Step 3 If reseating the SPA after OIR does not resolve the problem, replace the SPA hardware.

Configuring the Interface for Internal Loopback

Loopback support is useful for testing the interface without connectivity to the network, or for diagnosing equipment malfunctions between the interface and a device. The 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA supports both an internal and an external loopback mode. The external loopback mode requires the use of a loopback cable and implements a loopback through the transceiver on the SPA.

You can also configure an internal loopback without the use of a loopback cable that implements a loopback at the PHY device internally on a Fast Ethernet interface and Gigabit Ethernet interface port, or at the MAC device internally on a Gigabit Ethernet interface port. By default, loopback is disabled.

Configuring the Interface for Internal Loopback at the PHY Device

Note Before you enable internal loopback at the PHY device, you must disable autonegotiation on the interface. For more information, see the "Disabling Autonegotiation on RJ-45 Interfaces Configuration Example" section on page 4-22 or the "Disabling Autonegotiation on Fiber Interfaces Configuration Example" section on page 4-23.

To enable internal loopback at the PHY device for an interface on a SPA, use the following commands beginning in interface configuration mode:

	Command or Action	Purpose
Step 1	Router(config-if)# **speed 100** or Router(config-if)# **speed 10**	Forces the interface to operate at 100 Mbps. or Forces the interface to operate at 10 Mbps only. **Note** When a value for the **speed** command (other than **auto**) is configured with a value for the **duplex** command (other than **auto**), the values are said to be *forced*. These values are not advertised and autonegotiation is disabled.

	Command or Action	Purpose
Step 2	Router(config-if)# **duplex full**	Forces the interface to operate in full-duplex mode only.
	or	or
	Router(config-if)# **duplex half**	Forces the interface to operate in half-duplex mode only.
Step 3	Router(config-if)# **loopback**	Enables an interface for internal loopback at the PHY device on the 4-Port 10/100 Fast Ethernet SPA.
	or	or
	Router(config-if)# **loopback driver**	Enables an interface for internal loopback at the PHY device on the 2-Port 10/100/1000 Gigabit Ethernet SPA.

Configuring the Interface for Internal Loopback at the MAC Device

To enable internal loopback at the MAC device for an interface on a SPA, use the following commands beginning in interface configuration mode:

Command	Purpose
Router(config-if)# **loopback mac**	Enables an interface for internal loopback at the MAC device on the 2-Port 10/100/1000 Gigabit Ethernet SPA.

Verifying Loopback Status

To verify whether loopback is enabled on an interface port on a SPA, use the **show interfaces fastethernet** or **show interfaces gigabitethernet** privileged EXEC command and observe the value shown in the "loopback" field.

The following example shows that loopback is disabled for interface port 0 (the first port) on the SPA installed in the top (0) subslot of the MSC that is located in slot 4 of the Cisco 7304 router:

```
Router# show interfaces fastethernet 4/0/0
FastEthernet4/0/0 is up, line protocol is up
  Hardware is SPA-4FE-7304, address is 00b0.64ff.5d80 (bia 00b0.64ff.5d80)
  Internet address is 192.168.50.1/24
  MTU 9216 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
.
.
.
```

Using the Cisco IOS Event Tracer to Troubleshoot Problems

Note This feature is intended for use as a software diagnostic tool and should be configured only under the direction of a Cisco Technical Assistance Center (TAC) representative.

The Event Tracer feature provides a binary trace facility for troubleshooting Cisco IOS software. This feature gives Cisco service representatives additional insight into the operation of the Cisco IOS software and can be useful in helping to diagnose problems in the unlikely event of an operating system malfunction or, in the case of redundant systems, route processor switchover.

Event tracing works by reading informational messages from specific Cisco IOS software subsystem components that have been preprogrammed to work with event tracing, and by logging messages from those components into system memory. Trace messages stored in memory can be displayed on the screen or saved to a file for later analysis.

The SPAs currently support the “spa” component to trace SPA OIR-related events.

For more information about using the Event Tracer feature, refer to the following URL:

http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s18/evnttrcr.htm

Preparing for Online Insertion and Removal of a SPA

The Cisco 7304 routers supports online insertion and removal (OIR) of the MSC, in addition to each of the SPAs. Therefore, you can remove an MSC with its SPAs still intact, or you can remove a SPA independently from the MSC, leaving the MSC installed in the router.

This means that an MSC can remain installed in the router with one SPA remaining active, while you remove another SPA from one of the MSC subslots. If you are not planning to immediately replace a SPA into the MSC, then be sure to install a SPA blank filler plate in the subslot. The MSC should always be fully installed with either functional SPAs or blank filler plates.

MSC-100, Fast Ethernet SPA, and Gigabit Ethernet SPA Command Summary

Table 7-1 provides an alphabetical list of some of the related commands to configure, monitor, and maintain MSCs and SPAs on the Cisco 7304 router. For more information about the commands, see Chapter 8, “Command Reference” in this book and the Cisco IOS Release 12.2 command reference and master index publications.

Caution The **debug hw-module subslot**, **debug tcam_mgr**, **test hw-module subslot**, and **test tcam-mgr subslot** commands are not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. The **test** commands can produce unexpected operation of your SPA. For more information, see Chapter 8, “Command Reference.”

Table 7-1 MSC-100, Fast Ethernet SPA, and Gigabit Ethernet SPA Command Summary

Command	Purpose
Router# **debug hw-module subslot** *slot*/*subslot* {**all** | **driver** | **fpga** | **if** | **mac** | **phy** | **tcam** | **force-intr**}	Debugs a SPA and all of its interfaces.
Router# **debug tcam_mgr** {**error** | **event** | **profile**}	Debugs the TCAM manager.
Router(config-if)# **duplex** {**full** | **half** | **auto**}	Configures the duplex operation on an interface.
Router(config-subif)# **encapsulation dot1q** *vlan-id* [**native**]	Enables IEEE 802.1Q encapsulation of traffic on a specified subinterface in VLANs.
Router# **hw-module slot** *slot-number* {**start** | **stop**}	Deactivates or reactivates a line card or MSC, and any installed SPAs in that MSC.
Router# **hw-module subslot** *slot*/*subslot* {**start** | **stop**}	Deactivates or reactivates a SPA and all of its interfaces.
Router(config)# **interface fastethernet** *slot*/*subslot*/*port*[**.***subinterface-number*] Router(config)# **interface gigabitethernet** *slot*/*subslot*/*port*[**.***subinterface-number*]	Specifies the Fast Ethernet or Gigabit Ethernet interface to configure.
Router(config-if)# **ip address** *ip-address mask* [**secondary**]	Sets a primary or secondary IP address for an interface.
Router(config-if)# **loopback**	Enables an interface for internal loopback at the PHY device on the 4-Port 10/100 Fast Ethernet SPA.
Router(config-if)# **loopback driver**	Enables internal loopback at the PHY device or transceiver level on a Gigabit Ethernet interface.

Table 7-1 MSC-100, Fast Ethernet SPA, and Gigabit Ethernet SPA Command Summary (continued)

Command	Purpose
Router(config-if)# **loopback mac**	Enables internal loopback at the MAC device on a Gigabit Ethernet interface.
Router(config-if)# **mac-address** *ieee-address*	Modifies the default Media Access Control (MAC) address of an interface to some user-defined address.
Router(config-if)# **media-type** {**rj45** | **gbic**}	Specifies the physical connection on a Gigabit Ethernet interface.
Router(config-if)# **mtu** *bytes*	Configures the maximum packet size for an interface.
Router(config-if)# **negotiation auto**	Enables advertisement of speed, duplex mode, and flow control on a Gigabit Ethernet interface using fiber media.
Router(config-if)# **no shutdown**	Enables an interface.
Router# **show c7300**	Displays the types and status of cards (NSEs, line cards, MSCs, and SPAs) installed in a Cisco 7300 series router.
Router# **show controllers fastethernet** *slot*/*subslot*/*port* [**detail**] Router# **show controllers gigabitethernet** *slot*/*subslot*/*port* [**detail**]	Displays interface information, transmission statistics and errors, and the MAC destination address and virtual LAN (VLAN) filtering table for interfaces on a 4-Port 10/100 Fast Ethernet SPA or 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.
Router# **show diag** [*slot-number* | **chassis** | {**subslot** *slot*/*subslot*}]	Displays all hardware and diagnostic information for a line card, NSE, chassis, MSC, or SPA including IDPROM and FPGA version information.
Router# **show environment** [**all** | **last** | **table**]	Displays power supply, fan, voltage, and temperature information for the router.
Router# **show hw-module subslot** *slot*/*subslot* {**brief** | **config** | **counters** | **errors** | **registers** | **status**} {**fpga** | **mac** | **phy**| **optics** | **spi4**} *port*	Displays diagnostic information about internal hardware devices for a SPA.
Router# **show interfaces fastethernet** *slot*/*subslot*/*port* Router# **show interfaces gigabitethernet** *slot*/*subslot*/*port*	Displays information about the Fast Ethernet or Gigabit Ethernet interfaces.
Router# **show pxf interface fastethernet** *slot/subslot/port*	Displays PXF counters for the 4-Port 10/100 Fast Ethernet SPA.
Router# **show tcam-mgr subslot** *slot/subslot* **inst-info** Router# **show tcam-mgr subslot** *slot/subslot* **region** *region-number* [**config** | **statistics**] Router# **show tcam-mgr subslot** *slot/subslot* {**rx-dest-mac** | **rx-vlan**}{**alloc-mbus** [**summary**] | **table**}	Displays TCAM manager information for a SPA.
Router# **show vlans** [*vlan-id*]	Displays VLAN subinterfaces.
Router(config-if)# **speed** {**10** | **100** | **1000** | **auto**}	Configures the speed of an interface.
Router# **test hw-module subslot** *slot*/*subslot* **c2w** {**read** *device-address port subaddress bytes* | **write** *device-address port subaddress bytes*}	Tests the Cisco 2 wire (c2w) device on a SPA.
Router# **test hw-module subslot** *slot*/*subslot* **failed** *failure-code*	Sends a failed event on a SPA.

Table 7-1 MSC-100, Fast Ethernet SPA, and Gigabit Ethernet SPA Command Summary (continued)

Command	Purpose
Router# **test hw-module subslot** *slot*/*subslot* **mac config** *port* {**1000mbps-gmii** | **1000mbps-rgmii** | **100mbps** | **10mbps**} {**full** | **half**} {**copper** | **fiber**} Router# **test hw-module** subslot *slot*/*subslot* **mac crc** *port* {**enable** | **disable**} Router# **test hw-module subslot** *slot*/*subslot* **mac loopback** *port* {**line** | **none** | **spi3**}	Tests the MAC device on a SPA.
Router# **test hw-module subslot** *slot*/*subslot* **mdio** {**read** *phy-number phy-register-address* | **write** *phy-number phy-register-address*}	Reads or writes to the PHY device registers through the MAC MII data input/output (MDIO) interface on a SPA.
Router# **test hw-module subslot** *slot*/*subslot* **pause** *port* {**disable** | **enable** | **set** { **threshold** {**fpga** *fpga-pause-threshold-value* | **mac** *mac-pause-threshold-value* } **timer** *pause-timer-value*}}	Enables, disables, and sets the pause frame-related configurations on a SPA.
Router# **test hw-module subslot** *slot*/*subslot* **phy config** *port* {**copper** | **fiber**} {**1000mbps** | **100mbps** | **10mbps** | **auto**} {**auto** | **full** | **half**} {**autoneg** | **force**} Router# **test hw-module subslot** *slot*/*subslot* **phy crossover** *port* {**auto** | **mdi** | **mdix**} Router# **test hw-module subslot** *slot*/*subslot* **phy loopback** *port* {**internal** | **line** | **none**}	Tests the physical interface (PHY) device on a SPA.
Router# **test hw-module subslot** *slot*/*subslot* **policyram** {**read** *ram-virtual-address* | **write** {*ram-data* | [{**deny** | **permit**} [**tunnel** [**ignoreda**]]}	Tests the policy table used by the Field Programmable Gate Array (FPGA) device for ternary content addressable memory (TCAM) lookup on a SPA.
Router# **test hw-module subslot** *slot*/*subslot* **tcam insert** *port* {**dmac addr** *hex-mac-address* **mask** *hex-mask* | **vlan** *vlan-id*} {**deny** | **permit**} Router# **test hw-module subslot** *slot*/*subslot* **tcam lookup** *port* {**dmac addr** *hex-mac-address* **mask** *hex-mask* | **vlan** *vlan-id*} Router# **test hw-module subslot** *slot*/*subslot* **tcam read** *tcam-virtual-address* Router# **test hw-module subslot** *slot*/*subslot* **tcam remove** {**dmac addr** *hex-mac-address* **mask** *hex-mask* | **vlan** *vlan-id*} Router# **test hw-module subslot** *slot*/*subslot* **tcam write** {**mask** |**value**} *tcam-virtual-address port lookup-type* {**dmac** *hex-mac-address* | **vlan** *vlan-id*}	Tests the ternary content addressable memory (TCAM) device on a SPA.

Table 7-1 MSC-100, Fast Ethernet SPA, and Gigabit Ethernet SPA Command Summary (continued)

Command	Purpose
Router# **test hw-module subslot** *slot/subslot* **temperature** *sensor-number*	Tests a temperature sensor on a SPA.
Router# **test tcam-mgr subslot** *slot/subslot* {**delete | empty | fill**}{**rx-dest-mac | rx-vlan**} *value* Router# **test tcam-mgr subslot** *slot/subslot* **insert** [**bottom** | **top**]{**rx-dest-mac | rx-vlan**} *value* Router# **test tcam-mgr subslot** *slot/subslot* **fulltcam** {**off** | **on**} Router# **test tcam-mgr subslot** *slot/subslot* **off** Router# **test tcam-mgr subslot** *slot/subslot* **read mc-index** *value* **vc-index** *value*	Tests the TCAM manager for a SPA.

CHAPTER 8

Command Reference

This chapter documents new and modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.2 command reference and master index publications.

Commands in this document that have been replaced by new commands continue to perform their normal function in this release but are no longer documented. Support for these commands will cease in a future release.

Note Some of the commands in this chapter apply to multiple Cisco products and are supported on different platforms. The documentation for these commands describes differences in syntax and usagefor certain platform or product variations. Therefore, when you see multiple forms of syntax, examples, or usage guidelines for a command in this guide, be sure to locate the heading within the command reference page that corresponds to the related SPA (or MSC) for your platform.

New Commands

- debug hw-module subslot
- show hw-module subslot
- show hw-module subslot fpd
- show upgrade fpd file
- show upgrade fpd package default
- show upgrade fpd progress
- show upgrade fpd table
- test hw-module subslot c2w
- test hw-module subslot failed
- test hw-module subslot mac
- test hw-module subslot mdio
- test hw-module subslot pause
- test hw-module subslot phy
- test hw-module subslot policyram
- test hw-module subslot tcam
- test hw-module subslot temperature
- upgrade fpd auto

- upgrade fpd path
- upgrade hw-module subslot

Modified Commands

- bert errors
- bert pattern
- card type (T1/E1)
- card type (T3/E3)
- framing (T1/E1 controller)
- framing (T3 controller)
- framing (T3/E3 interface)
- loopback (T3/E3 interface)
- mac-address
- mdl
- negotiation
- show c7300
- show controllers fastethernet
- show controllers gigabitethernet
- show controllers pos
- show controllers serial
- show diag
- show interfaces pos
- show interface sdcc
- show interfaces serial
- show tcam-mgr subslot
- t1 framing
- test tcam-mgr subslot
- ttb

Other Supported Commands

- debug tcam_mgr
- duplex
- loopback driver
- loopback mac
- media-type (Gigabit Ethernet)
- show environment
- show interfaces fastethernet
- show interfaces gigabitethernet
- speed

Replaced Commands

Command Until Cisco IOS Release 12.2(20)S6	Replacement Command in Cisco IOS Release 12.2(20)S6
show upgrade file	show upgrade fpd file
show upgrade package default	show upgrade fpd package default
show upgrade progress	show uprade fpd progress
show upgrade table	show upgrade fpd table

bert errors

To transmit bert errors while running any bert pattern, use the **bert error** command in interface configuration mode.

bert errors [*number*]

Syntax Description

number	(Optional) Range of **1-255** bert errors that may be introduced in a bert pattern.

Defaults

Default is 1

Command Modes

Interface configuration

Command History

Release	Modification
12.1(12c)EX1	This command was introduced for Cisco 7304 routers.
12.2(18)S	This command was introduced on Cisco 7304 routers running Cisco IOS Release 12.2 S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

Use this command to test link availability by injecting a fixed number of bert errors when a pattern is running and check that the same number of errors were received on the remote end.

Examples

This example injects 200 bit errors in a running bit pattern on slot 5, bay 2.

```
Router# configure terminal
Router(config)#int serial 5/0/0
Router(config-if)#bert errors 200
```

Related Commands

Command	Description
bert pattern	Start a BERT pattern on a port.
show controller serial	Displays serial line statistics.

bert pattern

To start a BERT pattern on a port, use the **bert pattern** command in interface configuration mode. Use the **no bert pattern** command to stop the sequence.

bert pattern {**0s** | **1s** | **2^15** | **2^20** | **2^23** | **alt-0-1** | **qrss**} **interval** *minutes*}

no bert pattern {**0s** | **1s** | **2^15** | **2^20** | **2^23** | **alt-0-1** | **qrss**} **interval** *minutes*}

Syntax Description

0s	Repeating pattern of zeros (...000...).
1s	Repeating pattern of ones (...111...).
2^15	Pseudorandom 0.151 test pattern that is 32,768 bits in length.
2^20	Pseudo-andom 0.153 test pattern that is 1,048,575 bits in length.
2^23	Pseudorandom 0.151 test pattern that is 8,388,607 bits in length.
alt-0-1	Repeating pattern of alternating zeros and ones (...01010...).
qrss	Pseudorandom quasi-random signal sequence (QRSS) 0.151 test pattern that is 1,048,575 bits in length.
interval *minutes*	Specifies the length of the BERT test in minutes.

Defaults

Bert is disabled by default.

Command Modes

Interface configuration

Command History

Release	Modification
11.1CC	The command was introduced.
12.0(5)XE	The command was enhanced as an ATM interface configuration command
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.1(12c)EX1	Support for Cisco 7304 routers was added.
12.2(18)S	Support for Cisco 7304 routers was added.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

Use the **bert pattern** commamd to start or stop a specific bit pattern. To test link availability, start a pattern on one end and put the remote end in network loopback and verify that there are no bert errors.

Examples

This example starts a bert pattern on slot 5, bay 0.

```
Router# configure terminal
Router(config)#int serial 5/0/0
Router(config-if)#bert pattern 0s
```

Related Commands

Command	Description
bert errors	Transmit bert errors while running any bert pattern.
show controller serial	Displays serial line statistics.
loopback	Loopback at various points in the transmit and receive path.

card type (T1/E1)

To configure the ports on SPA in T1 or E1 mode, use the **card type** command in global configuration mode. To deselect the card type, use the **no** form of this comand.

card type {**t1** | **e1**} *slot subslot*

no card type {**t1** | **e1**} *slot subslot*

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding “Identifying Slots and Subslots for MSCs and SPAs” topic in the platform-specific SPA software configuration guide.
subslot	Secondary slot number on a SPA interface processor (MSC) where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding “Specifying the Interface Address on a SPA” topic in the platform-specific SPA software configuration guide for subslot information.
t1	Clear-channel T1 with integrated data service units (DSUs).
e1	Clear-channel E1 with integrated data service units (DSUs).

Defaults

No default behavior or values. There is no card type when the SPA is inserted for first time. The user must configure this command before they can configure individual ports.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)XE	This command was introduced.
12.0(7)T	This command was integrated into Cisco IOS Release 12.0(7)T.
12.2S	This command was integrated into Cisco IOS Release 12.2S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

To change all the SPA ports from T1 or T3 to E1 or E3 (or E3 to T3), you must deselect the card type and then configure the card with the new type of interface.

Examples

The following example configures all ports of a T3/E3 SPA, seated in slot 5, bay 2, in T3 mode:

```
Router# configure terminal
Router(config)# card type t3 5 2
```

Related Commands

Command	Description
show interface serial	Displays the serial interface type and other information.

card type (T3/E3)

To configure the ports on SPA in T3 or E3 mode, use the **card type** command in global configuration mode. To deselect the card type, use the **no** form of this comand.

card type {**t3** | **e3**} *slot subslot*

no card type {**t3** | **e3**} *slot subslot*

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
subslot	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
t3	Clear-channel T3 with integrated data service units (DSUs).
e3	Clear-channel E3 with integrated data service units (DSUs).

Defaults

No default behavior or values. There is no card type when the SPA is inserted for first time. The user must configure this command before they can configure individual ports.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)XE	This command was introduced.
12.0(7)T	This command was integrated into Cisco IOS Release 12.0(7)T.
12.1(1)T	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.
12.3(1)	This command was integrated into Cisco IOS Release 12.3(1) and support was added for Cisco 2610XM, Cisco 2611XM, Cisco 2620XM, Cisco 2621XM, Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3631, Cisco 3660, Cisco 3725, and Cisco 3745 platforms.
12.2S	This command was integrated into Cisco IOS Release 12.2S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Release	Modification
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.

Usage Guidelines

To change all the SPA ports from T3 to E3, you must deselect the **card type** and then configure the card with the new type of interface.

Once a card type is issued, the user can enter the **no card type** command and then another card type command to configure a new card type. The user must save the configuration to NVRAM and reboot the router in order for the new configuration to take effect.

When the router comes up, the software comes up with the new card type. Note that the software will reject the configuration associated with the old controller and old interface. The user will now have to configure the new controller and serial interface and save it.

Examples

The following example configures all ports of a T3/E3 SPA, seated in slot 5, bay 2, in T3 mode:

```
Router# configure terminal
Router(config)# card type t3 5 2
```

Related Commands

Command	Description
show interface serial	Displays the serial interface type and other information.

debug hw-module subslot

To debug a shared port adapter (SPA) and all of its interfaces, use the **debug hw-module subslot** command in privileged EXEC configuration mode.

debug hw-module subslot *slot/subslot* {**all** | **driver** | **fpga** | **if** | **mac** | **phy** | **tcam** | **upgrade** [**error** | **event**] **intr** | **force-intr**}

no debug hw-module subslot *slot/subslot* {**all** | **driver** | **fpga** | **if** | **mac** | **phy** | **tcam** | **upgrade** [**error** | **event**] | **intr** | **force-intr**}

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/subslot	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
all	Enables all SPA debug messages.
driver	Enables debug messages for SPA drivers.
fpga	Enables debug messages related to SPA field programmable gate array (FPGA) processing.
if	Enables debug messages related to SPA interface processing
mac	Enables debug messages related to SPA MAC driver processing.
phy	Enables debug messages related to SPA PHY driver processing.
tcam	Enables debug messages related to SPA ternary content addressable memory (TCAM) processing.
upgrade [error | event]	Enables debug messages related to Field-Programmable Device (FPD) upgrade information. • **error**—Specifies that upgrade error messages are displayed. • **event**—Specifies that upgrade event messages are displayed.
intr	Enables debug messages related to SPA interrupts. **Caution** The **intr** option should be used only under the supervision of Cisco Systems technical support personnel and is not intended for production networks.
force-intr	Enables debug messages related to manually forced SPA interrupts. **Caution** The **force-intr** option should be used only under the supervision of Cisco Systems technical support personnel and is not intended for production networks.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

The **debug hw-module subslot** command is intended for use by Cisco Systems technical support personnel.

If you attempt to use this command without a SPA installed, or with an incompatible SPA installed, the keyword options are not provided.

Caution Because debugging output is assigned high priority in the CPU process, it can render the system unusable. For this reason, use **debug** commands only to troubleshoot specific problems or during troubleshooting sessions with Cisco Systems technical support personnel. Moreover, it is best to use **debug** commands during periods of lower network traffic and fewer users. Debugging during these periods decreases the likelihood that increased **debug** command processing overhead will affect system use.

Examples

The following example enables interface debug messages for the 4-Port 10/100 Fast Ethernet SPA located in the top subslot (0) of the MSC that is installed in slot 4 of the Cisco 7304 router and shows an interface being shut down and restarted:

```
Router# debug hw-module subslot 4/0 if
SPA 4xFE/2xGE interface debugging is on
Router# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# int fast 4/0/0
Router(config-if)# shut
Router(config-if)#
4d01h: Interface FastEthernet4/0/0, stopping the devices
4d01h: Interface FastEthernet4/0/0, Turning off the port LED
Router(config-if)#
4d01h: %LINK-5-CHANGED: Interface FastEthernet4/0/0, changed state to administratively
down
4d01h: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet4/0/0, changed state to
down
Router(config-if)#
Router(config-if)# no shut
Router(config-if)#
4d01h: Interface FastEthernet4/0/0, stopping the devices
4d01h: Interface FastEthernet4/0/0, clearing the MAC address filter table
4d01h: Interface FastEthernet4/0/0, Disabling promiscuous mode
4d01h: Interface FastEthernet4/0/0, setting the MAC address to 00b0.64ff.4480
4d01h: Interface FastEthernet4/0/0, Disabling promiscuous mode
4d01h: Interface FastEthernet4/0/0, configuring media_type = RJ45, speed = Auto Speed,
duplex = Auto Duplex, mode = auto-negotiation
4d01h: Interface FastEthernet4/0/0, starting the devices
4d01h: Interface FastEthernet4/0/0, clearing the hardware counters
4d01h: %LINK-3-UPDOWN: Interface FastEthernet4/0/0, changed state to up
```

```
4d01h: Interface FastEthernet4/0/0, Setting port LED to green
4d01h: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet4/0/0, changed state to
up
```

Related Commands

Command	Description
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show tcam-mgr subslot	Displays TCAM manager information for SPAs.
test hw-module subslot mac	Tests the MAC device on a SPA.
test hw-module subslot phy	Tests the PHY device on a SPA.
test hw-module subslot tcam	Tests the TCAM device on a SPA.
test tcam-mgr subslot	Tests the TCAM manager for a SPA.

debug tcam_mgr

To debug the ternary content addressable memory (TCAM) manager, use the **debug tcam_mgr** command in privileged EXEC configuration mode.

debug tcam_mgr {**error** | **event** | **profile**}

no debug tcam_mgr {**error** | **event** | **profile**}

Syntax Description

error	Enables debug messages related to TCAM manager errors.
event	Enables debug messages for TCAM manager events.
profile	Enables debug messages about the amount of time it takes to add and remove entries from the TCAM regions.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0 S	This command was introduced.
12.2(20)S2	This command was integrated into Cisco IOS Release 12.2(20)S2.

Usage Guidelines

The **debug tcam_mgr** command is intended for use by Cisco Systems technical support personnel.

Caution Because debugging output is assigned high priority in the CPU process, it can render the system unusable. For this reason, use **debug** commands only to troubleshoot specific problems or during troubleshooting sessions with Cisco Systems technical support personnel. Moreover, it is best to use **debug** commands during periods of lower network traffic and fewer users. Debugging during these periods decreases the likelihood that increased **debug** command processing overhead will affect system use.

Examples

The following example enables TCAM manager event debug messages. It shows the messages associated with shutting down and restarting an interface on the the 4-Port 10/100 Fast Ethernet SPA located in the top subslot (0) of the MSC that is installed in slot 4 of the Cisco 7304 router:

```
Router# debug tcam_mgr event
TCAM Manager Events debugging is on
Router# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)# int fast 4/0/0
Router(config-if)# shut
Router(config-if)#
```

```
4d01h: %LINK-5-CHANGED: Interface FastEthernet4/0/0, changed state to administratively
down
4d01h: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet4/0/0, changed state to
down
Router(config-if)#
Router(config-if)# no shut
Router(config-if)#
4d01h: Freeing VC at 0 from mask at 0
4d01h: Freeing VC at 1 from mask at 0
4d01h: Freeing VC at 0 from mask at 8
4d01h:  Found Mbu at offset 0 index 0
4d01h: Allocated mbu at offset 0 index 0, vc_index 0 region 0
4d01h:  Found Mbu at offset 0 index 0
4d01h: Allocated mbu at offset 0 index 0, vc_index 1 region 0
4d01h:  Found Mbu at offset 0 index 1
4d01h: Allocated mbu at offset 0 index 1, vc_index 0 region 0
4d01h: %LINK-3-UPDOWN: Interface FastEthernet4/0/0, changed state to up
4d01h: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet4/0/0, changed state to
up
```

Related Commands

Command	Description
show controllers fastethernet	Displays Fasgt Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show tcam-mgr subslot	Displays TCAM manager information for SPAs.
test hw-module subslot policyram	Tests the policy table used by the FPGA device for TCAM lookup on a SPA.
test hw-module subslot tcam	Tests the TCAM device on a SPA.

duplex

To configure duplex operation on an interface, use the **duplex** command in interface configuration mode. To return to the default value, use the **no** form of this command.

duplex {**full** | **half** | **auto**}

no duplex

Syntax Description

full	Specifies full-duplex operation.
half	Specifies half-duplex operation.
auto	Enables autonegotiation. The interface automatically operates at half or full duplex depending on environmental factors, such as the type of media and the transmission speeds for the peer routers, hubs, and switches used in the network configuration. This is the default.

Defaults

auto

Command Modes

Interface configuration

Command History

Release	Modification
11.2(10)P	This command was introduced.
12.2 S	This command was integrated into Cisco IOS Release 12.2 S.
12.2(20)S2	This command was implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Usage Guidelines

The **duplex** command applies to SPA interfaces that are using RJ-45 media. Gigabit Ethernet interfaces using fiber media support full-duplex mode only, and use the **negotiation** command to enable and disable autonegotiation.

To enable the autonegotiation capability on an RJ-45 interface, you must set either the **speed** command or the **duplex** command to **auto**. The default configuration is that both commands are set to **auto**.

Table 8-1 describes the interface behavior for different combinations of the **duplex** and **speed** command settings. The specified **duplex** command configured with the specified **speed** command produces the resulting system action.

If you specify both a **duplex** and **speed** setting other than **auto** on an RJ-45 interface, then autonegotiation is disabled for the interface.

Note If you need to force an interface port to operate with certain settings and therefore disable autonegotiation, you must be sure that the remote link is configured with compatible link settings for proper transmission. This includes support of flow control on the link.

Note Every interface on a 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA automatically supports transmission of pause frames to stop packet flow when the MSC is full. You cannot disable flow control for an interface on the 4-Port 10/100 Fast Ethernet SPA or 2-Port 10/100/1000 Gigabit Ethernet SPA. Therefore, flow control support is not configurable, but it is advertised during autonegotiaton.

If you disable autonegotiation, then you must be sure that the remote device is configured to support flow control because flow control is automatically enabled for all interfaces on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA.

Table 8-1 Relationship Between duplex and speed Commands

duplex Command	speed Command	Resulting System Action
duplex auto	**speed auto**	Autonegotiates both speed and duplex mode. The interface advertises capability for the following link settings: • 10 Mbps and half duplex • 10 Mbps and full duplex • 100 Mbps and half duplex • 100 Mbps and full duplex • 1000 Mbps and half duplex • 1000 Mbps and full duplex
duplex auto	**speed 10** or **speed 100** or **speed 1000**	Autonegotiates the duplex mode. The interface advertises capability for the configured speed with capability for both half-duplex or full-duplex mode. For example, if the **speed 100** command is configured with **duplex auto**, then the interface advertises the following capability: • 100 Mbps and half duplex • 100 Mbps and full duplex
duplex half or **duplex full**	**speed auto**	Autonegotiates the speed. The interface advertises capability for the configured duplex mode with capability for both 10-Mbps and 100-Mbps operation for Fast Ethernet interfaces, and 10-Mbps, 100-Mbps, and 1000-Mbps for Gigabit Ethernet interfaces. For example, if the **duplex full** command is configured with the **speed auto** command, then the interface advertises the following capability: • 10 Mbps and full duplex • 100 Mbps and full duplex • 1000 Mbps and full duplex (Gigabit Ethernet interfaces only)

Table 8-1 Relationship Between duplex and speed Commands (continued)

duplex Command	speed Command	Resulting System Action
duplex half	**speed 10**	Forces 10-Mbps and half-duplex operation, and disables autonegotiation on the interface.
duplex full	**speed 10**	Forces 10-Mbps and full-duplex operation, and disables autonegotiation on the interface.
duplex half	**speed 100**	Forces 100-Mbps and half-duplex operation, and disables autonegotiation on the interface.
duplex full	**speed 100**	Forces 100-Mbps and full-duplex operation, and disables autonegotiation on the interface.
duplex half	**speed 1000**	Forces 1000-Mbps and half-duplex operation, and disables autonegotiation on the interface (Gigabit Ethernet only).
duplex full	**speed 1000**	Forces 1000-Mbps and full-duplex operation, and disables autonegotiation on the interface (Gigabit Ethernet only).

Examples

The following example specifies advertisement of half-duplex support only, and either 10-Mbps or 100-Mbps capability during autonegotiation for the second interface (port 1) on the SPA located in the bottom subslot (1) of the MSC that is installed in slot 2 of the Cisco 7304 router:

```
Router# configure terminal
Router(config)# interface fastethernet 2/1/1
Router(config-if)# duplex half
Router(config-if)# speed auto
```

With this configuration, the interface advertises the following capabilities during autonegotiation:

- 10 Mbps and half duplex
- 100 Mbps and half duplex

Note Recall that flow control support is always advertised when autonegotiation is enabled.

Related Commands

Command	Description
speed	Configures the speed for a Fast Ethernet interface.
interface fastethernet	Selects a particular Fast Ethernet interface for configuration.
interface gigabitethernet	Selects a particular Gigabit Ethernet interface for configuration.
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.

Command	Description
show interfaces fastethernet	Displays information about the Fast Ethernet interfaces.
show interfaces gigabitethernet	Displays information about the Gigabit Ethernet interfaces.

framing (T1/E1 controller)

To select the frame type for the T1 or E1 data line, use the **framing** command in controller configuration mode.

T1 Lines

framing {**sf** | **esf**}

E1 Lines

framing {**crc4** | **no-crc4**} [**australia**]

T1 Shared Port Adapter

framing {**sf** | **esf**}

no framing {**sf** | **esf**}

E1 Shared Port Adapter

framing {**crc4** | **no-crc4** | **unframed**}

no framing {**crc4** | **no-crc4** | **unframed**}

Syntax Description

sf	Specifies super frame as the T1 frame type. This is the default for T1.
esf	Specifies extended super frame as the T1 frame type.
crc4	Specifies CRC4 frame as the E1 frame type. This is the default for E1.
no-crc4	Specifies no CRC4 frame as the E1 frame type.
australia	(Optional) Specifies the E1 frame type used in Australia.

Defaults

sf (for a T1 line)

crc4 (for an E1 line)

Command Modes

Controller configuration

Command History

Release	Modification
12.2S	This command was integrated into Cisco IOS Release 12.2S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

Use this command in configurations in which the router or access server is intended to communicate with T1 or E1 fractional data lines. The service provider determines the framing type required for your T1/E1 circuit.

To return to the default mode on a T1/E1 SPA, use the **no** form of this command. This command does not have a **no** form for other T1/E1 lines.

Examples

The following example selects extended super frame as the T1 frame type:

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

Related Commands

Command	Description
cablelength	Specifies the distance of the cable from the routers to the network equipment.
linecode	Selects the linecode type for T1 or E1 line.

framing (T3 controller)

To choose framing mode on a T3 port, use the **framing** command in controller configuration mode. To return to the default mode, use the **no** form of this command.

T3 Controllers

framing {**c-bit** | **m23**}

no framing

T3/E3 Shared Port Adapters and the Cisco 7500 Series Routers with CT3IP Port Adapter

framing {**c-bit** | **m23** | **auto-detect**}

no framing

Syntax Description

auto-detect	Specifies detection of the framing type that it receives from the far-end equipment.
c-bit	Specifies that C-bit framing is used as the T3 framing type.
m23	Specifies that M23 framing is used as the T3 framing type.

Defaults

c-bit (for T3 and most T3 controllers)

auto-detect (for the CT3IP in a Cisco 7500 series router)

Command Modes

Controller configuration

Command History

Release	Modification
11.1CA	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms for T3: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.
12.2S	This command was integrated into Cisco IOS Release 12.2S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

Use the **framing** command to set the framing mode on the T3/E3 port.

Examples

The following example sets the framing mode on a T3 interface.

```
Router# configure terminal
Router(config)# controller t1 6/0/0
Router(config-controller)# framing m23
```

The following example sets the framing for the CT3IP to C-bit:

```
Router(config)# controller t3 9/0/0
Router(config-controller)# framing c-bit
```

Related Commands

Command	Description
controller	Configures a T1, E1, or T3 controller and enters controller configuration mode.
show controller	Displays controller configuration.

framing (T3/E3 interface)

To choose framing mode on a T3 port, use the **framing** command in interface configuration mode. To return to the default mode, use the **no** form of this command.

framing {**bypass** | **c-bit** | **m13**}

no framing {**bypass** | **c-bit** | **m13**}

To choose framing mode on an E3 port, use the **framing** command in interface configuration mode. To return to the default mode, use the **no** form of this command.

framing {**bypass** | **g751** | **g832**}

no framing {**bypass** | **g751** | **g832**}

Syntax Description

bypass	Bypasses DS3 framing mode.
c-bit	Enables DS3 C-bit framing mode.
m13	Enables DS3 M13 framing mode.
g751	Enables E3 G.751 framing mode.
g832	Enables E3 G.832 framing mode.

Defaults

T3: C-bit framing

E3: g751 framing

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.
12.2S	This command was integrated into Cisco IOS Release 12.2S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router. The **g832** keyword option was added to the command.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

Use the **framing** command to set the framing mode on the T3 port.

Examples

The following example sets the framing mode on the first port on slot 5.

```
Router# configure terminal
Router(config)# interface serial 5/0/0
```

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

Related Commands

Command	Description
show controller serial	Displays serial line statistics.

hw-module subslot reload

To restart a shared port adapter (SPA) and its interfaces, use the **hw-module subslot reload** command in privileged EXEC configuration mode. The command does not have a **no** form.

hw-module subslot *slot*/*subslot* **reload**

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/subslot	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(25)S3	This command was introduced.

Usage Guidelines

The **hw-module subslot reload** command stops and starts power to the SPA. This command is useful when you want to restart all interfaces on a SPA.

The command is recommended to restart a SPA under some of the following conditions:

- To restart a SPA after it has been powered off because of a failure.
- To recover from corrupted messaging between the route processor (RP) and the MSC.

Examples

The following command power cycles the SPA in subslot 2 of the MSC installed in chassis slot 13:

```
Router# hw-module subslot 13/2 reload

SLOT 13/0: 00:27:08: %SCC-2-PROTO_HW: Module (13/2/-1) is a registered proto-type for
Cisco Lab use only, and not certified for live network operation.
```

Related Commands

Command	Description
show hw-module subslot oir	Displays the operational status of a SPA.

interface

To configure an interface type and enter interface configuration mode, use the **interface** command in global configuration mode.

Standard Syntax

interface *type number* [*name-tag*]

Analysis Module Network Module

interface analysis-module *slot*/*unit*

Content Engine Network Module

interface content-engine *slot*/*unit*

Cisco 7200 Series and Cisco 7500 Series with a Packet over SONET Interface Processor

interface *type slot*/*port*

Cisco 7200 VXR Router used as a Router Shelf in a Cisco AS5800 Universal Access Server

interface *type router-shelf*/*slot*/*port*

Cisco 7500 Series with Channelized T1 or E1

interface serial *slot*/*port*:*channel-group*

Cisco 7500 Series with Ports on VIP Cards

interface *type slot*/*port-adapter*/*port*

To configure a subinterface, use this form of the **interface** global configuration command.

Cisco 7200 Series

interface *type slot*/*port*.*subinterface-number* [**multipoint** | **point-to-point**]

Cisco 7500 Series

interface *type slot*/*port-adapter*.*subinterface-number* [**multipoint** | **point-to-point**]

Cisco 7500 Series with Ports on VIP Cards

interface *type slot*/*port-adapter*/*port*.*subinterface-number* [**multipoint** | **point-to-point**]

Shared Port Adapters

interface *type slot*/*subslot*/*port*[.*subinterface-number*]

Syntax Description

type	Type of interface to be configured. See Table 8-2.
number	Port, connector, or interface card number. On Cisco 4700 series routers, specifies the network interface module (NIM) or network processor module (NPM) number. The numbers are assigned at the factory at the time of installation or when added to a system, and can be displayed with the **show interfaces** command.
name-tag	(Optional) Specifies the logic name to identify the server configuration so that multiple server configurations can be entered. This optional argument is for use with the Redundant Link Manager (RLM) feature.
slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
/*unit*	Number of the daughter card on the network module. For analysis module and content engine (CE) network modules, always use 0.
/*port*	Port or interface number. Refer to the appropriate hardware manual for port information. For SPAs, refer to the corresponding "Specifying the Interface Address on a SPA" topics in the platform-specific SPA software configuration guide.
router-shelf	Router shelf number in a Cisco AS5800 universal access server. Refer to the appropriate hardware manual for router shelf information.
:*channel-group*	Channel group number. Cisco 7500 series routers specify the channel group number in the range of 0 to 4 defined with the **channel-group** controller configuration command.
/*port-adapter*	Port adapter number. Refer to the appropriate hardware manual for information about port adapter compatibility.
.*subinterface-number*	Subinterface number in the range 1 to 4294967293. The number that precedes the period (.) must match the number to which this subinterface belongs.
multipoint | **point-to-point**	(Optional) Specifies a multipoint or point-to-point subinterface. There is no default.

Defaults

No interface types are configured.

Command Modes

Global configuration

Note To use this command with the RLM feature, you must be in interface configuration mode.

Command History

Release	Modification
10.0	This command was introduced for the Cisco 7000 series routers.
11.0	This command was implemented on the Cisco 4000 series routers.
12.0(3)T	The optional *name-tag* argument was added for the RLM feature.
12.2(13)T	The **content-engine** keyword was added.
12.2(15)T	The **lex** keyword was removed because the LAN Extension feature is no longer available in Cisco IOS software.
12.3(7)T	The **analysis-module** keyword was added.
12.2(20)S2	This command was implemented for SPAs on the Cisco 7304 router.

Usage Guidelines

This command does not have a **no** form.

Subinterfaces can be configured to support partially meshed Frame Relay networks. Refer to the "Configuring Serial Interfaces" chapter in the *Cisco IOS Interface and Hardware Component Configuration Guide*.

Table 8-2 displays the keywords that represent the types of interfaces that can be configured with the **interface** command. Replace the *type* argument with the appropriate keyword from the table.

Table 8-2 Interface Type Keywords

Keyword	Interface Type
analysis-module	Analysis module interface. The analysis module interface is a Fast Ethernet interface on the router that connects to the internal interface on the Network Analysis Module (NAM). This interface cannot be configured for subinterfaces or for speed, duplex mode, and similar parameters. See the command-line interface (CLI) help for a list of valid parameters.
async	Port line used as an asynchronous interface.
atm	ATM interface.
bri	ISDN BRI. This interface configuration is propagated to each of the B channels. B channels cannot be individually configured. The interface must be configured with dial-on-demand commands in order for calls to be placed on that interface.
content-engine	Content engine (CE) network module interface. The CE network module interface cannot be configured for subinterfaces or for speed, duplex mode, and similar parameters. See the command-line interface (CLI) help for a list of valid parameters. The **content-engine** keyword was formerly documented as the **interface content-engine** command.
dialer	Dialer interface.
ethernet	Ethernet IEEE 802.3 interface.

Table 8-2 Interface Type Keywords (continued)

Keyword	Interface Type
fastethernet	100-Mbps Ethernet interface. The **fastethernet** keyword was formerly documented as the **interface fastethernet** command.
fddi	FDDI interface.
gigabitethernet	1000-Mbps Ethernet interface. The **gigabitethernet** keyword was formerly documented as the **interface gigabitethernet** command.
group-async	Master asynchronous interface. The **group-async** keyword was formerly documented as the **interface group-async** command.
hssi	High-Speed Serial Interface (HSSI).
loopback	Software-only loopback interface that emulates an interface that is always up. It is a virtual interface supported on all platforms. The *number* argument is the number of the loopback interface that you want to create or configure. There is no limit on the number of loopback interfaces that you can create.
null	Null interface.
port-channel	Port channel interface. The **port-channel** keyword was formerly documented as the **interface port-channel** command.
pos	Packet OC-3 interface on the Packet-over-SONET (POS) interface processor. The **pos** keyword was formerly documented as the **interface pos** command.
sdcc	Section data communications channel interface.
serial	Serial interface.
switch	Switch interface.
tokenring	Token Ring interface.
tunnel	Tunnel interface; a virtual interface. The *number* argument is the number of the tunnel interface that you want to create or configure. There is no limit on the number of tunnel interfaces that you can create.
vg-anylan	100VG-AnyLAN port adapter. The **vg-anylan** keyword was formerly documented as the **interface vg-anylan** command.

Using the analysis-module Keyword

The analysis module interface is used to access the NAM console for the initial configuration. After the NAM IP parameters are configured, the analysis module interface is typically used only during NAM software upgrades and while troubleshooting if the NAM Traffic Analyzer is inaccessible.

Visible only to the Cisco IOS software on the router, the analysis module interface is an internal Fast Ethernet interface on the router that connects to the internal NAM interface. The analysis module interface is connected to the router's Peripheral Component Interconnect (PCI) backplane, and all configuration and management of the analysis module interface must be performed from the Cisco IOS CLI.

Using the group-async Keyword

Using the **group-async** keyword, you create a single asynchronous interface with which other interfaces are associated as members using the **group-range** command. This one-to-many configuration allows you to configure all associated member interfaces by entering one command on the group master interface, rather than entering this command on each individual interface. You can create multiple group masters on a device; however, each member interface can be associated only with one group.

Using the port-channel Keyword

The Fast EtherChannel feature allows multiple Fast Ethernet point-to-point links to be bundled into one logical link to provide bidirectional bandwidth of up to 800 Mbps. You can configure the port-channel interface as you would any Fast Ethernet interface.

After you create a port-channel interface, you assign Fast Ethernet interfaces (up to four) to it. For information on how to assign a Fast Ethernet interface to a port-channel interface, refer to the **channel-group** interface configuration command.

Caution The port-channel interface is the routed interface. Do not enable Layer 3 addresses on the physical Fast Ethernet interfaces. Do not assign bridge groups on the physical Fast Ethernet interfaces because it creates loops. Also, you must disable spanning tree.

Caution With Release 11.1(20)CC, the Fast EtherChannel supports Cisco Express Forwarding (CEF) and distributed Cisco Express Forwarding (dCEF). We recommend that you clear all explicit **ip route-cache distributed** commands from the Fast Ethernet interfaces before enabling dCEF on the port-channel interface. Clearing the route cache gives the port-channel interface proper control of its physical Fast Ethernet links. When you enable CEF/dCEF globally, all interfaces that support CEF/dCEF are enabled. When CEF/dCEF is enabled on the port-channel interface, it is automatically enabled on each of the Fast Ethernet interfaces in the channel group. However, if you have previously disabled CEF/dCEF on the Fast Ethernet interface, CEF/dCEF is not automatically enabled. In this case, you must enable CEF/dCEF on the Fast Ethernet interface.

As you work with the **port-channel** keyword, consider the following points:

- Currently, if you want to use the Cisco Discovery Protocol (CDP), you must configure it only on the port-channel interface and not on the physical Fast Ethernet interface.
- If you do not assign a static MAC address on the port-channel interface, the Cisco IOS software automatically assigns a MAC address. If you assign a static MAC address and then later remove it, Cisco IOS software automatically assigns a MAC address.

Using the vg-anylan Keyword

The 100VG-AnyLAN port adapter provides a single interface port that is compatible with and specified by IEEE 802.12. The 100VG-AnyLAN port adapter provides 100 Mbps over Category 3 or Category 5 unshielded twisted-pair (UTP) cable with RJ-45 terminators, and supports IEEE 802.3 Ethernet packets.

You configure the 100VG-AnyLAN port adapter as you would any Ethernet or Fast Ethernet interface. The 100VG-AnyLAN port adapter can be monitored with the IEEE 802.12 Interface MIB.

Examples

Serial Interface Example

The following example shows how to configure serial interface 0 with PPP encapsulation:

```
Router(config)# interface serial 0
```

```
Router(config-if)# encapsulation ppp
```

Loopback Interace Example

The following example shows how to enable loopback mode and assigns an IP network address and network mask to the interface. The loopback interface established here will always appear to be up.

```
Router(config)# interface loopback 0
Router(config-if)# ip address 10.108.1.1 255.255.255.0
```

Cisco 7500 Series Router Ethernet Interface Processor Example

The following example shows how to configure Ethernet port 4 on the Ethernet Interface Processor (EIP) in slot 2 on the Cisco 7500 series router:

```
Router(config)# interface ethernet 2/4
```

Cisco 7500 Series Router Token Ring Interface Example

The following example shows how to configure the Token Ring interface processor in slot 1 on port 0 of a Cisco 7500 series router:

```
Router(config)# interface tokenring 1/0
```

Network Analysis Module Interface Example

The following example configures an analysis module interface when the NAM router is in router slot 1:

```
Router(config)# interface analysis-module 1/0
```

Content Engine Network Module Interface Example

The following example configures an interface for a content engine network module in slot 1:

```
Router(config)# interface content-engine 1/0
```

Cisco 4700 Series Router Fast Ethernet Interface Example

The following example shows how to configure Fast Ethernet interface 0 for standard ARPA encapsulation (the default setting) on a Cisco 4700 series router:

```
Router(config)# interface fastethernet 0
```

Gigabit Ethernet Interface Example

The following example shows how to configure the Gigabit Ethernet interface for slot 0, port 0:

```
Router(config)# interface gigabitethernet 0/0
```

Asynchronous Group Master Interface Example

The following example shows how to define asynchronous group master interface 0:

```
Router(config)# interface group-async 0
```

Port Channel Interface Example

The following example shows how to create a port-channel interface with a channel group number of 1 and adds two Fast Ethernet interfaces to port-channel 1:

```
Router(config)# interface port-channel 1
Router(config-if)# ip address 10.1.1.10 255.255.255.0
Router(config-if)# exit
Router(config)# interface fastethernet 1/0/0
Router(config-if)# channel-group 1
Router(config-if)# exit
Router(config)# interface fastethernet 4/0/0
Router(config-if)# channel-group 1
```

Packet over SONET Interface Example

The following example shows how to specify the single Packet OC-3 interface on port 0 of the POS OC-3 port adapter in slot 2:

```
Router(config)# interface pos 2/0
```

100VG-AnyLAN Interface Example

The following example shows how to specify the 100VG-AnyLAN port adapter in the first port adapter in slot 1:

```
Router(config)# interface vg-anylan 1/0/0
```

Frame Relay Subinterface Example

The following example shows how to configure a partially meshed Frame Relay network. In this example, subinterface serial 0.1 is configured as a multipoint subinterface with two associated Frame Relay permanent virtual connections (PVCs), and subinterface serial 0.2 is configured as a point-to-point subinterface.

```
Router(config)# interface serial 0
Router(config-if)# encapsulation frame-relay
Router(config-if)# exit
Router(config)# interface serial 0/0.1 multipoint
Router(config-if)# ip address 10.108.10.1 255.255.255.0
Router(config-if)# frame-relay interface-dlci 42 broadcast
Router(config-if)# frame-relay interface-dlci 53 broadcast
Router(config-if)# exit
Router(config)# interface serial 0/0.2 point-to-point
Router(config-if)# ip address 10.108.11.1 255.255.255.0
Router(config-if)# frame-relay interface-dlci 59 broadcast
```

T1 Serial Interface Example

The following example shows how to configure circuit 0 of a T1 link for PPP encapsulation:

```
Router(config)# controller t1 4/1
Router(config-controller)# circuit 0 1
Router(config-controller)# exit
Router(config)# interface serial 4/1:0
Router(config-if)# ip address 10.108.13.1 255.255.255.0
Router(config-if)# encapsulation ppp
```

SDCC Interface on a POS Shared Port Adapter Example

The following example configures the first interface (port 0) as a section data communications channel (SDCC) interface on a POS SPA, where the SPA is installed in the top subslot (0) of the MSC, and the MSC is installed in slot 4 of the Cisco 7304 router:

```
Router(config)# interface sdcc 4/3/0
Router(config-if)# ip address 10.1.9.2 255.255.255.0
Router(config-if)# logging event link-status
Router(config-if)# load-interval 30
Router(config-if)# no keepalive
Router(config-if)# no fair-queue
Router(config-if)# no cdp enable
```

Shared Port Adapter Interface Example

The following example configures the second interface (port 1) on a 4-Port 10/100 Fast Ethernet SPA for standard ARPA encapsulation (the default setting), where the SPA is installed in the bottom subslot (1) of the MSC, and the MSC is installed in slot 2 of the Cisco 7304 router:

```
Router(config)# interface fastethernet 2/1/1
```

Related Commands

Command	Description
channel-group	Defines the timeslots that belong to each T1 or E1 circuit.
channel-group (Fast EtherChannel)	Assigns a Fast Ethernet interface to a Fast EtherChannel group.
clear interface	Resets the hardware logic on an interface.
controller	Configures an E1, J1, T1, or T3 controller and enters controller configuration mode.
group-range	Creates a list of asynchronous interfaces that are associated with a group interface on the same device.
mac-address	Sets the MAC layer address.
ppp	Starts an asynchronous connection using PPP.
show controllers content-engine	Displays controller information for CE network modules.
show interfaces	Displays information about interfaces.
show interfaces content-engine	Displays basic interface configuration information for a CE network module.
shutdown (RLM)	Shuts down all of the links under the RLM group.
slip	Starts a serial connection to a remote host using SLIP.

loopback (T3/E3 interface)

To loopback at various points in the transmit and receive path, use the **loopback** command in interface configuration mode. To stop the loopback, use the **no** form of this command.

PA-T3 Port Adapter

loopback {**dte** | **local** | **network** {**line** | **payload**} | **remote**}

no loopback

PA-E3 Port Adapter

loopback {**dte** | **local** | **network** {**line** | **payload**}}

no loopback

T3/E3 Shared Port Adapters

loopback {**dte** | **local** | **dual** | **network** {**line** | **payload**} | **remote**}

no loopback {**dte** | **local** | **dual** | **network** {**line** | **payload**} | **remote**}

Syntax Description

dte	Loopback after the line interface unit (LIU) towards the terminal.
local	Loopback after going through the framer toward the terminal.
dual	Sets both local loopback and network line loopback.
network {**line** | **payload**}	Sets the loopback toward the network before going through the framer (**line**) or after going through the framer (**payload**).
remote	Sends FEAC to set remote in loopback.

Defaults

No loopback by default.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.
11.3	This command was introduced.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms for E3: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.
12.2S	This command was integrated into Cisco IOS Release 12.2S.

Release	Modification
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router. The **dual** keyword was added.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

Use the **loopback** command to diagnose problems on the local port, between the framer and the line interface unit (LIU) level.

Examples

The following example creates a loopback on slot 5, bay 0 after the LIU towards the terminal.

```
Router# configure terminal
Router(config)# interface serial 5/0/0
Router(config-if)# loopback dte
```

loopback driver

To enable internal loopback at the PHY device or transceiver level on a Gigabit Ethernet interface, use the **loopback driver** command in interface configuration mode. To disable loopback, use the **no** form of this command.

loopback driver

no loopback driver

Syntax Description

driver	Enables internal loopback at the PHY device on the interface.

Defaults

No default behavior or values

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.
12.2 S	This command was integrated into Cisco IOS Release 12.2 S.
12.2(20)S2	This command was implemented on the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Usage Guidelines

You can use the **loopback driver** and **loopback mac** interface configuration commands with the 2-Port 10/100/1000 Gigabit Ethernet SPA. These commands do not apply to the 4-Port 10/100 Fast Ethernet SPA.

To properly enable internal loopback, you must disable autonegotiation.

Examples

The following example configures the second interface (port 1) on a 2-Port 10/100/1000 Gigabit Ethernet SPA to loop data back at the PHY device, where the SPA is installed in the bottom subslot (1) of the MSC, and the MSC is installed in slot 2 of the Cisco 7304 router. The **no negotiation auto** interface configuration command disables autonegotiation for a fiber interface:

```
Router(config)# interface gigabitethernet 2/1/1
Router(config-if)# no negotiation auto
Router(config-if) loopback driver
```

Related Commands

Command	Description
loopback mac	Enables internal loopback at the MAC device on an interface.
show interfaces gigabitethernet	Displays information about the Gigabit Ethernet interfaces.

loopback mac

To enable internal loopback at the MAC device on a Gigabit Ethernet interface, use the **loopback mac** command in interface configuration mode. To disable loopback, use the **no** form of this command.

loopback mac

no loopback mac

Syntax Description

mac	Enables internal loopback at the MAC device on the interface.

Defaults

No default behavior or values

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.
12.2 S	This command was integrated into Cisco IOS Release 12.2 S.
12.2(20)S2	This command was implemented on the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Usage Guidelines

You can use the **loopback mac** and **loopback driver** interface configuration commands with the 2-Port 10/100/1000 Gigabit Ethernet SPA. These commands do not apply to the 4-Port 10/100 Fast Ethernet SPA.

To properly enable internal loopback, you must disable autonegotiation.

Examples

The following example configures the second interface (port 1) on a 2-Port 10/100/1000 Gigabit Ethernet SPA to loop data back at the MAC device, where the SPA is installed in the bottom subslot (1) of the MSC, and the MSC is installed in slot 2 of the Cisco 7304 router. The **no negotiation auto** interface configuration command disables autonegotiation for a fiber interface:

```
Router(config)# interface gigabitethernet 2/1/1
Router(config-if)# no negotiation auto
Router(config-if) loopback mac
```

Related Commands

Command	Description
loopback driver	Enables internal loopback at the PHY device or transceiver level on an interface.
show interfaces gigabitethernet	Displays information about the Gigabit Ethernet interfaces.

mac-address

To modify the default MAC address of an interface to some user-defined address, use the **mac-address** command in interface configuration mode. To return to the default MAC address on the interface, use the **no** form of this command.

mac-address *ieee-address*

no mac-address *ieee-address*

Syntax Description

ieee-address	48-bit IEEE MAC address written as a dotted triple of four-digit hexadecimal numbers.

Defaults

The interface uses a default MAC address that is derived from the base address stored in the electrically erasable programmable read-only memory (EEPROM) on the backplane of the Cisco 7304 router.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2 S	This command was integrated into Cisco IOS Release 12.2 S.
12.2(20)S2	This command was implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Usage Guidelines

Be sure that no other interface on the network is using the MAC address that you assign.

Examples

The following example changes the default MAC address on the interface to 1111.2222.3333:

```
Router# configure terminal
Router(config)# interface fastethernet 2/1/1
Router(config-if)# mac-address 1111.2222.3333
```

Related Commands

Command	Description
show interfaces fastethernet	Displays information about the Fast Ethernet interfaces.
show interfaces gigabitethernet	Displays information about the Gigabit Ethernet interfaces.

mdl

To configure the Maintenance Data Link (MDL) message defined in the ANSI T1.107a-1990 specification, use the **mdl** command in controller configuration mode.

mdl [**string** {**eic** | **fic** | **generator** | **lic** | **pfi** | **port** | **unit**}*string*] | [**transmit** {**idle-signal** | **path** | **test-signal**}]

no mdl [**string** {**eic** | **fic** | **generator** | **lic** | **pfi** | **port** | **unit**}*string*] | [**transmit** {**idle-signal** | **path** | **test-signal**}]

Syntax Description

string eic *string*	Specifies the Equipment Identification Code; can be up to 10 characters.
string fic *string*	Specifies the Frame Identification Code; can be up to 10 characters.
string generator *string*	Specifies the Generator number string sent in the MDL Test Signal message; can be up to 38 characters.
string lic *string*	Specifies the Location Identification Code; can be up to 11 characters.
string pfi *string*	Specifies the Path Facility Identification Code sent in the MDL Path message; can be up to 38 characters.
string port *string*	Specifies the Port number string sent in the MDL Idle Signal message; can be up to 38 characters.
string unit *string*	Specifies the Unit Identification Code; can be up to 6 characters.
transmit idle-signal	Enables MDL Idle-Signal message transmission.
transmit path	Enables MDL Path message transmission.
transmit test-signal	Enables MDL Test-Signal message transmission.

Defaults

No default behavior or values

Command Modes

Controller configuration

Command History

Release	Modification
11.3	This command was introduced.
12.1(13)EX	This command was introduced on the Cisco 7304 router.
12.2(11)YT	This command was integrated into Cisco IOS Release 12.2(11)YT and implemented on the following platforms: Cisco 2650XM, Cisco 2651XM, Cisco 2691, Cisco 3660 series, Cisco 3725, and Cisco 3745 routers.
12.2(15)T	This command was integrated into Cisco IOS Release 12.2(15)T.
12.2(18)S	This command was introduced on Cisco 7304 routers running Cisco IOS Release 12.2 S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

Use the **mdl** command to send msgs in maintainance data link in T3 c-bit framing mode.

Examples

The following example sends a test signal on the maintenance data link.

```
Router# configure terminal
Router(config)#controller t3 5/0/0
Router(config-controller)#mdl transmit test-signal
```

Related Commands

Command	Description
controller	Configures a T1, E1, or T3 controller and enters controller configuration mode.
show controllers serial	Displays serial line statistics.

media-type (Gigabit Ethernet)

To specify the physical connection on a Gigabit Ethernet interface, use the **media-type** command in interface configuration mode. To restore the default value, use the **no** form of this command.

media-type {**rj45** | **gbic**}

no media-type {**rj45** | **gbic**}

Syntax Description

rj45	Specifies an RJ-45 physical connection. This is the default.
gbic	Specifies a Gigabit Interface Converter (GBIC) or small-form factor pluggable (SFP) physical connection for fiber media.

Defaults

rj45

Command Modes

Interface configuration

Command History

Release	Modification
12.1 E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(20)S2	This command was implemented on the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Usage Guidelines

Use the **media-type** interface configuration command to modify the default physical media connection type from **rj45** to **gbic**, to configure a Gigabit Ethernet interface to support fiber media using a GBIC or small form-factor pluggable (SFP) optical transceiver.

RJ-45 is the only media type supported by the 4-Port 10/100 Fast Ethernet SPA on the Cisco 7304 router is RJ-45, so the **media-type** command does not apply.

Examples

The following example configures the second interface (port 1) on a 2-Port 10/100/1000 Gigabit Ethernet SPA for a fiber SFP, where the SPA is installed in the bottom subslot (1) of the MSC, and the MSC is installed in slot 2 of the Cisco 7304 router:

```
Router(config)# interface gigabitethernet 2/1/1
Router(config-if) media-type gbic
```

Related Commands

Command	Description
show interfaces gigabitethernet	Displays information about the Gigabit Ethernet interfaces.

negotiation

To enable advertisement of speed and duplex mode, and flow control on a Gigabit Ethernet interface, use the **negotiation** command in interface configuration mode. To disable automatic negotiation, use the **no negotiation auto** command.

negotiation {**forced** | **auto**}

no negotiation auto

Syntax Description

forced	Disables flow control and configures the Gigabit Ethernet interface in 1000/full-duplex mode. **Note** This keyword is not supported on the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.
auto	Enables the autonegotiation protocol to configure the speed, duplex, and automatic flow control of the Gigabit Ethernet interface.

Defaults

negotiation auto

Command Modes

Interface configuration

Command History

Release	Modification
11.1 CC	This command was introduced.
12.0(7)S, 12.0(6)T	The **forced** keyword was added.
12.1(3a)E	The command was integrated into Cisco IOS Release 12.1 E and implemented on the Cisco 7200-I/O-GE+E controller.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2(20)S2	This command was implemented on the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router. The **forced** keyword is not supported.

Usage Guidelines

The **negotiation** command is applicable to the Gigabit Ethernet interface of the Cisco 7200-I/O-GE+E and interfaces on the 2-Port 10/100/1000 Gigabit Ethernet SPA that are using fiber media. The **negotiation auto** command is used instead of the **duplex** and **speed** commands (which are used on Ethernet and Fast Ethernet interfaces, and interfaces on the 2-Port 10/100/1000 Gigabit Ethernet SPA that are using RJ-45 media) to automatically configure the duplex and speed settings of the interfaces.

The **negotiation forced** command is used to configure the Gigabit Ethernet interface of the Cisco 7200-I/O-GE+E to be 1000/full-duplex only and to disable flow control. The **negotiation forced** command is not supported by the 2-Port 10/100/1000 Gigabit Ethernet SPA.

The Gigabit Ethernet interface of the Cisco 7200-I/O-GE+E and the interfaces on the 2-Port 10/100/1000 Gigabit Ethernet SPA that are using fiber media are restricted to 1000 Mbps/full duplex only. Autonegotiation advertises and negotiates only to these values.

Examples

The following example enables the second interface (port 1) on a 2-Port 10/100/1000 Gigabit Ethernet SPA for autonegotiation, where the SPA is installed in the bottom subslot (1) of the MSC, and the MSC is installed in slot 2 of the Cisco 7304 router:

```
Router(config)# interface gigabitethernet 2/1/1
Router(config-if) media-type gbic
Router(config-if) negotiation auto
```

The following example disables the second interface (port 1) on a 2-Port 10/100/1000 Gigabit Ethernet SPA for autonegotiation, where the SPA is installed in the bottom subslot (1) of the MSC, and the MSC is installed in slot 2 of the Cisco 7304 router:

```
Router(config)# interface gigabitethernet 2/1/1
Router(config-if) no negotiation auto
```

Related Commands

Command	Description
show interfaces gigabitethernet	Displays information about the Gigabit Ethernet interfaces.

show c7300

To display the types and status of cards (NSEs, line cards, MSCs, and SPAs) installed in a Cisco 7300 series router, use the **show c7300** command in privileged EXEC configuration mode.

show c7300

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(9)EX	This command was introduced.
12.2(18)S	This command was integrated into Cisco IOS Release 12.2 S on the Cisco 7300 series routers.
12.2(20)S2	The command output was modified to provide status on MSCs and SPAs on the Cisco 7304 router.

Usage Guidelines

This command displays the types and status of cards (NSEs and line cards) installed in a Cisco 7300 series router. This command also displays whether your system is in compliance with line card configuration guidelines.

On the Cisco 7304 router, the command provides information about any modular services cards (MSCs) or shared port adapters (SPAs) that are installed.

For NSEs and line cards, empty slots are not displayed in the output. However, for SPAs, several status values are reported, including an empty subslot, which is reported as “missing.”

Examples

The following example displays information about a Cisco 7304 router with an NSE-100, MSC-100s, and 4-Port 10/100 Fast Ethernet SPAs:

```
Router# show c7300
Slot      Card Type           Status          Insertion time
----      ---------           ------          --------------
0,1       NSE100              Active          00:45:29 ago
2         7304-MSC-100        Active          00:44:36 ago
3         7304-MSC-100        Active          00:44:36 ago
4         7304-MSC-100        Active          00:44:36 ago
5         7304-MSC-100        Active          00:14:39 ago

The FPGA versions for the cards listed above are current

Shared Port Adapter information:
Slot/Subslot  SPA Type            Status          Insertion time
------------  --------            ------          --------------
```

```
2/0          SPA-4FE-7304       ok              00:44:36 ago
2/1          SPA-4FE-7304       ok              00:44:36 ago
3/0          SPA-4FE-7304       ok              00:44:35 ago
3/1          not present        missing         never
4/0          SPA-4FE-7304       ok              00:44:35 ago
4/1          SPA-4FE-7304       ok              00:44:35 ago
5/0          SPA-4FE-7304       ok              00:14:36 ago
5/1          SPA-4FE-7304       ok              00:14:36 ago

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

Table 8-3 provides a description for each of the possible status fields for SPAs.

Table 8-3 SPA Status Field Descriptions

Status Field for SPAs	Description
booting	SPA is initializing.
failed	SPA is powered off due to five automatic recovery failures.
FW mismatch	An FPGA version mismatch with the Cisco IOS software has been detected for the SPA.
missing	SPA is not present in the MSC subslot.
not allowed online	SPA is not supported.
ok	SPA is operational.
stopped	SPA is deactivated by the **hw-module subslot stop** command.
unknown	SPA is in unrecognizable state.

Related Commands

Command	Description
show diag	Displays hardware information for any slot or the chassis.
show version[1]	Displays 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. Displays the configuration of the ROM monitor.

1. Refer to the Cisco IOS Release 12.2 command reference and master index publications.

show controllers fastethernet

To display Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables, use the **show controllers fastethernet** command in privileged EXEC configuration mode.

show controllers fastethernet *slot*/*subslot*/*port* [**detail**]

Syntax Description

slot	(Optional) Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	(Optional) Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
/*port*	(Optional) Port or interface number. Refer to the appropriate hardware manual for port information. For SPAs, refer to the corresponding "Specifying the Interface Address on a SPA" topics in the platform-specific SPA software configuration guide.
detail	Specifies display of additional low-level diagnostic information.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
11.2	This command was introduced.
12.2 S	This command was integrated into Cisco IOS Release 12.2 S.
12.2(20)S2	This command was implemented on the 4-Port 10/100 Fast Ethernet SPA on the Cisco 7304 router and introduced a new address format and output.

Usage Guidelines

The output from the **show controllers fastethernet** command for the 4-Port 10/100 Fast Ethernet SPA provides several different sections of information and statistics that are organized according to the internal hardware devices and the various paths in the flow of data on the SPA. The following sections are provided:

- Interface configuration information—Table 8-4 on page 8-49
- Media Access Control (MAC) device counters—Table 8-5 on page 8-50
- Field programmable gate array (FPGA) device counters—Table 8-6 on page 8-51

- SPA carrier card counters—Table 8-7 on page 8-52
- SPA error counters—Table 8-8 on page 8-53
- MAC destination address filtering table—Table 8-9 on page 8-54
- Virtual LAN (VLAN) filtering table—Table 8-10 on page 8-55
- Platform details (including Parallel Express Forwarding [PXF] information)—Table 8-11 on page 8-56

Several areas of the output are generally useful for diagnostic tasks performed by Cisco Systems technical support personnel only.

Examples

The following is sample output from the **show controllers fastethernet** command for the first interface (port 0) on a 4-Port 10/100 Fast Ethernet SPA that is located in the top subslot (0), of the MSC that is installed in slot 4 on a Cisco 7304 router:

```
Router# show controllers fastethernet 4/0/0
Interface FastEthernet4/0/0
  Hardware is SPA-4FE-7304
  Connection mode is auto-negotiation
  Interface state is up, link is up
  Configuration is Auto Speed, Auto Duplex
  Selected media-type is RJ45
  Promiscuous mode is off, VLAN filtering is enabled
  MDI crossover status: MDI
  Auto-negotiation configuration and status:
    Auto-negotiation is enabled and is completed
    Speed/duplex is resolved to 100 Mbps, full duplex
    Advertised capabilities: 10M/HD 10M/FD 100M/HD 100M/FD Pause capable (Asymmetric)
    Partner capabilities: 10M/HD 10M/FD 100M/HD 100M/FD Pause capable
MAC counters:
  Input: packets = 15, bytes = 1776
         FIFO full/reset removed = 0, error drop = 0
  Output: packets = 18, bytes = 2622
          FIFO full/reset removed = 0, error drop = 0
  Total pause frames: transmitted = 0, received = 0
FPGA counters:
  Input: Total (good & bad) packets: 15, TCAM drops: 4
         Satisfy (host-backpressure) drops: 0, CRC drops: 0
         PL3 RERRs: 0
  Output: EOP (SPI4) errors: 0
SPA carrier card counters:
  Input: packets = 11, bytes = 1476, drops = 0
  Output: packets = 18, bytes = 2550, drops = 0
  Egress flow control status: XON
  Per bay counters:
  General errors: input = 0, output = 0
  SPI4 errors: ingress dip4 = 0, egress dip2 = 0
SPA Error counters:
  SPI4 TX out of frame error = 2 (00:02:31 ago)
  SPI4 TX Train valid error = 1 (00:02:11 ago)
  SPI4 TX DIP4 error = 1 (00:01:30 ago)
  SPI4 RX out of frame error = 1 (00:00:36 ago)
  SPI4 RX DIP2 error = 1 (00:00:13 ago)
MAC destination address filtering table:
  Table entries: Total = 512, Used = 4, Available = 508
  Index MAC destination address       Mask
  ----- ----------------------  --------------
  1     0007.0ed3.ba80           ffff.ffff.ffff
  2     ffff.ffff.ffff           ffff.ffff.ffff
```

```
  3     0100.0000.0000          0100.0000.0000
  4     0100.0ccc.cccc          ffff.ffff.ffff
VLAN filtering table:
  Number of VLANs configured on this interface = 0
  Table entries: Total = 1024, Used = 2, Available = 1022
  Index  VLAN identifier  Enabled  Tunnel
  -----  ---------------  -------  ------
  1          0              No       No
  2          0              Yes      No
Platform details:
  PXF tif number: 0x10
```

Table 8-4 describes the fields shown in the interface configuration section of the display. This section is useful for verifying the status of autonegotiation and configured parameters on the link, and the amount of traffic being handled by the interface.

Table 8-4 show controllers Command Field Descriptions—Interface Section

Field	Description
Interface	Name of the interface.
Hardware	Type of hardware.
Connection mode	Indicator of autonegotiation used to establish the connection.
Link	State of the link.
Configuration	Configuration of the speed and duplex operation on the interface.
Selected media-type	Interface port media type. RJ-45 is the only type supported on the 4-Port 10/100 Fast Ethernet SPA.
Promiscuous mode	State of promiscuous mode (on or off). When promiscuous mode is on, the SPA disables MAC destination address and VLAN filtering. When promiscuous mode is off, the SPA enables MAC destination address and VLAN filtering.
VLAN filtering	Status of ternary content addressable memory (TCAM) filtering of VLANs (enabled or disabled). By default, the SPA always enables VLAN filtering. The SPA disables VLAN filtering if the TCAM table is full, or if the SPA is operating in promiscuous mode. **Note** VLAN filtering is not enabled or disabled using any command-line interface (CLI) command.
MDI crossover status	State of the media dependent interface (MDI) for the PHY device on the specified interface. The possible values are MDI for straight-through cables or media dependent interface crossover (MDI-X) for crossover cables.
Auto-negotiation	State of autonegotiation (enabled or disabled) on the interface and its current status.
Speed/duplex is resolved to	Results of autonegotiated parameter values (speed and duplex) currently being used on the link.

Table 8-4 show controllers Command Field Descriptions—Interface Section (continued)

Field	Description
Advertised capabilities	List of the possible combinations of speed and duplex modes (in *speed*/*duplex* format) and flow control that the local interface has advertised it supports to the remote device: • For speed—10M is 10 Mbps, and 100M is 100 Mbps. • For duplex—HD is half duplex, and FD is full duplex. • For flow control—"Pause capable (Asymmetric)" means that the SPA advertises support of the PAUSE flow control bit and the ASM_DIR (asymmetric) flow control bit.
Partner capabilities	List of the possible combinations of speed and duplex modes (in *speed*/*duplex* format) and flow control that the remote device has advertised it supports to the local interface: • For speed—10M is 10 Mbps, and 100M is 100 Mbps. • For duplex—HD is half duplex, and FD is full duplex. • For flow control—"Pause capable" means that the remote device supports implementation of the PAUSE flow control bit; "Pause capable (Asymmetric)" means that the remote device supports implementation of the PAUSE flow control bit and the ASM_DIR (asymmetric) flow control bit.

Table 8-5 describes the fields shown in the MAC counters section of the display. This section is useful for verifying the status of packets processed by the MAC device for the interface. This information is useful for Cisco Systems technical support personnel.

Table 8-5 show controllers Command Field Descriptions—MAC Counters Section

Field	Description
Input: packets, bytes	Total number of packets and bytes received by the MAC device for the interface since it was activated or cleared. You can clear these counters using the **clear counters** privileged EXEC command.
Input: FIFO full/reset removed	Total number of packets removed by the MAC device due to a first-in, first-out (FIFO) overflow condition in the input buffer for the interface.
Input: error drop	Total number of input packets with errors that are dropped by the MAC device for the interface.
Output: packets, bytes	Total number of packets and bytes transmitted by the MAC device for the interface since it was activated or cleared. You can clear these counters using the **clear counters** privileged EXEC command.

Table 8-5 show controllers Command Field Descriptions—MAC Counters Section (continued)

Field	Description
Output: FIFO full/reset removed	Total number of packets removed by the MAC device due to a first-in, first-out (FIFO) overflow condition in the output buffer for the interface.
Output: error drop	Total number of output packets with errors that are dropped by the MAC device for the interface.
Total pause frames	Total number of Ethernet 802.3x pause frames transmitted and received by the MAC device for flow control on the interface.

Table 8-6 describes the fields shown in the FPGA counters section of the display. This section is useful for verifying the status of packets processed by the FPGA device for the interface. This information is useful for Cisco Systems technical support personnel.

Table 8-6 show controllers Command Field Descriptions—FPGA Counters Section

Field	Description
Input: Total (good & bad) packets	Total number of packets received by the FPGA device in the ingress direction for the interface.
Input: TCAM drops	Total number of packets dropped by the FPGA device in the ingress direction for the interface due to a ternary content addressable memory (TCAM) lookup failure. This counter increments when the interface receives a frame with a destination MAC address or VLAN identifier that is not present in the TCAM table.
Input: Satisfy (host-backpressure) drops	Total number of packets dropped by the FPGA device in the ingress direction for the interface due to back-pressure from the MSC.
Input: CRC drops	Total number of packets dropped by the FPGA device in the ingress direction for the interface due to cyclic redundancy check (CRC) errors.
Input: PL3 RERRs	Total number of packets with errors received for the interface by the FPGA device in the ingress direction over the System Packet Interface Level 3 (SPI3) (also called PL3) path from the MAC device to the FPGA device.
Output: EOP (SPI4) errors	Total number of packets with end-of-packet (EOP) errors received by the FPGA device in the egress direction for the interface over the System Packet Interface Level 4 (SPI4) path from the MSC to the FPGA device.

Table 8-7 describes the fields shown in the SPA carrier card counters section of the display. This section is useful for verifying the status of packets processed by the MSC for the interface. This information is useful for Cisco Systems technical support personnel.

Table 8-7 show controllers Command Field Descriptions—SPA Carrier Card Counters Section

Field	Description
Input: packets, bytes, drops	Total number of packets, bytes, and packet drops that have occurred on the SPI4 path from the FPGA device to the MSC.
Output: packets, bytes, drops	Total number of packets, bytes, and packet drops that have occurred on the SPI4 path from the MSC to the FPGA device.
Egress flow control status	Status of flow control between the MSC and the Route Processor (RP). The possible values are: • XON—A control frame has been sent by the MSC to the RP to indicate that the MSC is ready to accept data. • XOFF—A control frame has been sent by the MSC to the RP to indicate congestion on the MSC. The MSC cannot accept any more data from the RP during this condition.
General errors	Total number of errors (such as parity) on the MSC in the ingress and egress direction.
SPI4 errors: ingress dip4	Total number of 4-bit Diagonal Interleaved Parity (DIP4) errors in the ingress direction on the SPI4 path from the FPGA device to the MSC. DIP4 is a parity algorithm where a 4-bit odd parity is computed diagonally over control and data words.
SPI4 errors: egress dip2	Total number of 2-bit Diagonal Interleaved Parity (DIP2) errors in the egress direction on the SPI4 path from the FPGA device to the MSC. DIP2 is a parity algorithm where a 2-bit odd parity is computed diagonally over status words.

Table 8-8 describes the fields shown in the SPA error counters section of the display. This section appears only when one of the SPI4 transmit or receive errors occurs on the interface. This information is useful for Cisco Systems technical support personnel.

Note None of the SPA SPI4 error counters appear in **show controllers fastethernet** command output until at least one of those types of SPI4 errors occurs.

All of the errors in the SPA error counters section are subject to the SPA automatic recovery process when certain thresholds are reached. For more information, see the “Understanding SPA Automatic Recovery” section on page 6-11.

Table 8-8 show controllers Command Field Descriptions—SPA Error Counters Section

Field	Description
SPI4 TX out of frame error = (*hh:mm:ss* ago)	Number of SPI4 out-of-frame errors (events) detected in the transmit direction (toward the network), from the MSC to the SPA FPGA device. The time stamp indicates how long ago (in hours:minutes:seconds) from the current system time, that the last error was detected. This error indicates a loss of synchronization between the synchronization block and the data received on the SPI4 path. When synchronization is reacquired, the error no longer occurs.
SPI4 TX Train valid error = (*hh:mm:ss* ago)	Number of times that a low-level synchronization problem was detected in the transmit direction (toward the network), from the MSC to the SPA FPGA device. The time stamp indicates how long ago (in hours:minutes:seconds) from the current system time, that the last error was detected.
SPI4 TX DIP4 error = (*hh:mm:ss* ago)	Number of 4-bit Diagonal Interleaved Parity (DIP4) errors in the transmit direction (toward the network), from the MSC to the SPA FPGA device. The time stamp indicates how long ago (in hours:minutes:seconds) from the current system time, that the last error was detected. DIP4 is a parity algorithm where a 4-bit odd parity is computed diagonally over control and data words.
SPI4 RX out of frame error = (*hh:mm:ss* ago)	Number of SPI4 out-of-frame errors (events) detected in the receive direction (from the network), from the SPA FPGA device to the MSC. The time stamp indicates how long ago (in hours:minutes:seconds) from the current system time, that the last error was detected. This error indicates a loss of synchronization between the synchronization block and the data received on the SPI4 path. When synchronization is reacquired, the error no longer occurs.
SPI4 RX DIP2 error = (*hh:mm:ss* ago)	Number of 2-bit Diagonal Interleaved Parity (DIP2) errors in the receive direction (from the network), from the SPA FPGA device to the MSC. The time stamp indicates how long ago (in hours:minutes:seconds) from the current system time, that the last error was detected. DIP2 is a parity algorithm where a 2-bit odd parity is computed diagonally over status words.

Table 8-9 describes the fields shown in the MAC destination address filtering table section of the display. This section is useful for verifying the multicast destination addresses that are in the TCAM table and permitted by the interface. This information is useful for Cisco Systems technical support personnel.

Table 8-9 show controllers Command Field Descriptions—MAC Destination Address Filtering Table Section

Field	Description
Table entries: Total, Used, Available	Total number of MAC destination address entries possible in the TCAM table for the interface, the number of table entries currently used by the interface, and the number of table entries that remain available. The 4-Port 10/100 Fast Ethernet SPA supports a 512-entry MAC filtering table for each supported interface (2048 entries total on the card).
Index	Table entry identifier.
MAC destination address	MAC destination address (multicast) permitted by the interface and used in the TCAM lookup table for packet filtering. The multicast MAC entries typically come from routing protocols [such as Open Shortest Path First (OSPF) and Enhanced IGRP (EIGRP)], and other protocols including the Hot Standby Router Protocol (HSRP). When the router reloads, three addresses appear by default in the MAC filtering table: the unicast address of the local interface, the Ethernet broadcast address, and the Ethernet multicast address.
Mask	Mask for the corresponding destination address. The SPA uses the bits that are set in the mask to look up the address in the TCAM table.

Table 8-10 describes the fields shown in the VLAN filtering table section of the display. This section is useful for verifying the VLANs that are in the TCAM table and are permitted by the interface. This information is useful for Cisco Systems technical support personnel.

Table 8-10 show controllers Command Field Descriptions—VLAN Filtering Table Section

Field	Description
Number of VLANs configured on this interface	Number of VLANs that are configured on the interface. If the number of VLANs configured on the interface is 1022 or less, then the VLAN filtering table also shows an index entry for every VLAN ID. The number of VLANs configured on the interface can be 0, while the number of used table entries reports 2, because the SPA always uses two entries to provide valid matching criteria for promiscuous mode and non-VLAN packets.
Table entries: Total, Used, Available	Total number of VLAN entries possible in the TCAM filtering table for the interface, the number of table entries currently used by the interface (two are always in use by default), and the number of table entries that remain available. The 4-Port 10/100 Fast Ethernet SPA supports a 1024-entry VLAN filtering table for each supported interface (4096 entries total on the card).
Index	Table entry identifier.
VLAN identifier	Number of the VLAN. Two VLAN ID 0 entries always appear in the table and represent the local interface port for handling of promiscuous mode and non-VLAN packets. Other VLAN entries appear in this table when VLANs are configured on the interface.

Table 8-10 show controllers Command Field Descriptions—VLAN Filtering Table Section (continued)

Field	Description
Enabled	Status of the VLAN ID for TCAM filtering, with the following possible values: • No—The entry is disabled for filtering. • Yes—The entry is enabled for filtering. The TCAM filter uses the "first-match" rule to filter packets that the SPA receives against entries in the table. The matching assessment begins at the top of the table with the VLAN ID 0 entries. **Note** The SPA always supports two VLAN ID 0 entries. The first VLAN ID 0 entry of the TCAM table is used for promiscuous mode. It has a value of "No," meaning it is disabled, whenever promiscuous mode is disabled for the interface. The second VLAN ID 0 entry is used for filtering of non-VLAN packets.
Tunnel	Status of tunneling for the interface, with the following possible values: • No—Tunneling is disabled and the SPA performs MAC destination address filtering. • Yes—Tunneling is enabled and the SPA does not perform MAC destination address filtering. **Note** If promiscuous mode is enabled, then the first VLAN ID 0 entry shows tunnel = Yes. All other VLAN ID entries show tunnel = No.

Table 8-11 describes the fields shown in the Platform details section of the display.

Table 8-11 show controllers Command Field Descriptions—Platform Details Section

Field	Description
PXF tif number	Number of the interface (in hexadecimal format) used for PXF on the network services engine (NSE) or by the Hyper Transport (HT) FPGA device on the network processing engine (NPE).

Related Commands

Command	Description
show interfaces fastethernet	Displays information about the Fast Ethernet interfaces.

show controllers gigabitethernet

To display Gigabit Ethernet interface information, transmission statistics and errors, and applicables MAC destination address and VLAN filtering tables, use the **show controllers gigabitethernet** command in privileged EXEC configuration mode.

show controllers gigabitethernet *slot*/*subslot*/*port* [**detail**]

Syntax Description

slot	(Optional) Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	(Optional) Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
/*port*	(Optional) Port or interface number. Refer to the appropriate hardware manual for port information. For SPAs, refer to the corresponding "Specifying the Interface Address on a SPA" topics in the platform-specific SPA software configuration guide.
detail	Specifies display of additional low-level diagnostic information.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
11.2	This command was introduced.
12.2 S	This command was integrated into Cisco IOS Release 12.2 S.
12.2(20)S2	This command was implemented on the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router with a new address format and output.

Usage Guidelines

The output from the **show controllers gigabitethernet** command for the 2-Port 10/100/1000 Gigabit Ethernet SPA provides several different sections of information and statistics that are organized according to the internal hardware devices and the various paths in the flow of data on the SPA. The following sections are provided:

- Interface configuration information—Table 8-12 on page 8-60
- Media Access Control (MAC) device counters—Table 8-13 on page 8-61
- Field Programmable Gate Array (FPGA) device counters—Table 8-14 on page 8-62

- SPA carrier card counters—Table 8-15 on page 8-63
- SPA error counters—Table 8-16 on page 8-64
- MAC destination address filtering table—Table 8-17 on page 8-65
- Virtual LAN (VLAN) filtering table—Table 8-18 on page 8-66
- Platform details, including Parallel Express Forwarding (PXF) information—Table 8-19 on page 8-67

Several areas of the output are generally useful for diagnostic tasks performed by technical support only.

Examples

The following is sample output from the **show controllers gigabitethernet** command for the first RJ-45 interface (port 0) in a 2-Port 10/100/1000 Gigabit Ethernet SPA located in the top subslot (0) of the MSC that is installed in slot 5 on a Cisco 7304 router. This output also shows the SPA Error counters section that appears only if one of the types of SPI4 errors occurs on the interface:

```
Router# show controllers gigabitethernet 5/0/0
Interface GigabitEthernet5/0/0
  Hardware is SPA-2GE-7304
  Connection mode is auto-negotiation
  Interface state is up, link is up
  Configuration is Auto Speed, Auto Duplex
  Selected media-type is RJ45
  Promiscuous mode is off, VLAN filtering is enabled
  MDI crossover status: MDIX
  Auto-negotiation configuration and status:
    Auto-negotiation is enabled and is completed
    Speed/duplex is resolved to 1000 Mbps, full duplex
    Advertised capabilities: 10M/HD 10M/FD 100M/HD 100M/FD 1000M/HD 1000M/FD
                             Pause capable (Asymmetric)
    Partner capabilities: 10M/HD 10M/FD 100M/HD 100M/FD 1000M/FD Pause capable
MAC counters:
  Input: packets = 0, bytes = 0
         FIFO full/reset removed = 0, error drop = 0
  Output: packets = 1, bytes = 64
          FIFO full/reset removed = 0, error drop = 0
  Total pause frames: transmitted = 0, received = 0
FPGA counters:
  Input: Total (good & bad) packets: 0, TCAM drops: 0
         Satisfy (host-backpressure) drops: 0, CRC drops: 0
         PL3 RERRs: 0
  Output: EOP (SPI4) errors: 0
SPA carrier card counters:
  Input: packets = 0, bytes = 0, drops = 0
  Output: packets = 1, bytes = 60, drops = 0
  Egress flow control status: XON
  Per bay counters:
  General errors: input = 0, output = 0
  SPI4 errors: ingress dip4 = 0, egress dip2 = 0
SPA Error counters:
  SPI4 TX out of frame error = 2 (00:02:31 ago)
  SPI4 TX Train valid error = 1 (00:02:11 ago)
  SPI4 TX DIP4 error = 1 (00:01:30 ago)
  SPI4 RX out of frame error = 1 (00:00:36 ago)
  SPI4 RX DIP2 error = 1 (00:00:13 ago)
MAC destination address filtering table:
  Table entries: Total = 1024, Used = 3, Available = 1021
  Index MAC destination address       Mask
  ----- ----------------------  --------------
  1     00b0.64ff.5aa0           ffff.ffff.ffff
```

```
  2     ffff.ffff.ffff           ffff.ffff.ffff
  3     0100.0000.0000           0100.0000.0000
VLAN filtering table:
  Number of VLANs configured on this interface = 0
  Table entries: Total = 2048, Used = 2, Available = 2046
  Index  VLAN identifier  Enabled  Tunnel
  -----  ---------------  -------  ------
  1          0             No      No
  2          0             Yes     No
Platform details:
  PXF tif number: 0x10
```

The following is sample output from the **show controllers gigabitethernet** command for the first fiber interface (port 0) in a 2-Port 10/100/1000 Gigabit Ethernet SPA located in the bottom subslot (1) of the MSC that is installed in slot 4 on a Cisco 7304 router:

```
Router# show controllers gigabitethernet 4/1/0
Interface GigabitEthernet4/1/0
  Hardware is SPA-2GE-7304
  Connection mode is auto-negotiation
  Interface state is up, link is up
  Configuration is Auto Speed, Auto Duplex
  Selected media-type is GBIC, GBIC type is 1000BaseSX
  SFP is present, LOS: no, Tx fault: no, Security check status: Pass
  Promiscuous mode is off, VLAN filtering is enabled
  MDI configuration is automatic crossover, status is MDI
  Auto-negotiation configuration and status:
    Auto-negotiation is enabled and is completed
    Speed/duplex is resolved to 1000 Mbps, full duplex
    Advertised capabilities: 1000BaseX/FD Pause capable (Asymmetric)
    Partner capabilities: 1000BaseX/FD Pause capable(Asymmetric)
MAC counters:
  Input: packets = 213, bytes = 21972
         FIFO full/reset removed = 0, error drop = 0
  Output: packets = 216, bytes = 22932
          FIFO full/reset removed = 0, error drop = 0
  Total pause frames: transmitted = 0, received = 0
FPGA counters:
  Input: Total (good & bad) packets: 213, TCAM drops: 183
         Satisfy (host-backpressure) drops: 0, CRC drops: 0
         PL3 RERRs: 0
  Output: EOP (SPI4) errors: 0
SPA carrier card counters:
  Input: packets = 30, bytes = 10140, drops = 0
  Output: packets = 216, bytes = 22068, drops = 0
  Egress flow control status: XON
  Per bay counters:
  General errors: input = 0, output = 0
  SPI4 errors: ingress dip4 = 0, egress dip2 = 0
MAC destination address filtering table:
  Table entries: Total = 1024, Used = 4, Available = 1020
  Index MAC destination address       Mask
  ----- ----------------------  --------------
  1     0007.0ed3.ba88           ffff.ffff.ffff
  2     ffff.ffff.ffff           ffff.ffff.ffff
  3     0100.0000.0000           0100.0000.0000
  4     0100.0ccc.cccc           ffff.ffff.ffff
VLAN filtering table:
  Number of VLANs configured on this interface = 0
  Table entries: Total = 2048, Used = 2, Available = 2046
  Index  VLAN identifier  Enabled  Tunnel
  -----  ---------------  -------  ------
  1          0             No      No
```

```
  2          0             Yes     No
Platform details:
  PXF tif number: 0x14
```

Table 8-12 describes the fields shown in the interface configuration section of the display. This section is useful for verifying the status of autonegotiation and configured parameters on the link, and the amount of traffic being handled by the interface.

Table 8-12 show controllers Command Field Descriptions—Interface Section

Field	Description
Interface	Name of the interface.
Hardware	Type of hardware.
Connection mode	Indicator of autonegotiation used to establish the connection.
Link	State of the link.
Configuration	Configuration of the speed and duplex operation on the interface.
Selected media-type	Interface port media type: RJ45 or Gigabit Interface Converter (GBIC).
GBIC type is	GBIC interface type: 1000BaseSX, 1000BaseLX, or 1000BaseZX
SFP is	Indicates presence of an SFP optical transceiver.
LOS	Indicates whether or not the SFP detects a loss of signal (LOS).
Tx fault	Indicates whether or not the SFP detects a transmission fault.
Security check status	Indicates whether or not the SFP passes the security check. The SPA enables a security check by default to verify whether a Cisco-approved SFP is inserted. If the SFP is not a Cisco-approved device, the link is brought down.
Promiscuous mode	State of promiscuous mode (on or off). When promiscuous mode is on, the SPA disables MAC destination address and VLAN filtering. When promiscuous mode is off, the SPA enables MAC destination address and VLAN filtering.
VLAN filtering	Status of ternary content addressable memory (TCAM) filtering of VLANs (enabled or disabled). By default, the SPA always enables VLAN filtering. The SPA disables VLAN filtering if the TCAM table is full, or if the SPA is operating in promiscuous mode. **Note** VLAN filtering is not enabled or disabled using any command-line interface (CLI) command.
MDI crossover status	State of the media dependent interface (MDI) for the PHY device on the specified interface. The possible values are MDI for straight-through cables or media dependent interface crossover (MDI-X) for crossover cables.
Auto-negotiation	State of autonegotiation (enabled or disabled) on the interface and its current status.

Table 8-12 show controllers Command Field Descriptions—Interface Section (continued)

Field	Description
Speed/duplex is resolved to	Results of autonegotiated parameter values (speed and duplex) currently being used on the link.
Advertised capabilities	List of the possible combinations of speed and duplex modes (in *speed*/*duplex* format) and flow control that the local interface has advertised it supports to the remote device: • For speed—10M is 10 Mbps, 100M is 100 Mbps, and 1000M is 1000 Mbps. • For duplex—HD is half duplex, and FD is full duplex. • For flow control—"Pause capable (Asymmetric)" means that the SPA advertises support of the PAUSE flow control bit and the ASM_DIR (asymmetric) flow control bit.
Partner capabilities	List of the possible combinations of speed and duplex modes (in *speed*/*duplex* format) and flow control that the remote device has advertised it supports to the local interface: • For speed—10M is 10 Mbps, 100M is 100 Mbps, and 1000M is 1000 Mbps. • For duplex—HD is half duplex, and FD is full duplex. • For flow control—"Pause capable" means that the remote device supports implementation of the PAUSE flow control bit; "Pause capable (Asymmetric)" means that the remote device supports implementation of the PAUSE flow control bit and the ASM_DIR (asymmetric) flow control bit.

Table 8-13 describes the fields shown in the MAC counters section of the display. This section is useful for verifying the status of packets processed by the MAC device for the interface. This information is useful for Cisco Systems technical support personnel.

Table 8-13 show controllers Command Field Descriptions—MAC Counters Section

Field	Description
Input: packets, bytes	Total number of packets and bytes received by the MAC device for the interface since it was activated or cleared. You can clear these counters using the **clear counters** privileged EXEC command.
Input: FIFO full/reset removed	Total number of packets removed by the MAC device due to a first-in, first-out (FIFO) overflow condition in the input buffer for the interface.
Input: error drop	Total number of input packets with errors that are dropped by the MAC device for the interface.

Table 8-13 show controllers Command Field Descriptions—MAC Counters Section (continued)

Field	Description
Output: packets, bytes	Total number of packets and bytes transmitted by the MAC device for the interface since it was activated or cleared. You can clear these counters using the **clear counters** privileged EXEC command.
Output: FIFO full/reset removed	Total number of packets removed by the MAC device due to a first-in, first-out (FIFO) overflow condition in the output buffer for the interface.
Output: error drop	Total number of output packets with errors that are dropped by the MAC device for the interface.
SPI3: disabled port drop	Total number of packets dropped by the MAC device at the System Packet Interface Level 3 (SPI3) path between the MAC device and FPGA device due to a disabled port condition.
SPI3: sync error drop	Total number of packets dropped by the MAC device at the SPI3 path between the MAC device and FPGA device due to a sync error (synchronization bits altered) condition.
SPI3: short packet drop	Total number of packets dropped by the MAC device at the SPI3 path between the MAC device and FPGA device due to a short packet (packet length is less than 64 bytes) condition.
SPI3: parity error drop	Total number of packets dropped by the MAC device at the path between the MAC device and FPGA device due to a parity error (parity bit is altered during data transmission) condition.
Total pause frames	Total number of Ethernet 802.3x pause frames transmitted and received by the MAC device for flow control on the interface.

Table 8-14 describes the fields shown in the FPGA counters section of the display. This section is useful for verifying the status of packets processed by the FPGA device for the interface. This information is useful for Cisco Systems technical support personnel.

Table 8-14 show controllers Command Field Descriptions—FPGA Counters Section

Field	Description
Input: Total (good & bad) packets	Total number of packets received by the FPGA device in the ingress direction for the interface.
Input: TCAM drops	Total number of packets dropped by the FPGA device in the ingress direction for the interface due to a ternary content addressable memory (TCAM) lookup failure. This counter increments when the interface receives a frame with a destination MAC address or VLAN identifier that is not present in the TCAM table.
Input: Satisfy (host-backpressure) drops	Total number of packets dropped by the FPGA device in the ingress direction for the interface due to back-pressure from the MSC.

Table 8-14 show controllers Command Field Descriptions—FPGA Counters Section (continued)

Field	Description
Input: CRC drops	Total number of packets dropped by the FPGA device in the ingress direction for the interface due to cyclic redundancy check (CRC) errors.
Input: PL3 RERRs	Total number of packets with errors received for the interface by the FPGA device in the ingress direction over the SPI3 (PL3) path from the MAC device to the FPGA device.
Output: EOP (SPI4) errors	Total number of packets with end-of-packet (EOP) errors received by the FPGA device in the egress direction for the interface over the System Packet Interface Level 4 (SPI4) path from the MSC to the FPGA device.

Table 8-15 describes the fields shown in the SPA carrier card counters section of the display. This section is useful for verifying the status of packets processed by the MSC for the interface. This information is useful for Cisco Systems technical support personnel.

Table 8-15 show controllers Command Field Descriptions—SPA Carrier Card Counters Section

Field	Description
Input: packets, bytes, drops	Total number of packets, bytes, and packet drops that have occurred on the SPI4 path from the FPGA device to the MSC.
Output: packets, bytes, drops	Total number of packets, bytes, and packet drops that have occurred on the SPI4 path from the MSC to the FPGA device.
Egress flow control status	Status of flow control between the MSC and the Route Processor (RP). The possible values are: • XON—A control frame has been sent by the MSC to the RP to indicate that the MSC is ready to accept data. • XOFF—A control frame has been sent by the MSC to the RP to indicate congestion on the MSC. The MSC cannot accept any more data from the RP during this condition.
General errors	Total number of errors (such as parity) on the MSC in the ingress and egress direction.
SPI4 errors: ingress dip4	Total number of 4-bit Diagonal Interleaved Parity (DIP4) errors in the ingress direction on the SPI4 path from the FPGA device to the MSC. DIP4 is a parity algorithm where a 4-bit odd parity is computed diagonally over control and data words.
SPI4 errors: egress dip2	Total number of 2-bit Diagonal Interleaved Parity (DIP2) errors in the egress direction on the SPI4 path from the FPGA device to the MSC. DIP2 is a parity algorithm where a 2-bit odd parity is computed diagonally over status words.

Table 8-16 describes the fields shown in the SPA error counters section of the display. This section appears only when one of the SPI4 transmit or receive errors occurs on the interface. This information is useful for Cisco Systems technical support personnel.

Note None of the SPA SPI4 error counters appear in **show controllers fastethernet** command output until at least one of those types of SPI4 errors occurs.

All of the errors in the SPA error counters section are subject to the SPA automatic recovery process when certain thresholds are reached. For more information, see the "Understanding SPA Automatic Recovery" section on page 6-11.

Table 8-16 show controllers Command Field Descriptions—SPA Error Counters Section

Field	Description
SPI4 TX out of frame error = (*hh:mm:ss* ago)	Number of SPI4 out of frame errors (events) detected in the transmit direction (toward the network), from the MSC to the SPA FPGA device. The time stamp indicates how long ago (in hours:minutes:seconds) from the current system time, that the last error was detected. This error indicates a loss of synchronization between the synchronization block and the data received on the SPI4 path. When synchronization is reacquired, the error no longer occurs.
SPI4 TX Train valid error = (*hh:mm:ss* ago)	Number of times that a low-level synchronization problem was detected in the transmit direction (toward the network), from the MSC to the SPA FPGA device. The time stamp indicates how long ago (in hours:minutes:seconds) from the current system time, that the last error was detected.
SPI4 TX DIP4 error = (*hh:mm:ss* ago)	Number of 4-bit Diagonal Interleaved Parity (DIP4) errors in the transmit direction (toward the network), from the MSC to the SPA FPGAdevice. The time stamp indicates how long ago (in hours:minutes:seconds) from the current system time, that the last error was detected. DIP4 is a parity algorithm where a 4-bit odd parity is computed diagonally over control and data words.

Table 8-16 show controllers Command Field Descriptions—SPA Error Counters Section (continued)

Field	Description
SPI4 RX out of frame error = (*hh:mm:ss* ago)	Number of SPI4 out of frame errors (events) detected in the receive direction (from the network), from the SPA FPGA device to the MSC. The time stamp indicates how long ago (in hours:minutes:seconds) from the current system time, that the last error was detected. This error indicates a loss of synchronization between the synchronization block and the data received on the SPI4 path. When synchronization is reacquired, the error no longer occurs.
SPI4 RX DIP2 error = (*hh:mm:ss* ago)	Number of 2-bit Diagonal Interleaved Parity (DIP2) errors in the receive direction (from the network), from the SPA FPGA device to the MSC. The time stamp indicates how long ago (in hours:minutes:seconds) from the current system time, that the last error was detected. DIP2 is a parity algorithm where a 2-bit odd parity is computed diagonally over status words.

Table 8-17 describes the fields shown in the MAC destination address filtering table section of the display. This section is useful for verifying the multicast destination addresses that are in the TCAM table and permitted by the interface. This information is useful for Cisco Systems technical support personnel.

Table 8-17 show controllers Command Field Descriptions—MAC Destination Address Filtering Table Section

Field	Description
Table entries: Total, Used	Total number of MAC destination address entries possible in the TCAM table for the interface, and the number of table entries currently used by the interface. The 2-Port 10/100/1000 Gigabit Ethernet SPA supports a 512-entry MAC filtering table for each supported interface (1024 entries total on the card).
Index	Table entry identifier.

Table 8-17 show controllers Command Field Descriptions—MAC Destination Address Filtering Table Section (continued)

Field	Description
MAC destination address	MAC destination address (multicast) permitted by the interface and used in the TCAM lookup table for packet filtering. The multicast MAC entries typically come from routing protocols [such as Open Shortest Path First (OSPF) and Enhanced IGRP (EIGRP)], and other protocols including the Hot Standby Router Protocol (HSRP). When the router reloads, three addresses appear by default in the MAC filtering table: the unicast address of the local interface, the Ethernet broadcast address, and the Ethernet multicast address.
Mask	Mask for the corresponding destination address. The SPA uses the bits that are set in the mask to look up the address in the TCAM table.

Table 8-18 describes the fields shown in the VLAN filtering table section of the display. This section is useful for verifying the VLANs that are in the TCAM table and are permitted by the interface. This information is useful for Cisco Systems technical support personnel.

Table 8-18 show controllers Command Field Descriptions—VLAN Filtering Table Section

Field	Description
Number of VLANs configured on this interface	Number of VLANs that are configured on the interface. If the number of VLANs configured on the interface is 1022 or less, then the VLAN filtering table also shows an index entry for every VLAN ID. The number of VLANs configured on the interface can be 0, while the number of used table entries reports 2, because the SPA always uses two entries to provide valid matching criteria for promiscuous mode and non-VLAN packets.
Table entries: Total, Used, Available	Total number of VLAN entries possible in the TCAM filtering table for the interface, the number of table entries currently used by the interface (two are always in use by default), and the number of table entries that remain available. The 2-Port 10/100/1000 Gigabit Ethernet SPA supports a 1024-entry VLAN filtering table for each supported interface (2048 entries total on the card).
Index	Table entry identifier.
VLAN identifier	Number of the VLAN. Two VLAN ID 0 entries always appear in the table and represent the local interface port for handling of promiscuous mode and non-VLAN packets. Other VLAN entries appear in this table when VLANs are configured on the interface.

Table 8-18 show controllers Command Field Descriptions—VLAN Filtering Table Section (continued)

Field	Description
Enabled	Status of the VLAN ID for TCAM filtering, with the following possible values: • No—The entry is disabled for filtering. • Yes—The entry is enabled for filtering. The TCAM filter uses the "first-match" rule to filter packets that the SPA receives against entries in the table. The matching assessment begins at the top of the table with the VLAN ID 0 entries. **Note** The SPA always supports two VLAN ID 0 entries. The first VLAN ID 0 entry of the TCAM table is used for promiscuous mode. It has a value of "No," meaning it is disabled, whenever promiscuous mode is disabled for the interface. The second VLAN ID 0 entry is used for filtering of non-VLAN packets.
Tunnel	Status of tunneling for the interface, with the following possible values: • No—Tunneling is disabled and the SPA performs MAC destination address filtering. • Yes—Tunneling is enabled and the SPA does not perform MAC destination address filtering. **Note** If promiscuous mode is enabled, then the first VLAN ID 0 entry shows tunnel = Yes. All other VLAN ID entries show tunnel = No.

Table 8-19 describes the fields shown in the platform details section of the display.

Table 8-19 show controllers Command Field Descriptions—Platform Details Section

Field	Description
PXF tif number	Number of the interface (in hexadecimal format) used for PXF on the network services engine (NSE) or by the Hyper Transport (HT) FPGA device on the network processing engine (NPE).

Related Commands

Command	Description
show interfaces gigabitethernet	Displays information about the Gigabit Ethernet interfaces.

show controllers pos

To display information about a Packet over SONET (POS) interface, use the **show controllers pos** command in privileged EXEC mode. The command does not have a **no** form.

Cisco 7500 Series Routers

show controllers pos [*slot*/*port-adapter*/*port*] [**details** | **pm** [*time-interval*]]

Cisco 12000 Series Routers

show controllers pos [*slot*/*port*] [**details** | **pm** [*time-interval*]]

POS Shared Port Adapters

show controllers pos [*slot*/*subslot*/*port*[/*sub_int*]] [**details** | **pm** [*time-interval*]]

Syntax Description

slot	(Optional) Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*port-adapter*	(Optional) Port adapter number. Refer to the appropriate hardware manual for information about port adapter compatibility.
/*subslot*	(Optional) Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
/*port*	(Optional) Port or interface number. Refer to the appropriate hardware manual for port information. For SPAs, refer to the corresponding "Specifying the Interface Address on a SPA" topics in the platform-specific SPA software configuration guide.
/*sub_int*	(Optional) Subinterface number.
details	(Optional) In addition to the normal information displayed by the **show controllers pos** command, the **details** keyword provides a hexadecimal and ASCII "dump" of the path trace buffer.
pm	(Optional) Displays SONET performance monitoring statistics accumulated for a 24-hour period in 15-minute intervals.
time-interval	(Optional) Number of the SONET MIB 15-minute time interval in the range from 1 to 96. If the *time-interval* argument is not specified, the performance monitoring statistics for the current time interval are displayed.

Defaults

If you do not specify any slot addressing, information for all installed POS interfaces is displayed.

The **show controllers pos** command with the **pm** keyword displays SONET performance monitoring statistics accumulated at 15-minute intervals, and these statistics can be queried using Simple Network Management Protocol (SNMP) tools. The performance monitoring statistics are collected according to the RFC 1595 specification.

The information that this command displays is generally useful only for diagnostic tasks performed by technical support personnel.

If no interface is specified, the command displays information for all POS interfaces.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1CC	This command was introduced.
12.2S	This command was integrated into Cisco IOS release 12.2S.
12.2(25)S3	The command was modified to support a new addressing format for SPAs on the Cisco 7304 router.

Examples

Example of the show controllers pos Command on the Cisco 7500 Series Router

The following is sample output from the **show controllers pos** command on a Cisco 7500 series router:

```
Router# show controllers pos

POS2/0/0
SECTION
  LOF = 0          LOS = 2335                        BIP(B1) = 77937133
LINE
  AIS = 2335       RDI = 20         FEBE = 3387950089 BIP(B2) = 1622825387
PATH
  AIS = 2340       RDI = 66090      FEBE = 248886263  BIP(B3) = 103862953
  LOP = 246806     NEWPTR = 11428072   PSE = 5067357     NSE = 4645

Active Defects: B2-TCA B3-TCA
Active Alarms:  None
Alarm reporting enabled for: B1-TCA

APS
  COAPS = 12612784   PSBF = 8339
  State: PSBF_state = False
  Rx(K1/K2): 00/CC  Tx(K1/K2): 00/00
  S1S0 = 03, C2 = 96
CLOCK RECOVERY
  RDOOL = 64322060
  State: RDOOL_state = True
PATH TRACE BUFFER: UNSTABLE
  Remote hostname :
  Remote interface:
  Remote IP addr  :
  Remote Rx(K1/K2): ../..  Tx(K1/K2): ../..
BER thresholds:  SF = 10e-3  SD = 10e-8
TCA thresholds:  B1 = 10e-7  B2 = 10e-3  B3 = 10e-6
```

Table 8-20 describes the fields shown in this display.

Table 8-20 show controllers pos Field Descriptions

Field	Description
POSx/y/z	Slot number of the POS interface.
LOF	Section loss of frame is detected when a severely error framing (SEF) defect on the incoming SONET signal persist for 3 milliseconds.
LOS	Section loss of signal is detected when an all-zeros pattern on the incoming SONET signal lasts 19 plus or minus 3 microseconds or longer. This defect might also be reported if the received signal level drops below the specified threshold.
BIP(B1)/BIP(B2)/BIP(B3)	Bit interleaved parity (BIP). For B1, the BIP error report is calculated by comparing the BIP-8 code with the BIP-8 code extracted from the B1 byte of the following frame. Differences indicate that section-level bit errors have occurred. For B2, the BIP error report is calculated by comparing the BIP-8/24 code with the BIP-8 code extracted from the B2 byte of the following frame. Differences indicate that line-level bit errors have occurred. For B3, the BIP error report is calculated by comparing the BIP-8 code with the BIP-8 code extracted from the B3 byte of the following frame. Differences indicate that path-level bit errors have occurred.
AIS	Alarm indication signal. A line alarm indication signal is sent by the section terminating equipment (STE) to alert the downstream line terminating equipment (LTE) that a loss of signal (LOS) or loss of frame (LOF) defect has been detected on the incoming SONET section. A path alarm indication signal is sent by the LTE to alert the downstream path terminating equipment (PTE) that it has detected a defect on its incoming line signal.
RDI	Remote defect indication. A line remote defect indication is reported by the downstream LTE when it detects LOF, LOS, or AIS. A path remote defect indication is reported by the downstream PTE when it detects a defect on the incoming signal.
FEBE	Far end block errors. Line FEBE (accumulated from the M0 or M1 byte) is reported when the downstream LTE detects BIP(B2) errors. Path FEBE (accumulated from the G1 byte) is reported when the downstream PTE detects BIP(B3) errors.
LOP	Path loss of pointer is reported as a result of an invalid pointer (H1, H2) or an excess number of new data flag (NDF) enabled indications.
NEWPTR	Inexact count of the number of times that the SONET framer has validated a new SONET pointer value (H1, H2).

Table 8-20 show controllers pos Field Descriptions (continued)

Field	Description
PSE	Inexact count of the number of times that the SONET framer has detected a positive stuff event in the received pointer (H1, H2).
NSE	Inexact count of the number of times that the SONET framer has detected a negative stuff event in the received pointer (H1, H2).
Active Defects	List of all currently active SONET defects.
Active Alarms	List of current alarms as enforced by Sonet Alarm Hierarchy.
Alarm reporting enabled for	List of alarms for which you enabled reporting with the **pos report** interface command.
APS	Automatic protection switching.
COAPS	An inexact count of the number of times that a new APS value has been detected in the K1, K2 bytes.
PSBF	An inexact count of the number of times that a protection switching byte failure has been detected (no three consecutive SONET frames contain identical K1 bytes).
PSBF_state	Protection switching byte failure state.
Rx(K1/K2)/Tx(K1/K2)	Contents of the received and transmitted K1 and K2 bytes.
S1S0	The two S bits received in the last H1 byte.
C2	The value extracted from the SONET path signal label byte (C2).
CLOCK RECOVERY	The SONET clock is recovered using information in the SONET overhead. RDOOL is an inexact count of the number of times that Receive Data Out Of Lock has been detected, which indicates that the clock recovery phased lock loop is unable to lock to the receive stream.
PATH TRACE BUFFER	SONET path trace buffer is used to communicate information regarding the remote host name, interface name/number, and IP address. This is a Cisco-proprietary use of the J1 (path trace) byte.
BER thresholds	List of the bit error rate (BER) thresholds that you configured with the **pos threshold** interface command.
TCA thresholds	List of threshold crossing alarms (TCAs) that you configured with the **pos threshold** interface command.

Example of the show controllers pos Command on a POS Shared Port Adapter

The following is sample output from the **show controllers pos** command on a Cisco 7600 series router for POS interface 4/3/0 (which is the interface for port 0 of the SPA in subslot 3 of the MSC in chassis slot 4):

```
Router# show controllers pos 4/3/0
POS4/3/0
SECTION
  LOF = 0          LOS    = 0                            BIP(B1) = 60
LINE
  AIS = 0          RDI    = 0          FEBE = 261        BIP(B2) = 553
PATH
  AIS = 0          RDI    = 0          FEBE = 85         BIP(B3) = 75
  LOP = 0          NEWPTR = 0          PSE  = 0          NSE     = 0

Active Defects:None
```

```
Active Alarms: None
Alarm reporting enabled for:SF SLOS SLOF B1-TCA B2-TCA PLOP B3-TCA

Framing:SONET
APS
 working (active)
  COAPS = 3          PSBF = 0
  State:PSBF_state = False
  ais_shut = TRUE
  Rx(K1/K2):00/00  S1S0 = 00, C2 = CF
  Remote aps status (none); Reflected local aps status (none)
CLOCK RECOVERY
  RDOOL = 0
  State:RDOOL_state = False
PATH TRACE BUFFER :STABLE
  Remote hostname :r-c7600
  Remote interface:POS4/0
  Remote IP addr  :50.0.0.2
  Remote Rx(K1/K2):00/00  Tx(K1/K2):00/00

BER thresholds: SF = 10e-3  SD = 10e-6
TCA thresholds: B1 = 10e-6  B2 = 10e-6  B3 = 10e-6
```

Table 8-20 describes the fields shown in this display.

Example of the show controllers pos pm Command on the Cisco 12000 Series Router

The following is sample output from the **show controllers pos pm** command that displays performance monitoring statistics on a Cisco 12000 series router:

```
Router# show controllers pos 1/0 pm

POS1/0
Medium is SONET
Line coding is RZ, Line type is LONG SM
Data in current interval (516 seconds elapsed)
SECTION ( NO DEFECT )
    515 Errored Secs, 515 Severely Err Secs
    0 Coding Violations, 515 Sev Err Framing Secs
LINE ( NO DEFECT )
    0 Errored Secs, 0 Severely Err Secs
    0 Coding Violations, 0 Unavailable Secs
FAR END LINE
    0 Errored Secs, 0 Severely Err Secs
    0 Coding Violations, 0 Unavailable Secs
PATH ( NO DEFECT )
    0 Errored Secs, 0 Severely Err Secs
    0 Coding Violations, 0 Unavailable Secs
FAR END PATH
    0 Errored Secs, 0 Severely Err Secs
    0 Coding Violations, 0 Unavailable Secs
```

Table 8-21 describes the fields shown in the display.

Table 8-21 show controllers pos pm Field Descriptions

Field	Description
POSx/y	Slot number of the POS interface.
Line coding	Shows the current line encoding type, either return to zero (RZ) or nonreturn to zero (NRZ).

Table 8-21 show controllers pos pm Field Descriptions (continued)

Field	Description
Line type	Line type for this interface. Optical line types can be either long range (LONG) or short range (SHORT), and either single mode (SM) or multimode (MM).
Data in current interval	Shows the current accumulation period, which rolls into the 24-hour accumulation every 15 minutes. Accumulation period is from 1 to 900 seconds. The oldest 15-minute period falls off the back of the 24-hour accumulation buffer.
Errored Secs	An errored second is a second in which one of the following is detected: • One or more coding violations. • One or more incoming defects (for example, a severely errored frame (SEF) defect, an LOS defect, an AIS defect, or an LOP defect).
Severely Err Secs	A severely errored second (SES) is a second with one of the following errors: • A certain number of coding violations. The number is dependent on the line rate and the BER. • A certain number of incoming defects.
Coding Violations	Number of coding violations for the current interval. Coding violations are defined as BIP errors that are detected in the incoming signal. The coding violations counter is incremented for each BIP error detected.
Sev Err Framing Secs	Severely errored framing seconds (SEFS) are seconds with one or more SEF defects.
Unavailable Secs	Total number of seconds for which the interface is unavailable. The interface is considered to be unavailable after a series of ten consecutive SESs.

POS Shared Port Adapter Example

The following is sample output from the **show controllers pos** command on a Cisco 7304 router for POS interface 2/0/0 (which is the interface for port 0 of the SPA in subslot 0 of the MSC in chassis slot 2):

```
Router# show controllers pos 2/0/0 details
POS2/0/0
SECTION
LOF = 0 LOS = 1 BIP(B1) = 5
LINE
AIS = 0 RDI = 1 FEBE = 5790 BIP(B2) = 945
PATH
AIS = 0 RDI = 0 FEBE = 0 BIP(B3) = 5
PLM = 0 UNEQ = 0 TIM = 0 TIU = 0
LOP = 1 NEWPTR = 0 PSE = 0 NSE = 0

Active Defects: None
Active Alarms: None
Alarm reporting enabled for: SF SLOS SLOF B1-TCA B2-TCA PLOP B3-TCA

Line alarm trigger delay = 100 ms
Path alarm trigger delay = 100 ms
.
.
.
```

Related Commands

Command	Description
pos report	Permits selected SONET alarms to be logged to the console for a POS interface.
pos threshold	Sets the BER threshold values of specified alarms for a POS interface.

show controllers serial

To display serial controller statistics, use the **show controllers serial** command in privileged EXEC mode.

Standard Syntax

show controllers serial [*slot*/*port*]

Cisco 7000 Series Routers with the RSP7000 and RSP7000CI and Cisco 7500 Series Routers

show controllers serial [*slot*/*port-adapter*/*port*]

T3/E3 Shared Port Adapters and 2-Port and 4-Port Channelized T3 SPA in Unchannelized Mode

show controllers serial [*slot*/*subslot*/*port*]

Channelized T3 Shared Port Adapters

show controllers serial [*slot*/*subslot*/*port*/*t1-number*]

Syntax Description

slot	(Optional) Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding “Identifying Slots and Subslots for MSCs and SPAs” topic in the platform-specific SPA software configuration guide.
port-adapter	(Optional) On Cisco 7500 series routers and Cisco 7000 series routers with the RSP7000 and RSP7000CI, the location of the port adapter on a Versatile Interface Processor (VIP). The value can be 0 or 1.
/subslot	(Optional) Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding “Specifying the Interface Address on a SPA” topic in the platform-specific SPA software configuration guide for subslot information.
/*port*	(Optional) Port or interface number. Refer to the appropriate hardware manual for port information. For SPAs, refer to the corresponding “Specifying the Interface Address on a SPA” topics in the platform-specific SPA software configuration guide.
t1-number	(Optional) Logical T1 number in channelized mode. For SPAs, refer to the corresponding “Specifying the Interface Address on a SPA” topics in the platform-specific SPA software configuration guide.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
11.1CA	This command was modified to include support for the PA-E3 and PA-T3 port adapters.
12.2S	This command was integrated into Cisco IOS Release 12.2S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE and introduced a new output for interfaces on the serial SPAs on the Cisco 7304 router.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

The output from the **show controllers serial** command provides error and alarm information that is useful in troubleshooting line problems.

The information displayed is generally useful for diagnostic tasks performed by Cisco Systems technical support personnel only. For the PA-E3 or PA-T3 port adapters, the **show controllers serial** command also displays configuration information such as the framing, clock source, bandwidth limit, whether scrambling is enabled, the national bit, the international bits, and DSU mode configured on the interface. Also displayed are the performance statistics for the current interval and last 15-minute interval and whether any alarms exist.

Examples

Example of the show controllers serial Command on the Cisco 4000 Series Router

The following is sample output from the **show controllers serial** command on the Cisco 4000:

```
Router# show controllers serial

MK5 unit 0, NIM slot 1, NIM type code 7, NIM version 1
idb = 0x6150, driver structure at 0x34A878, regaddr = 0x8100300
IB at 0x6045500: mode=0x0108, local_addr=0, remote_addr=0
N1=1524, N2=1, scaler=100, T1=1000, T3=2000, TP=1
buffer size 1524
DTE V.35 serial cable attached


RX ring with 32 entries at 0x45560 : RLEN=5, Rxhead 0
00 pak=0x6044D78  ds=0x6044ED4 status=80 max_size=1524 pak_size=0
01 pak=0x60445F0  ds=0x604474C status=80 max_size=1524 pak_size=0
02 pak=0x6043E68  ds=0x6043FC4 status=80 max_size=1524 pak_size=0
03 pak=0x60436E0  ds=0x604383C status=80 max_size=1524 pak_size=0
04 pak=0x6042F58  ds=0x60430B4 status=80 max_size=1524 pak_size=0
05 pak=0x60427D0  ds=0x604292C status=80 max_size=1524 pak_size=0
06 pak=0x6042048  ds=0x60421A4 status=80 max_size=1524 pak_size=0
07 pak=0x60418C0  ds=0x6041A1C status=80 max_size=1524 pak_size=0
08 pak=0x6041138  ds=0x6041294 status=80 max_size=1524 pak_size=0
09 pak=0x60409B0  ds=0x6040B0C status=80 max_size=1524 pak_size=0
10 pak=0x6040228  ds=0x6040384 status=80 max_size=1524 pak_size=0
11 pak=0x603FAA0  ds=0x603FBFC status=80 max_size=1524 pak_size=0
12 pak=0x603F318  ds=0x603F474 status=80 max_size=1524 pak_size=0
13 pak=0x603EB90  ds=0x603ECEC status=80 max_size=1524 pak_size=0
14 pak=0x603E408  ds=0x603E564 status=80 max_size=1524 pak_size=0
15 pak=0x603DC80  ds=0x603DDDC status=80 max_size=1524 pak_size=0
16 pak=0x603D4F8  ds=0x603D654 status=80 max_size=1524 pak_size=0
17 pak=0x603CD70  ds=0x603CECC status=80 max_size=1524 pak_size=0
18 pak=0x603C5E8  ds=0x603C744 status=80 max_size=1524 pak_size=0
```

```
19 pak=0x603BE60  ds=0x603BFBC status=80 max_size=1524 pak_size=0
20 pak=0x603B6D8  ds=0x603B834 status=80 max_size=1524 pak_size=0
21 pak=0x603AF50  ds=0x603B0AC status=80 max_size=1524 pak_size=0
22 pak=0x603A7C8  ds=0x603A924 status=80 max_size=1524 pak_size=0
23 pak=0x603A040  ds=0x603A19C status=80 max_size=1524 pak_size=0
24 pak=0x60398B8  ds=0x6039A14 status=80 max_size=1524 pak_size=0
25 pak=0x6039130  ds=0x603928C status=80 max_size=1524 pak_size=0
26 pak=0x60389A8  ds=0x6038B04 status=80 max_size=1524 pak_size=0
27 pak=0x6038220  ds=0x603837C status=80 max_size=1524 pak_size=0
28 pak=0x6037A98  ds=0x6037BF4 status=80 max_size=1524 pak_size=0
29 pak=0x6037310  ds=0x603746C status=80 max_size=1524 pak_size=0
30 pak=0x6036B88  ds=0x6036CE4 status=80 max_size=1524 pak_size=0
31 pak=0x6036400  ds=0x603655C status=80 max_size=1524 pak_size=0
TX ring with 8 entries at 0x45790 : TLEN=3, TWD=7
tx_count = 0, tx_head = 7, tx_tail = 7
00 pak=0x000000 ds=0x600D70C status=0x38 max_size=1524 pak_size=22
01 pak=0x000000 ds=0x600D70E status=0x38 max_size=1524 pak_size=2
02 pak=0x000000 ds=0x600D70E status=0x38 max_size=1524 pak_size=2
03 pak=0x000000 ds=0x600D70E status=0x38 max_size=1524 pak_size=2
04 pak=0x000000 ds=0x600D70E status=0x38 max_size=1524 pak_size=2
05 pak=0x000000 ds=0x600D70E status=0x38 max_size=1524 pak_size=2
06 pak=0x000000 ds=0x600D70E status=0x38 max_size=1524 pak_size=2
07 pak=0x000000 ds=0x6000000 status=0x38 max_size=1524 pak_size=0
XID/Test TX desc at 0xFFFFFF, status=0x30, max_buffer_size=0, packet_size=0
XID/Test RX desc at 0xFFFFFF, status=0x0, max_buffer_size=0, packet_size=0
Status Buffer at 0x60459C8: rcv=0, tcv=0, local_state=0, remote_state=0
phase=0, tac=0, currd=0x00000, curxd=0x00000
bad_frames=0, frmrs=0, T1_timeouts=0, rej_rxs=0, runts=0
0 missed datagrams, 0 overruns, 0 bad frame addresses
0 bad datagram encapsulations, 0 user primitive errors
0 provider primitives lost, 0 unexpected provider primitives
0 spurious primitive interrupts, 0 memory errors, 0 tr
%LINEPROTO-5-UPDOWN: Linansmitter underruns
mk5025 registers: csr0 = 0x0E00, csr1 = 0x0302, csr2 = 0x0704
                  csr3 = 0x5500, csr4 = 0x0214, csr5 = 0x0008
```

Example of the show controllers serial Command for a PA-E3 Serial Port Adapter

The following is sample output from the **show controllers serial** command for a PA-E3 serial port adapter installed in slot 2:

```
Router# show controllers serial 2/0

M1T-E3 pa: show controller:
PAS unit 0, subunit 0, f/w version 2-55, rev ID 0x2800001, version 2
idb = 0x6080D54C, ds = 0x6080F304, ssb=0x6080F4F4
Clock mux=0x30, ucmd_ctrl=0x0, port_status=0x1
Serial config=0x8, line config=0x1B0202
maxdgram=4474, bufpool=128Kb, 256 particles

   rxLOS inactive, rxLOF inactive, rxAIS inactive
   txAIS inactive, rxRAI inactive, txRAI inactive

line state: up
E3 DTE cable, received clockrate 50071882

base0 registers=0x3D000000, base1 registers=0x3D002000
mxt_ds=0x608BA654, rx ring entries=128, tx ring entries=256
rxring=0x4B01F480, rxr shadow=0x6081081C, rx_head=26
txring=0x4B01F960, txr shadow=0x60810E48, tx_head=192, tx_tail=192, tx_count=0
throttled=0, enabled=0, disabled=0
rx_no_eop_err=0, rx_no_stp_err=0, rx_no_eop_stp_err=0
rx_no_buf=0, rx_soft_overrun_err=0, dump_err= 1
tx_underrun_err=0, tx_soft_underrun_err=0, tx_limited=0
```

```
tx_fullring=0, tx_started=11504
   Framing is g751, Clock Source is Line, Bandwidth limit is 34010.
   Scrambling is enabled
   National Bit is 0, International Bits are: 0 0
   DSU mode 1
   Data in current interval (213 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Severely Err Secs
     0 Severely Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Severely Errored Secs
   Total Data (last 24 hours)
     0 Line Code Violations, 0 P-bit Coding Violation,
     0 C-bit Coding Violation,
     0 P-bit Err Secs, 0 P-bit Severely Err Secs,
     0 Severely Err Framing Secs, 0 Unavailable Secs,
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Severely Errored Secs

   No alarms detected.
```

Example of the show controllers serial Command for a PA-T3 Serial Port Adapter

The following is sample output from the **show controllers serial** command that shows serial port 1/0/0 on a 1-port PA-T3 serial port adapter installed on a VIP2 in chassis slot 1:

```
Router# show controllers serial 2/0/1

Serial1/0/0 -
   Mx T3(1) HW Revision 0x3, FW Revision 2.55
   Framing is c-bit, Clock Source is Line
   Bandwidth limit is 35000, DSU mode 1, Cable length is 50

   Data in current interval (325 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
   Total Data (last 24 hours)
     0 Line Code Violations, 0 P-bit Coding Violation,
     0 C-bit Coding Violation,
     0 P-bit Err Secs, 0 P-bit Sev Err Secs,
     0 Sev Err Framing Secs, 0 Unavailable Secs,
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
No alarms detected.
```

Example of the show controllers serial Command for a Channelized T3 SPA

The following is sample output from the **show controllers serial** command for a 2-port or 4-Port CT3 SPA located in slot 3 of a Cisco 7304 router:

```
Router# show controllers serial
Serial3/1/0 -
   Framing is c-bit, Clock Source is Internal
   Bandwidth limit is 44210, DSU mode 0, Cable length is 10
   rx FEBE since last clear counter 0, since reset 0
   Data in current interval (0 seconds elapsed):
     0 Line Code Violations, 0 P-bit Coding Violation
     0 C-bit Coding Violation
     0 P-bit Err Secs, 0 P-bit Sev Err Secs
     0 Sev Err Framing Secs, 0 Unavailable Secs
     0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
     0 Severely Errored Line Secs
     0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
```

```
      0 CP-bit Far-end Unavailable Secs
      0 Near-end path failures, 0 Far-end path failures
      0 Far-end code violations, 0 FERF Defect Secs
      0 AIS Defect Secs, 0 LOS Defect Secs

    Transmitter is sending AIS.

    Receiver has loss of signal.
Serial3/1/3 -
    Framing is c-bit, Clock Source is Line
    Bandwidth limit is 44210, DSU mode 0, Cable length is 10
    rx FEBE since last clear counter 0, since reset 0
    Data in current interval (757 seconds elapsed):
      0 Line Code Violations, 0 P-bit Coding Violation
      0 C-bit Coding Violation
      0 P-bit Err Secs, 0 P-bit Sev Err Secs
      0 Sev Err Framing Secs, 0 Unavailable Secs
      0 Line Errored Secs, 0 C-bit Errored Secs, 0 C-bit Sev Err Secs
      0 Severely Errored Line Secs
      0 Far-End Errored Secs, 0 Far-End Severely Errored Secs
      0 CP-bit Far-end Unavailable Secs
      0 Near-end path failures, 0 Far-end path failures
      0 Far-end code violations, 0 FERF Defect Secs
      0 AIS Defect Secs, 0 LOS Defect Secs

    No alarms detected.
```

Table 8-4 describes the fields shown in the **show controllers serial** output.

Note The fields appearing in the ouput will vary depending on card type, controller configuration, and the status of the controller line.

Table 8-22 show controllers serial Field Descriptions

Field	Description
Serial	Name of the serial controller.
Framing	Framing type.
Clock source	Source of the synchronization signal (clock).
Bandwidth limit	The allowable bandwidth for the controller.
DSU mode	The Data Service Unit (DSU) interoperability mode.
Cable length	The distance to the first repeater.
rx FEBE since last clear counter	Number of received far-end block errors. **Note** Line far-end block error (accumulated from the M0 or M1 byte) is reported when the downstream LTE detects BIP(B2) errors. Path far-end block error (accumulated from the G1 byte) is reported when the downstream PTE detects BIP(B3) errors.
rx FEBE since last reset	Number of received far-end block errors.
Line Code Violations	Number of Bipolar Violation (BPV) errors or Excessive Zeros (EXZ) errors.

Table 8-22 show controllers serial Field Descriptions (continued)

Field	Description
P-bit Coding Violations	Number of P-bit errors encountered between source and destination.
C-bit coding violations	Number of C-bit errors encountered between source and destination.
P-bit Err Secs (PES)	Number of seconds with P-bit errors. **Note** A PES is a second with one or more PCVs or one or more Out of Frame defects or a detected incoming AIS. This gauge is not incremented when UASs are counted.
P-bit Sev Err Secs (PSES)	Number of seconds with P-bit severe errors. **Note** A PSES is a second with 44 or more PCVs or one or more Out of Frame defects or a detected incoming AIS. This gauge is not incremented when UASs are counted.
Sev Err Framing Secs	The number of 1-second intervals in which either a Remote Alarm Indication was received or a Loss Of Frame condition occurred.
Unavailable Secs	The number of 1-second intervals in which the controller was down.
Line Errored Secs	The number of 1-second intervals in which a Line Code Violation occurred.
C-bit Errored Secs (CES)	Number of seconds with C-bit errors. **Note** A CES is a second with one or more CCVs or one or more Out of Frame defects or a detected incoming AIS. This count is only for the SYNTRAN and C-bit Parity DS3 applications. This gauge is not incremented when UASs are counted.
C-bit Sev Err Secs (CSES)	Number of seconds with severe C-bit errors. **Note** A CSES is a second with 44 or more CCVs or one or more Out of Frame defects or a detected incoming AIS. This count is only for the SYNTRAN and C-bit Parity DS3 applications. This gauge is not incremented when UASs are counted.

Table 8-22 show controllers serial Field Descriptions (continued)

Field	Description
Severely Errored Line Secs	For ESF signals, this is a second in which one of the following defects is detected: • 320 or more Path Code Violation errors. • One or more Out of Frame defects. • An AIS defect. For E1-CRC signals, this is a second with one of the following errors: • 832 or more Path Code Violation errors. • One or more Out of Frame defects. For E1-nonCRC signals, this is a second with 2048 or more Line Code Violations.
Far-End Errored Secs	Number of seconds of far-end failures.
Far-End Severely Errored Secs	The number of 1-second intervals in which either a Remote Alarm Indication was received or a Loss Of Frame condition occurred.
P-bit Unavailable Secs	Number of seconds the interface is unavailable because of P-bit errors.
CP-bit Unavailable Secs	Number of seconds the interface is unavailable because of CP-bit errors.
CP-bit Far-end Unavailable Secs	Number of seconds the interface is unavailable because of CP-bit errors from the far-end device.
Near-end path failures	
Far-end path failures	
Far-end code violations	
FERF Defect Secs	Number of far-end receive failures detected per second.
AIS Defect Secs	Number of alarm indication signals per second.
LOS Defect Secs	Number of loss of signal alarms per second.
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.
Slip Secs	Indicates the replication or deletion of the payload bits of a domestic trunk interface (DS1) frame. A slip might happen when there is a difference between the timing of a synchronous receiving terminal and the received signal.
Fr Loss Secs	Indicates the number of seconds an Out of Frame (OOF) error is detected.
Line Err Secs	Line Errored Seconds (LES) is a second in which one or more Line Code Violation errors are detected.
Degraded Mins	A degraded minute is one in which the estimated error rate exceeds 1E-6 but does not exceed 1E-3.

Table 8-22 show controllers serial Field Descriptions (continued)

Field	Description
Errored Secs	In ESF and E1-CRC links, an errored second is a second in which one of the following defects is detected: • One or more Path Code Violations. • One or more Controlled Slip events. **Note** For SF and E1 no-CRC links, the presence of Bipolar Violations also triggers an errored second.
Bursty Err Secs	A second with more than one but fewer than 320 Path Coding Violation errors, no Severely Errored Frame defects, and no detected incoming AIS defects. Controlled slips are not included in this parameter.

show diag

To display all hardware and diagnostic information for a line card, NSE, chassis, MSC, or SPA, use the **show diag** command in EXEC or privileged EXEC configuration mode.

show diag [*slot-number* | **chassis** | {**subslot** *slot/subslot*}]

Syntax Description

slot-number	(Optional) Slot number of the network services engine (NSE), line card, or modular services card (MSC) that you want to display.
chassis	(Optional) Specifies the display of diagnostic information about the backplane, power supplies, and fan modules.
subslot *slot/subslot*	(Optional) Specifies the display of diagnostic information about the shared port adapter (SPA), where: • *slot*—Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding “Identifying Slots and Subslots for MSCs and SPAs” topic in the platform-specific SPA software configuration guide. • *subslot*—Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding “Specifying the Interface Address on a SPA” topic in the platform-specific SPA software configuration guide for subslot information.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1 CA	This command was introduced.
11.2	This command was integrated into Cisco IOS release 11.2.
11.2 P	This command was modified to update the example for the PA-12E/2FE port adapter, PA-E3 port adapter, and PA-T3 port adapter.
11.2 GS	This command was implemented on the Cisco 12000 series Gigabit Switch Routers (GSRs).
11.3 XA	This command was integrated into Cisco IOS Release 11.3 XA.
12.0(5)XQ	This command was enhanced and implemented on the Cisco 1750 router.
12.0(7)T	This command was integrated into Cisco IOS Release 12.0(7)T.
12.1(9)EX	The *slot-number* argument and **chassis** keyword were added. This command was introduced on Cisco 7300 series routers.
12.2	This command was introduced on the Cisco AS5300.

Release	Modification
12.2(18)S	This command was introduced on the Cisco 7304 router.
12.2(20)S2	This command was integrated into Cisco IOS Release 12.2(20)S2 and the **subslot** *slot*/*subslot* keyword and arguments were added to support SPAs on the Cisco 7304 router.

Usage Guidelines

Use this command to determine the type of hardware installed in your router, and to show detailed hardware information and EEPROM version information. For the Cisco 7304 router, this command applies to NSEs, line cards, MSCs, and SPAs:

- To display hardware information for an NSE, line card, or MSC in the specified slot, use the *slot-number* argument. For MSCs, information about the MSC and each of its installed SPAs is displayed.
- To display hardware information about the backplane, power supplies, and fan modules, use the **chassis** keyword.
- To display hardware information for a SPA only, use the **show diag subslot** *slot*/*subslot* version of this command.

Examples

The following is sample output from the **show diag** *slot-number* version of the command for an MSC-100 located in slot number 4 on a Cisco 7304 router. Information about the MSC is followed by information for its associated SPAs:

```
Router# show diag 4
Slot 4:
        7304-MSC-100 SPA Carrier Card Line Card
        Line Card state: Active
        Insertion time: 00:08:49 ago
        Bandwidth points: 4000000
        EEPROM contents at hardware discovery:
        Hardware Revision        : 0.18
        Boot Time out            : 0000
        PCB Serial Number        : CSJ07288905
        Part Number              : 73-8789-01
        Board Revision           : A0
        Fab Version              : 02
        RMA Test History         : 00
        RMA Number               : 0-0-0-0
        RMA History              : 00
        Deviation Number         : 0-0
        Product Number           : 7304-MSC-100
        Top Assy. Part Number    : 68-1163-04
        Manufacturing Test Data  : 00 00 00 00 00 00 00 00
        Field Diagnostics Data   : 00 00 00 00 00 00 00 00
        Calibration Data         : Minimum: 0 dBmV, Maximum: 0 dBmV
              Calibration values :
        EEPROM format version 4
        EEPROM contents (hex):
          0x00: 04 FF 40 04 50 41 00 12 46 00 00 C1 8B 43 53 4A
          0x10: 30 37 32 38 38 39 30 35 82 49 22 55 01 42 41 30
          0x20: 02 02 03 00 81 00 00 00 00 04 00 80 00 00 00 00
          0x30: CB 94 37 33 30 34 2D 4D 53 43 2D 31 30 30 20 20
          0x40: 20 20 20 20 20 20 87 44 04 8B 04 C4 08 00 00 00
          0x50: 00 00 00 00 00 C5 08 00 00 00 00 00 00 00 00 C8
          0x60: 09 00 00 00 00 00 00 00 00 00 C7 7C F6 44 3F 30
          0x70: 00 00 00 00 00 00 00 00 00 00 00 00 02 EE FF C8
```

```
          0x80: C8 37 26 05 DC 64 28 1E 37 26 09 C4 64 32 28 32
          0x90: DD 0C E4 64 32 28 43 24 2E E0 AA 82 64 F4 24 00
          0xA0: 00 00 00 00 00 00 F0 2E FF FF FF FF FF FF FF FF
          0xB0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0xC0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0xD0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0xE0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0xF0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x100: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x110: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x120: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x130: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x140: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x150: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x160: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x170: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x180: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x190: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x1A0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x1B0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x1C0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x1D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x1E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
          0x1F0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
        FPGA information:
          Current FPGA version     : 00.23
          IOS bundled FPGA version : 00.23
        CPLD version     : 01.02

Subslot 4/1:
        Shared port adapter: SPA-4FE-7304, 4 ports
        State: ok
        Insertion time: 00:15:13 ago
        Bandwidth: 400000 kbps
        EEPROM contents:
.
.
.
```

The following is sample output from the **show diag subslot** command for a 4-Port 10/100 Fast Ethernet SPA located in the bottom subslot (1) of the MSC that is installed in slot 4 on a Cisco 7304 router:

```
Router# show diag subslot 4/1
Subslot 4/1:
        Shared port adapter: SPA-4FE-7304, 4 ports
        Info: hw-ver=0x100, sw-ver=0x0 fpga-ver=0x0
        State: ok
        Insertion time: 23:20:42 ago
        Bandwidth: 400000 kbps
        EEPROM contents:
        Hardware Revision        : 1.0
        Boot Time out            : 0190
        PCB Serial Number        : JAB073204G5
        Part Number              : 73-8717-03
        73/68 Level Revision     : 01
        Fab Version              : 02
        RMA Test History         : 00
        RMA Number               : 0-0-0-0
        RMA History              : 00
        Deviation Number         : 0
        Product Number           : SPA-4FE-7304
        Product Version Id       : V01
        Top Assy. Part Number    : 68-2181-01
        73/68 Level Revision     : A0
```

```
CLEI Code                 : CNS9420AAA
Base MAC Address          : 0000.0000.0000
MAC Address block size    : 1024
Manufacturing Test Data   : 00 00 00 00 00 00 00 00
Field Diagnostics Data    : 00 00 00 00 00 00 00 00
Field Diagnostics Data    : 00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00 00 00 00 00
                            00 00 00 00
Calibration Data          : Minimum: 0 dBmV, Maximum: 0 dBmV
      Calibration values :
Power Consumption         : 160000mW max
                  Mode 1 : 0mW
                  Mode 2 : 0mW
                  Mode 3 : 0mW
EEPROM format version 4
EEPROM contents (hex):
  0x00: 04 FF 40 04 35 41 01 00 46 01 90 C1 8B 4A 41 42
  0x10: 30 37 33 32 30 34 47 35 82 49 22 0D 03 8A 30 31
  0x20: 20 20 02 02 03 00 81 00 00 00 00 04 00 88 00 00
  0x30: 00 00 CB 94 53 50 41 2D 34 46 45 2D 37 33 30 34
  0x40: 20 20 20 20 20 20 20 20 89 56 30 31 20 87 44 08
  0x50: 85 01 8A 41 30 20 20 C6 8A 43 4E 53 39 34 32 30
  0x60: 41 41 41 CF 06 00 00 00 00 00 00 43 04 00 C4 08
  0x70: 00 00 00 00 00 00 00 00 C5 08 00 00 00 00 00 00
  0x80: 00 00 F4 00 64 00 00 00 00 00 00 00 00 00 00 00
  0x90: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0xA0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0xB0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0xC0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0xD0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0xE0: 00 00 00 00 00 00 00 00 00 C8 09 00 00 00 00 00
  0xF0: 00 00 00 00 D7 08 3E 80 00 00 00 00 00 00 F3 00
  0x100: 41 01 08 F6 48 43 34 F6 49 44 35 02 31 04 B0 B4
  0x110: A0 8C 00 00 05 DC 64 46 32 00 00 07 08 64 46 32
  0x120: 00 00 09 C4 64 46 32 00 00 0C E4 64 46 32 00 00
  0x130: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 FE 02
  0x140: F2 A6 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
  0x150: CC A0 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x160: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x170: 00 00 D4 A0 00 00 00 00 00 00 00 00 00 00 00 00
  0x180: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x190: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1A0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1B0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1C0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1D0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1E0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1F0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
FPGA version:
  Software version : 04.17
  Hardware version : 04.17
```

The following is sample output from the **show diag subslot** command for a 2-Port 10/100/1000 Gigabit Ethernet SPA located in the top subslot (0) of the MSC that is installed in slot 4 on a Cisco 7304 router:

```
Router# show diag subslot 4/0
Subslot 4/0:
        Shared port adapter: SPA-2GE-7304, 2 ports
        Info: hw-ver=0x17, sw-ver=0x0 fpga-ver=0x0
        State: ok
        Insertion time: 00:08:47 ago
        Bandwidth: 2000000 kbps
        EEPROM contents:
        Hardware Revision        : 0.23
        Boot Time out            : 0190
        PCB Serial Number        : JAB073406YH
        Part Number              : 73-8792-02
        73/68 Level Revision     : 01
        Fab Version              : 02
        RMA Test History         : 00
        RMA Number               : 0-0-0-0
        RMA History              : 00
        Deviation Number         : 0
        Product Number           : SPA-2GE-7304
        Product Version Id       : V01
        Top Assy. Part Number    : 68-2181-01
        73/68 Level Revision     : A0
        CLEI Code                : CNS9420AAA
        Base MAC Address         : 0000.0000.0000
        MAC Address block size   : 1024
        Manufacturing Test Data  : 00 00 00 00 00 00 00 00
        Field Diagnostics Data   : 00 00 00 00 00 00 00 00
        Field Diagnostics Data   : 00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00 00 00 00 00
                                   00 00 00 00
        Calibration Data         : Minimum: 0 dBmV, Maximum: 0 dBmV
              Calibration values :
        Power Consumption        : 160000mW max
                          Mode 1 : 0mW
                          Mode 2 : 0mW
                          Mode 3 : 0mW
        EEPROM format version 4
        EEPROM contents (hex):
          0x00: 04 FF 40 04 36 41 00 17 46 01 90 C1 8B 4A 41 42
          0x10: 30 37 33 34 30 36 59 48 82 49 22 58 02 8A 30 31
          0x20: 20 20 02 02 03 00 81 00 00 00 00 04 00 88 00 00
          0x30: 00 00 CB 94 53 50 41 2D 32 47 45 2D 37 33 30 34
          0x40: 20 20 20 20 20 20 20 20 89 56 30 31 20 87 44 08
          0x50: 85 01 8A 41 30 20 20 C6 8A 43 4E 53 39 34 32 30
          0x60: 41 41 41 CF 06 00 00 00 00 00 00 43 04 00 C4 08
          0x70: 00 00 00 00 00 00 00 00 C5 08 00 00 00 00 00 00
          0x80: 00 00 F4 00 64 00 00 00 00 00 00 00 00 00 00 00
          0x90: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
          0xA0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
          0xB0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
          0xC0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

```
  0xD0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0xE0: 00 00 00 00 00 00 00 00 00 C8 09 00 00 00 00 00
  0xF0: 00 00 00 00 D7 08 3E 80 00 00 00 00 00 00 F3 00
  0x100: 41 01 08 F6 48 43 34 F6 49 44 35 02 31 03 E8 B4
  0x110: A0 8C 37 26 05 DC 64 46 32 37 26 07 08 64 46 32
  0x120: 37 26 09 C4 64 46 32 32 DD 0C E4 64 46 32 43 24
  0x130: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 FE 02
  0x140: EF E2 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
  0x150: CC A0 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x160: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x170: 00 00 D4 A0 00 00 00 00 00 00 00 00 00 00 00 00
  0x180: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x190: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1A0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1B0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1C0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1D0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1E0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
  0x1F0: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
FPGA version:
  Software version : 04.17
  Hardware version : 04.17
```

Related Commands

Command	Description
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.

show environment

To display power supply, fan, voltage, and temperature information for the router, use the **show environment** command in privileged EXEC configuration mode.

show environment [**all** | **last** | **table**]

Syntax Description

all	(Optional) Displays a detailed listing of all environmental monitor parameters (for example, the power supplies, temperature readings, voltage readings, and blower speeds). This is the default.
last	(Optional) Displays information from the last measurement made before a reload of the system.
table	(Optional) Displays low and high values for warning, critical, and shutdown threshold settings for various voltages and temperature.

Defaults

all

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
11.2 GS	The **alarms**, **fans**, **hardware**, **leds**, **power-supply**, **table**, **temperature**, and **voltages** keywords were added for Cisco 12000 series GSRs.
11.3(6)AA	This command was expanded to monitor the RPs and board temperature for the Cisco AS5300 platform, Cisco 3600 series routers, Cisco 7200 series routers, and the Cisco 12000 series GSRs.
12.2 S	This command was integrated into Cisco IOS Release 12.2 S.
12.2(20)S2	This command was integrated into Cisco IOS Release 12.2(20)S2 to support MSCs and SPAs on the Cisco 7304 router using the **all**, **last**, and **table** keywords.

Usage Guidelines

For the chassis, NPEs, NSEs, line cards, and MSCs, a routine runs once a minute that reads environmental measurements from sensors and stores the output into a buffer. For SPAs, the temperature and voltage sensors are read every few seconds to get environmental data. The environmental buffer is displayed on the console when you use the **show environment** command.

If a measurement exceeds desired margins, but has not exceeded fatal margins, a warning message is written to the system console. The system software queries the sensors for measurements once a minute, but warnings for a given test point are written at most once every hour for sensor readings in the warning range and once every five minutes for sensor readings in the critical range. If a measurement is out of line within these time segments, an automatic warning message appears on the console. You can query the environmental status using the **show environment** command at any time to determine whether a measurement is at the warning or critical tolerance.

A SPA is shut down when any of the SPA environment readings exceed the shutdown threshold.

If a shutdown occurs because of detection of fatal environmental margins, the last measured value from each sensor is stored in internal nonvolatile memory.

For environmental specifications, refer to the hardware installation and configuration publication for your individual chassis.

For NPEs, NSEs, line cards, and MSCs, environmental information is recorded in the CISCO-ENVMON-MIB. SPAs are not supported by the CISCO-ENVMON-MIB. In Cisco IOS Release 12.2(20)S2 and later, the CISCO-ENTITY-SENSOR-MIB supports environmental information for SPAs, as well as NPEs, NSEs, line cards, and MSCs.

Examples

Cisco 7304 Router Example Using the all Keyword

The following is sample output from the **show environment all** command on a Cisco 7304 router with modular services cards (MSCs) and shared port adapters (SPAs) installed:

```
Router# show environment all
Power Supplies:
        Power supply 1 is AC power supply. Unit is on.
        Power supply 2 is empty.
Fans:
        Fan 1 is on.
        Fan 2 is on.
Temperature readings:
  Active RP (NPEG100, slot 0):
        npeg100 outlet       measured at 29C/84F
        npeg100 inlet        measured at 34C/93F
        npeg100 hotspot      measured at 35C/95F
  Line card (7304-MSC-100, slot 4):
        7304-MSC-100         measured at 32C/89F
  Card in subslot 4/0:
        SPA-4FE-7304 inlet   measured at 31C/87F
        SPA-4FE-7304 outlet  measured at 32C/89F
Voltage readings:
  Active RP (NPEG100, slot 0):
        npe outlet  2.5  V   measured at  2.496 V
        npe outlet  3.3  V   measured at  3.302 V
        npe outlet  5.0  V   measured at  4.992 V
        npe outlet 12.0  V   measured at 11.812 V
        npe outlet  3.3c V   measured at  3.199 V
        npe inlet   1.5  V   measured at  1.494 V
        npe outlet  1.8  V   measured at  1.790 V
        npe outlet  1.2  V   measured at  1.198 V
        npe outlet  1.2c V   measured at  1.198 V
  Line card (7304-MSC-100, slot 4):
        7304-MSC-100 0.75 V  measured at  0.733 V
        7304-MSC-100 1.5 V   measured at  1.494 V
        7304-MSC-100 2.5 V   measured at  2.483 V
        7304-MSC-100 3.3 V   measured at  3.250 V
        7304-MSC-100 12 V    measured at 11.937 V
  Card in subslot 4/0:
        SPA-4FE-7304 1.8V    measured at  1.802 V
        SPA-4FE-7304 1.5V    measured at  1.503 V
        SPA-4FE-7304 2.5V    measured at  2.474 V
        SPA-4FE-7304 3.3V    measured at  3.252 V
        SPA-4FE-7304 1.0V    measured at  1.015 V
Envm stats saved 13 time(s) since reload
```

Cisco 7304 Router Example Using the last Keyword

The following is sample output from the **show environment last** command on a Cisco 7304 router with MSCs and SPAs installed and an NSE-100:

```
Router# show environment last
Temperature information:
  NSE board:
        nse outlet           is unmeasured
        nse inlet            is unmeasured
        nse hotspot          is unmeasured
        nse db               is unmeasured
  Line card slot 4:
        7304-MSC-100         is unmeasured
  Card in subslot 4/1:
        SPA-4FE-7304 inlet   previously measured at 30C/86F
        SPA-4FE-7304 outlet  previously measured at 32C/89F
Voltage information:
  NSE board:
        nse outlet 1.8 V     is unmeasured
        nse outlet 2.5 V     is unmeasured
        nse outlet 3.3 V     is unmeasured
        nse outlet 5 V       is unmeasured
        nse outlet 12 V      is unmeasured
        nse inlet 1.8 V      is unmeasured
        nse inlet 3.3 V      is unmeasured
        nse inlet 1.5 V      is unmeasured
        nse hotspot 1.8 V    is unmeasured
        nse db 1.65 V        is unmeasured
        nse db 1.8 V         is unmeasured
  Line card slot 4:
        7304-MSC-100 0.75 V  is unmeasured
        7304-MSC-100 1.5 V   is unmeasured
        7304-MSC-100 2.5 V   is unmeasured
        7304-MSC-100 3.3 V   is unmeasured
        7304-MSC-100 12 V    is unmeasured
  Card in subslot 4/1:
        SPA-4FE-7304 1.8V    previously measured at  1.823 V
        SPA-4FE-7304 1.5V    previously measured at  1.512 V
        SPA-4FE-7304 2.5V    previously measured at  2.504 V
        SPA-4FE-7304 3.3V    previously measured at  3.258 V
        SPA-4FE-7304 1.0V    previously measured at  1.014 V
Last shutdown reason: shutdown undefined
```

Cisco 7304 Router Example Using the table Keyword

The following is sample output from the **show environment table** command on a Cisco 7304 router with MSCs and SPAs installed:

```
Router# show environment table
Temperature tables:
  Active RP (NPEG100, slot 0):
        Sample Point        HighWarning     HighCritical HighShutdown
        npeg100 outlet      53C/127F        68C/154F        73C/163F
        npeg100 inlet       53C/127F        68C/154F        73C/163F
        npeg100 hotspot     53C/127F        68C/154F        73C/163F
  Line card (7304-MSC-100, slot 4):
        Sample Point        HighWarning     HighCritical HighShutdown
        7304-MSC-100        48C/118F        63C/145F        68C/154F
  Card in subslot 4/0:
        Sample Point        HighWarning     HighCritical HighShutdown
        SPA-4FE-7304 inlet  52C/125F        67C/152F        72C/161F
        SPA-4FE-7304 outlet 52C/125F        67C/152F        72C/161F
Voltage tables:
  Active RP (NPEG100, slot 0):
```

```
      Sample Point       LowShut  LowCrit  LowWarn  HighWarn HighCrit HighShut
      npe outlet  2.5  V 2.275 V  2.375 V  2.400 V  2.600 V  2.625 V  2.725 V
      npe outlet  3.3  V 3.003 V  3.135 V  3.185 V  3.415 V  3.465 V  3.597 V
      npe outlet  5.0  V 4.500 V  4.750 V  4.800 V  5.200 V  5.250 V  5.500 V
      npe outlet 12.0  V 9.960 V 10.440 V 10.800 V 13.200 V 13.560 V 14.040 V
      npe outlet  3.3c V 3.003 V  3.135 V  3.185 V  3.415 V  3.465 V  3.597 V
      npe inlet   1.5  V 1.350 V  1.425 V  1.455 V  1.545 V  1.575 V  1.650 V
      npe outlet  1.8  V 1.620 V  1.710 V  1.728 V  1.872 V  1.890 V  1.980 V
      npe outlet  1.2  V 1.128 V  1.164 V  1.167 V  1.233 V  1.236 V  1.272 V
      npe outlet  1.2c V 1.128 V  1.164 V  1.167 V  1.233 V  1.236 V  1.272 V
Line card (7304-MSC-100, slot 4):
      Sample Point       LowShut  LowCrit  LowWarn  HighWarn HighCrit HighShut
      7304-MSC-100 0.75  0.559 V  0.600 V  0.600 V  0.900 V  0.900 V  0.941 V
      7304-MSC-100 1.5 V 1.350 V  1.440 V  1.455 V  1.545 V  1.560 V  1.650 V
      7304-MSC-100 2.5 V 2.250 V  2.375 V  2.400 V  2.600 V  2.625 V  2.750 V
      7304-MSC-100 3.3 V 2.970 V  3.135 V  3.168 V  3.432 V  3.465 V  3.630 V
      7304-MSC-100 12 V  9.960 V 10.440 V 10.800 V 13.200 V 13.560 V 14.040 V
Card in subslot 4/0:
      Sample Point       LowShut  LowCrit  LowWarn  HighWarn HighCrit HighShut
      SPA-4FE-7304 1.8V  1.620 V  1.710 V  1.728 V  1.872 V  1.890 V  1.980 V
      SPA-4FE-7304 1.5V  1.350 V  1.425 V  1.440 V  1.560 V  1.575 V  1.650 V
      SPA-4FE-7304 2.5V  2.250 V  2.375 V  2.400 V  2.600 V  2.625 V  2.750 V
      SPA-4FE-7304 3.3V  2.970 V  3.135 V  3.168 V  3.432 V  3.465 V  3.630 V
      SPA-4FE-7304 1.0V  0.900 V  0.950 V  0.960 V  1.040 V  1.050 V  1.100 V
```

Table 8-23 describes the significant fields show in the display.

Table 8-23 show environment table Field Descriptions for the Cisco 7304 Router

Field	Description
Sample Point	Area for which measurements are taken.
LowShut	Lowest level for an out-of-tolerance condition at which the system shuts itself down. For out-of-tolerance conditions with SPA environment variables, only the SPA is shut down.
LowCrit/LowCritical	Level at which a critical message is issued for an out-of-tolerance voltage condition. The system continues to operate; however, the system is approaching shutdown.
LowWarn/LowWarning	Level at which a warning message is issued for an out-of-tolerance voltage condition. The system continues to operate, but operator action is recommended to bring the system back to a normal state.
HighWarn/HighWarning	Level at which a warning message is issued for an out-of-tolerance voltage condition. The system continues to operate, but operator action is recommended to bring the system back to a normal state.
HighCrit/HighCritical	Level at which a critical message is issued for an out-of-tolerance voltage condition. The system continues to operate; however, the system is approaching shutdown.
HighShut/HighShutdown	Highest level for an out-of-tolerance condition at which the system shuts itself down. For out-of-tolerance conditions with SPA environment variables, only the SPA is shut down.

Related Commands

Command	Description
test hw-module subslot temperature	Tests a temperature sensor on a SPA.

show hw-module subslot

To display diagnostic information about internal hardware devices for a SPA, use the **show hw-module subslot** command in privileged EXEC configuration mode.

show hw-module subslot *slot*/*subslot* {**brief** | **config** | **counters** | **errors** | **registers** | **status**} {**fpga** | **mac** | **optics** | **phy** | **spi4**} *port*

Syntax Description

slot	(Optional) Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	(Optional) Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
{**brief** | **config** | **counters** | **errors** | **registers** | **status**}	Specifies the display of diagnostic and register information related to the following areas: • **brief**—Reserved for future. • **config**—Displays information related to configuration of the specified internal hardware device. • **counters**—Displays statistics related to the processing by the specified internal hardware device. • **errors**—Reserved for future. • **registers**—Displays register information for the specified internal hardware device. • **status**—Displays status information for the specified internal hardware device.
{**fpga** | **mac** | **optics** | **phy** | **spi4**}	Specifies the internal hardware device or path on the SPA for which you want to display diagnostic information, including the field programmable gate array (FPGA) device, MAC device, small form-factor pluggable (SFP) optical transceiver, PHY device, or System Packet Interface Level 4 (SPI4) path from the MSC to the FPGA device.
port	(Optional) Port or interface number. Refer to the appropriate hardware manual for port information. For SPAs, refer to the corresponding "Specifying the Interface Address on a SPA" topics in the platform-specific SPA software configuration guide.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

Use the **show hw-module subslot** command to obtain diagnostic information about an interface on the SPA.

The **counters** keyword displays a subset of the statistics that are also provided by the **show controllers fastethernet** command and **show controllers gigabitethernet** command for the specified SPA device.

Examples

The following examples provide sample output for several versions of the **show hw-module subslot** command for a 4-Port 10/100 Fast Ethernet SPA located in the top subslot (0) of the MSC that is installed in slot 4 on a Cisco 7304 router:

- show hw-module subslot config fpga Example, page 8-95
- show hw-module subslot config phy Example, page 8-95
- show hw-module subslot config phy on Gigabit Ethernet SPA Example, page 8-96
- show hw-module subslot counters fpga Example, page 8-96
- show hw-module subslot status mac Example, page 8-97
- show hw-module subslot status mac on Gigabit Ethernet SPA Example, page 8-97
- show hw-module subslot status phy Example, page 8-97
- show hw-module subslot status phy on Gigabit Ethernet SPA Example, page 8-98

show hw-module subslot config fpga Example

The following shows sample output from the **show hw-module subslot config** command for the FPGA device on the first interface (port 0):

```
Router# show hw-module subslot 4/0 config fpga 0
FPGA RX Config
  RX FIFO parity select is even
  RX CRC check is  enabled
  RX SHIM header insertion is  disabled
  RX Flow control is enabled
  RX CRC strip is  enabled
  RX TCAM LKUP is enabled
FPGA TX Config
  TX FIFO parity select is even
  TX CRC generation is enabled
  TX Padding is enabled
```

show hw-module subslot config phy Example

The following shows sample output from the **show hw-module subslot config** command for the PHY device on the first interface (port 0):

```
Router# show hw-module subslot 4/0 config phy 0
  PHY version: identifier1 = 0x141, identifier2 = 0xCD2
  PHY Configuration:
  control (reg 0) = 0x3100
    PHY state: not in reset, not powered down, not isoloated
    speed: 100 Mbps, duplex: full
    auto-negotiation enabled, loopback disabled, collision test disabled
  phy specific control (reg 16) = 0x78
```

```
    force link good: no
    MDI cross-over mode: automatic crossover
    Tx FIFO depth: +/- 16 bits, Rx FIFO depth: +/- 16 bits
    never assert CRS on transmit, energy detect: off
    enable extended distance: no, 125 clock: low
    MAC interface power: always up, SQE test: disabled
    polarity reversal: enabled, jabber function: enabled
  extended phy specific control (reg 20) = 0xCE2
    line loopback: disabled, detect lost lock: no, enabled RCLK
    master downshift counter: 4, slave downshift counter: 0
    default MAC interface speed: 1000 Mbps
    fiber auto-negotiation disabled
    add delay to RX_CLK for RXD outputs: yes
    add delay to GTX_CLK for TXD latching: yes
  auto-negotiation advertisement for 10/100 (reg 4) = 0xDE1
    10Base-Tx half-duplex: yes, full-duplex: yes
    100Base-Tx half-duplex: yes, full-duplex: yes
    pause frame support: yes, asymmetric pause: yes
    set remote fault bit: no, advertise next page: no
```

show hw-module subslot config phy on Gigabit Ethernet SPA Example

The following shows sample output from the **show hw-module subslot config** command for the PHY device on the first interface (port 0) on a 2-Port 10/100/1000 Gigabit Ethernet SPA:

```
Router# show hw-module subslot 4/1 config phy 0
  PHY version: identifier1 = 0x141, identifier2 = 0xCD2
  PHY Configuration:
  control (reg 0) = 0x1140
    PHY state: not in reset, not powered down, not isoloated
    speed: 1000 Mbps, duplex: full
    auto-negotiation enabled, loopback disabled, collision test disable
  phy specific control (reg 16) = 0x78
    force link good: no
    MDI cross-over mode: automatic crossover
    Tx FIFO depth: +/- 16 bits, Rx FIFO depth: +/- 16 bits
    never assert CRS on transmit, energy detect: off
    enable extended distance: no, 125 clock: low
    MAC interface power: always up, SQE test: disabled
    polarity reversal: enabled, jabber function: enabled
  extended phy specific control (reg 20) = 0xCE2
    line loopback: disabled, detect lost lock: no, enabled RCLK
    master downshift counter: 4, slave downshift counter: 0
    default MAC interface speed: 1000 Mbps
    fiber auto-negotiation disabled
    add delay to RX_CLK for RXD outputs: yes
    add delay to GTX_CLK for TXD latching: yes
  auto-negotiation advertisement for 10/100 (reg 4) = 0x1A0
    1000BaseX half-duplex: no, full-duplex: yes
    pause frame support: yes, asymmetric pause: yes
  Extended PHY specific control 2 register(reg 26) = 0x6A
    Fiber signal detect input: forced to be good
    Fiber input impedance: 75 ohm, Fiber input impedance: 75 ohm
    Fiber mode clock disabled, Fiber output boost: 1000Base-X
    Fiber output amplitude: 0.7V
```

show hw-module subslot counters fpga Example

The following shows sample output from the **show hw-module subslot counters** command for the FPGA device on the first interface (port 0):

Note This information is also available using the **show controllers fastethernet** command and **show controllers gigabitethernet** command.

```
Router# show hw-module subslot 4/0 counters fpga 0
Input: Total (good & bad) packets: 5734
         TCAM drops: 4908
         Satisfy (host-backpressure) drops: 0
         CRC drops: 0
         PL3 RERRs: 0
  Output: EOP (SPI4) errors: 0
```

show hw-module subslot status mac Example

The following shows sample output from the **show hw-module subslot** command for MAC device status on the first interface (port 0):

```
Router# show hw-module subslot 4/0 status mac 0
  Status registers:
    speed = 100 Mbps, duplex = full, interface mode = copper
    spi3 side loopback is disabled, line side loopback is disabled
    padding is disabled, crc add is disabled
    force duplex is enabled
  Rx FIFO status:
    Read pointer = 0xCDE, Write pointer = 0xCDE
    Occupancy of FIFO in 8 byte locations = 0
    Reset is not set
    Overflow event did not occur
  Tx FIFO status:
    Read pointer = 0x498, Write pointer = 0x498
    Occupancy of FIFO in 8 byte locations = 0
    Overflow event did not occur
    Underflow event did not occur
    Out of sequence event did not occur
```

show hw-module subslot status mac on Gigabit Ethernet SPA Example

The following shows sample output from the **show hw-module subslot** command for MAC device status on the first interface (port 0) on a 2-Port 10/100/1000 Gigabit Ethernet SPA:

```
Router# show hw-module subslot 4/1 status mac 0
  Status registers:
    speed = 1000 Mbps, RGMII, duplex = full, interface mode = copper
    spi3 side loopback is disabled, line side loopback is disabled
    padding is disabled, crc add is disabled
    force duplex is enabled
  Rx FIFO status:
    Read pointer = 0x0, Write pointer = 0x0
    Occupancy of FIFO in 8 byte locations = 0
    Reset is not set
    Overflow event did not occur
  Tx FIFO status:
    Read pointer = 0x328, Write pointer = 0x328
    Occupancy of FIFO in 8 byte locations = 0
    Overflow event did not occur
    Underflow event did not occur
    Out of sequence event did not occur
```

show hw-module subslot status phy Example

The following shows sample output from the **show hw-module subslot** command for PHY device status on the first interface (port 0):

```
Router# show hw-module subslot 4/0 status phy 0
  PHY Status:
  status (reg 1) = 0x7949
    link is down, auto-negotiation is not complete
    remote fault not detected, jabber not detected
  phy specific status (reg 17) = 0x4100
    link is down (real-time), speed/duplex not resolved
    speed: 100 Mbps, duplex: half
    page not received, cable length is 80 - 110m
    MDI cross-over status: MDI, downshift status: no
    energy detect status: active
    transmit pause: disabled, receive pause: disabled
    polarity: normal, jabber: no
  phy specific extended status (reg 27) = 0x848B
    Fiber/ copper auto selection disabled, copper link
    Serial interface auto-negotiation bypass disabled
    Serial interface auto-negotiation bypass status:
      Link came up because regular fiber autoneg completed
    Interrupt polarity is active low
  receive error count: 0x0
```

show hw-module subslot status phy on Gigabit Ethernet SPA Example

The following shows sample output from the **show hw-module subslot** command for PHY device status on the first interface (port 0) on a 2-Port 10/100/1000 Gigabit Ethernet SPA:

```
Router# show hw-module subslot 4/1 status phy 0
  PHY Status:
  status (reg 1) = 0x149
    link is down, auto-negotiation is not complete
    remote fault not detected, jabber not detected
  Extended status register (reg 15) = 0xC000
    1000BaseX full duplex capable    1000BaseX half duplex capable
    1000BaseT full duplex NOT capable    1000BaseT half duplex NOT capable
  phy specific status (reg 17) = 0x8010
    link is down (real-time), speed/duplex not resolved
    speed: 1000 Mbps, duplex: half
    page not received, cable length is < 50m
    MDI cross-over status: MDI, downshift status: no
    energy detect status: sleep
    transmit pause: disabled, receive pause: disabled
    polarity: normal, jabber: no
  phy specific extended status (reg 27) = 0xA483
    Fiber/ copper auto selection disabled, fiber link
    Serial interface auto-negotiation bypass disabled
    Serial interface auto-negotiation bypass status:
      Link came up because regular fiber autoneg completed
    Interrupt polarity is active low
  receive error count: 0x0
```

Related Commands

Command	Description
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.

show hw-module subslot fpd

To display all current versions of FPD image files for all of the active SPAs on a router, enter the **show hw-module subslot fpd** command in privileged EXEC configuration mode.

show hw-module subslot [*slot*/*subslot*] **fpd**

Syntax Description

slot	(Optional) Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/subslot	(Optional) Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.

Defaults

No default behavior or values. If no location is specified, the output for this command will show information for all SPAs in the router.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

Entering the **show hw-module subslot fpd** command will show the FPD image information for all of the SPAs on the router.

Other than the FPD version information, the output for this command may also contain useful FPD-related notes.

Examples

The output display in this example shows that FPD image file versions on the SPAs in the system do not meet the minimum FPD requirements:

```
Router# show hw-module subslot fpd

==== ====================== ====== =============================================
                             H/W   Field Programmable   Current   Min. Required
Slot Card Description        Ver.  Device: "ID-Name"    Version      Version
==== ====================== ====== ================== =========== ==============
 2/0 SPA-2GE-7304            0.15  1-Data & I/O FPGA      4.12        4.17    *
---- ---------------------- ------ ------------------ ----------- --------------
 2/1 SPA-4FE-7304            0.32  1-Data & I/O FPGA      4.13        4.17    *
==== ====================== ====== =============================================
```

```
 NOTES:
       - FPD images that are required to be upgraded are indicated with a '*'
         character in the "Minimal Required Version" field.
       - The following FPD image package file is required for the upgrade:
         "spa-fpd.122-20.S2.pkg"
```

This example shows the output when using the *slot#/subslot#* argument to identify a particular SPA card and that slot meets the minimum FPD requirements for that SPA on that particular Cisco IOS Release:

```
Router# show hw-module subslot 2/0 fpd

==== ====================== ====== =============================================
                             H/W   Field Programmable   Current   Min. Required
Slot Card Description        Ver.  Device: "ID-Name"    Version      Version
==== ====================== ====== ================== =========== ==============
 2/0 SPA-2GE-7304            0.15  1-Data & I/O FPGA      4.17          4.17
==== ====================== ====== =============================================
```

The output display in this example shows that the SPA in slot 2/0 is disabled because one of the programmable devices on the card does not meet the minimum version requirements. The output also contains a “NOTES” section that provides the name of the FPD image package file needed to upgrade the FPD image for that particular SPA.

```
Router# show hw-module subslot fpd

==== ====================== ====== =============================================
                             H/W   Field Programmable   Current   Min. Required
Slot Card Description        Ver.  Device:"ID-Name"     Version      Version
==== ====================== ====== ================== =========== ==============
 2/0 SPA-4FE-... <DISABLED>  0.32  1-Data & I/O FPGA      4.12        4.13    *
---- ---------------------- ------ ------------------ ----------- --------------
 2/1 SPA-2GE-7304            0.15  1-Data & I/O FPGA      4.13        4.13
==== ====================== ====== =============================================
 NOTES:
       - FPD images that are required to be upgraded are indicated with a '*'
         character in the "Minimal Required Version" field.
       - The following FPD image package files is required for the upgrade:
         "spa_fpd.122-20.S2.pkg"
```

Related Commands

Command	Description
upgrade hw-module subslot	Manually upgrades the current FPD image on the specified SPA.
upgrade fpd auto	Configures the router to automatically upgrade the FPD image when an FPD version incompatability is detected.
upgrade fpd path	Specifies the location from where the FPD image package should be loaded when an automatic FPD upgrade is initiated by the router.
show upgrade fpd file	Displays the contents of an FPD image package file.
show upgrade fpd package default	Displays which FPD image package is needed for the router to properly support the SPAs.
show upgrade fpd progress	Displays the progress of the FPD upgrade while an FPD upgrade is taking place.
show upgrade fpd table	Displays various information used by the Cisco IOS software to manage the FPD image package file.

show hw-module subslot oir

To display the operational status of a shared port adapter (SPA), use the **show hw-module subslot oir** command in privileged EXEC configuration mode. The command does not have a **no** form.

show hw-module subslot [*slot*/*subslot*] **oir** [**internal**]

Syntax Description

slot	(Optional) Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/subslot	(Optional) Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
internal	(Optional) Displays detailed diagnostic information. This option is intended for internal diagnostic use with Cisco Systems technical support personnel.

Defaults

No default behavior or values. If no location is specified, the output for this command will show information for all SPAs in the router.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(25)S3	This command was introduced.

Usage Guidelines

Use the **show hw-module subslot oir** command to obtain operational status information about one or more SPAs. To display information for a specific SPA, specify the *slot* number of the SIP and the *subslot* number of the SPA that you want information about. To display information for all SPAs in the router, do not specify the *slot*/*subslot* arguments.

The optional **internal** keyword displays detailed diagnostic information that is recommended only for use with Cisco technical support personnel.

Note The following status descriptions are not applicable to every SPA and can be platform-specific.

Table 8-24 describes the possible values for the Operational Status field in the output.

Table 8-24 Operational Status Field Descriptions

Operational Status	Description
admin down	SPA is administratively disabled by the **hw-module subslot shutdown** global configuration command.
booting	SPA is initializing.
missing	SPA is not present in the MSC subslot.
ok	SPA is operational.
out of service (*reason*)	The SPA is out of service for one of the following reasons: **Note** The following reasons are not applicable to every SPA and can be platform-specific. • Analyze failed—Failed to create a SPA data structure, most likely due to a memory allocation problem. • Authentication failed—SPA has failed hardware validation. • Data structure create error—Failed to create a SPA data structure, most likely due to a memory allocation problem. • Event corrupt—A SPA online insertion and removal (OIR) event has been corrupted. This could be caused by a corrupted message between the MSC and the route processor (RP) or some other software or hardware problem. • Event sequence error—A SPA OIR event was received out of sequence. This could be caused by a corrupted message between the MSC and the route processor (RP) or some other software or hardware problem. • Fail code not set—Failure code could not be read from a SPA OIR event message. This could be caused by a corrupted message between the MSC and the RP or some other software or hardware problem. • Failed too many times—SPA is disabled because it has failed more than the allowable limit on the platform. • FPD upgrade failed—A field-programmable device, such as the Field-Programmable Gate Array (FPGA), failed to automatically upgrade. • H/W signal deasserted—The SPA_OK or PWR_OK hardware signal indicating that the SPA is accessible are no longer asserted. • Heartbeat failed—Occurs when intelligent SPAs encounter heartbeat failures. • Incompatible FPD—An FPGA version mismatch with the Cisco IOS software has been detected for the SPA.

Table 8-24 Operational Status Field Descriptions

Operational Status	Description
out of service (*reason*)—CONTINUED	• Init timeout—Time limit has been reached during initialization of a SPA. • Read SPA type failed—A read from the hardware for the SPA type failed. • Reload request—SPA reload is in progress from the **hw-module subslot reload** command. • SPA h/w error—The SPA software driver has detected a hardware error. • SPA ready timeout—A timeout ocurred on the RP while waiting for the SPA to become operational. • SPA type mismatch—Occurs when you have pre-configured a SPA of one type, but have inserted a SPA of a different type. **Note** This reason code only applies to those platforms that support pre-configuration. This is not applicable to a Cisco 7304 router. • SPA unrecognized—SPA is not supported by the Cisco IOS software release. • Start failed—Failed to start interfaces on SPA. • Unexpected inserted event—The SPA OIR software has received a SPA insertion event when the OIR software considered the SPA already present. • Wait h/w ok timeout—A timeout occurred while waiting for the SPA_OK and PWR_OK hardware signals to be asserted. • Wait start timeout—A timeout occurred on the MSC while waiting for permission from the RP to bring up the SPA.
stopped	SPA has been gracefully deactivated using the **hw-module subslot stop** privileged EXEC command on the Cisco 7304 router.

Examples

The following example shows the operational status of all of the SPAs installed in the router:

```
Router# show hw-module subslot oir
Module         Model             Operational Status
-------------- ----------------- -------------------------
subslot 4/0    SPA-4XOC3-POS     booting
subslot 4/1    SPA-4XOC3-ATM     out of service(FPD upgrade failed)
subslot 4/2    SPA-4XOC3-POS     ok
subslot 4/3    SPA-1XTENGE-XFP   out of service(SPA unrecognized)
```

The following example shows sample output when using the optional **internal** keyword:

```
Router# show hw-module subslot 4/0 oir internal
WARNING: This command is not intended for production use
and should only be used under the supervision of
Cisco Systems technical support personnel.
```

```
sm(spa_oir_tsm subslot 4/0 TSM), running yes, state ready
Admin Status: admin enabled,  Operational Status: ok(1)
Last reset Reason: manual
TSM Context:
    configured_spa_type 0x483
    soft remove fail code 0x0(none)
    last_fail_code 0x110E(SPA unrecognized)
    fail_count 0
    timed_fail_count 0, failed_spa_type 0x483
    recovery_action 6
    associated_fail_code 0x110E(SPA unrecognized)
    sequence numbers: next from tsm 4, last to tsm 2
    flags 0x0
Subslot:
    spa type 0x483, active spa type 0x483
    subslot flags 0x0, plugin flags 0x0
TSM Parameters:
    wait_psm_ready_timeout 360000 ms, init_timeout 240000 ms
    short_recovery_delay 5000 ms, long_recovery_delay 120000 ms
    ok_up_time 1200000 ms, bad_fail_count 10
    fail_time_period 600000 ms, max_fail_count 5
    does not support pre-configuration
SPA OIR state machine audit statistics
                In-sync poll-count  qry-fail resp-fail  restarts fail-count
subslot 4/0         yes          1         0         0         0          0
```

Related Commands

Command	Description
hw-module subslot reload	Restarts a SPA and its interfaces.
hw-module subslot shutdown	Shuts down a SPA with or without power.

show interface sdcc

To display configuration information and statistics for a sections data communications channel (SDCC) interface, use the **show interface sdcc** command in privileged EXEC mode. The command does not have a **no** form.

show interface sdcc *slot*/*subslot*/*port*[/*sub_int*]

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
/*port*	(Optional) Port or interface number. Refer to the appropriate hardware manual for port information. For SPAs, refer to the corresponding "Specifying the Interface Address on a SPA" topics in the platform-specific SPA software configuration guide.
/*sub_int*	(Optional) Subinterface number.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(11)BC3	This command was introduced.
12.2(25)S3	This command was integrated into Cisco IOS release 12.2(25)S3 to support POS SPAs on the Cisco 7304 router.

Examples

The following command displays configuration information and statistics for SDCC interface 4/0/0:

```
Router# show interface sdcc 4/0/0
SDCC4/0/0 is up, line protocol is up
  Hardware is SDCC
  Internet address is 10.10.10.1/24
  MTU 1500 bytes, BW 192 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input never, output 00:00:07, output hang never
  Last clearing of "show interface" counters 00:01:52
```

```
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
   5 packets input, 520 bytes, 0 no buffer
   Received 0 broadcasts (0 IP multicast)
   0 runts, 0 giants, 0 throttles
   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
   5 packets output, 520 bytes, 0 underruns
   0 output errors, 0 collisions, 1 interface resets
   0 output buffer failures, 0 output buffers swapped out
   0 carrier transitions
```

show interfaces fastethernet

To display information about the Fast Ethernet interfaces, use the **show interfaces fastethernet** command in privileged EXEC configuration mode.

show interfaces fastethernet *slot*/*subslot*/*port*

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/subslot	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
/port	(Optional) Port or interface number. Refer to the appropriate hardware manual for port information. For SPAs, refer to the corresponding "Specifying the Interface Address on a SPA" topics in the platform-specific SPA software configuration guide.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
11.2	This command was introduced.
12.2 S	This command was integrated into Cisco IOS Release 12.2 S.
12.2(20)S2	This command was implemented on the 4-Port 10/100 Fast Ethernet SPA on the Cisco 7304 router.

Examples

The following is sample output from the **show interfaces fastethernet** command for the second interface (port 1) in a 4-Port 10/100 Fast Ethernet SPA located in the bottom subslot (1) of the MSC that is installed in slot 2 on a Cisco 7304 router:

```
Router# show interfaces fastethernet 2/1/1
FastEthernet2/1/1 is up, line protocol is up
  Hardware is SPA-4FE-7304, address is 00b0.64ff.5d80 (bia 00b0.64ff.5d80)
  Internet address is 192.168.50.1/24
  MTU 9216 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full-duplex, 100Mb/s, 100BaseTX/FX
```

```
ARP type: ARPA, ARP Timeout 04:00:00
Last input 00:00:22, output 00:00:02, 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
   5 packets input, 320 bytes
   Received 1 broadcasts (0 IP multicast)
   0 runts, 0 giants, 0 throttles
   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
   0 watchdog
   0 input packets with dribble condition detected
   8 packets output, 529 bytes, 0 underruns
   0 output errors, 0 collisions, 2 interface resets
   0 babbles, 0 late collision, 0 deferred
   2 lost carrier, 0 no carrier
   0 output buffer failures, 0 output buffers swapped out
```

Note There are variations in the output for the **show interfaces** commands on Cisco Systems routers depending on the platform, type of interface, and also other features that you might have configured, such as Quality of Service (QoS). Therefore, some additional output fields might appear in your **show** command output. For more information about these fields, see the **show interfaces** command description in the *Cisco IOS Interface Command Reference*, Release 12.2.

Table 8-25 describes the fields shown in the display.

Table 8-25 show interfaces fastethernet Field Descriptions—Fast Ethernet SPA

Field	Description
Fast Ethernet...is up ...is administratively down	Indicates whether the interface hardware is currently active and if it has been taken down by an administrator.
line protocol is	Indicates whether the software processes that handle the line protocol consider the line usable or if it has been taken down by an administrator.
Hardware	Hardware type (for example, SPA-4FE-7304) and MAC address.
Description	Alphanumeric string identifying the interface. This only appears if the **description** interface configuration command has been configured on the interface.
Internet address	Internet address followed by subnet mask.
MTU	Maximum transmission unit of the interface. The default is 1500 bytes for the 4-Port 10/100 Fast Ethernet SPA.
BW	Bandwidth of the interface in kilobits per second.
DLY	Delay of the interface in microseconds.
reliability	Reliability of the interface as a fraction of 255 (255/255 is 100 percent reliability), calculated as an exponential average over 5 minutes.
txload, rxload	Load on the interface (in the transmit “tx” and receive “rx” directions) as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes.

Table 8-25 show interfaces fastethernet Field Descriptions—Fast Ethernet SPA (continued)

Field	Description
Encapsulation	Encapsulation method assigned to the interface.
loopback	Indicates whether or not loopback is set.
Keepalive	Indicates whether or not keepalives are set, and the time interval.
Half-duplex, Full-duplex	Indicates the duplex mode for the interface.
100Mb/s, 10Mb/s	Speed of the interface in megabits per second.
100BaseTX/FX	Media protocol standard.
ARP type:	Type of Address Resolution Protocol (ARP) assigned and the timeout period.
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface and processed locally on the router. Useful for knowing when a dead interface failed. This field is not updated by fast-switched traffic.
output	Number of hours, minutes, and seconds since the last packet was successfully transmitted by the interface. Useful for knowing when a dead interface failed.
output hang	Number of hours, minutes, and seconds (or never) since the interface was last reset because of a transmission that took too long. When the number of hours in any of the “last” fields exceeds 24 hours, the number of days and hours is displayed. If that field overflows, asterisks are printed. **Note** This field does not apply to SPA interfaces.
Last clearing	Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Note that variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared. A series of asterisks (***) indicates the elapsed time is too large to be displayed. 0:00:00 indicates the counters were cleared more than 2^{31} ms (and less than 2^{32} ms) ago.
Input queue (size/max/drops/flushes)	Packet statistics on the input queue reported as: • Size—Number of packets in the input queue. • Max—Maximum size of the queue. • Drops—Number of packets dropped because of a full input queue. • Flushes—Number of packets dropped as part of selective packet discard (SPD). SPD implements a selective packet drop policy on the router’s IP process queue. Therefore, it only applies to process-switched traffic.
Total output drops	Total number of packets dropped because of a full output queue.
Queueing strategy	Type of Layer 3 queueing active on this interface. The default is first-in, first-out (FIFO).

Table 8-25 show interfaces fastethernet Field Descriptions—Fast Ethernet SPA (continued)

Field	Description
Output queue (size/max)	Number of packets in the output queue (size), and the maximum size of the queue (max).
5 minute input rate, 5 minute output rate	Average number of bits and packets transmitted per second in the last 5 minutes. If the interface is not in promiscuous mode, it senses network traffic it sends and receives (rather than all network traffic). The 5-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period.
packets input	Total number of error-free packets received by the system.
bytes	Total number of bytes, including data and MAC encapsulation, in the error-free packets received by the system.
Received...broadcasts	Total number of broadcast or multicast packets received by the interface.
runts	Number of packets that are discarded because they are smaller than the minimum packet size of the medium. For instance, any Ethernet packet that is smaller than 64 bytes is considered a runt.
giants	Number of packets that are discarded because they exceed the maximum packet size of the medium. For example, any Ethernet packet that is larger than 1536 bytes is considered a giant. **Note** For the 4-Port 10/100 Fast Ethernet SPA, the default is that a giant is any packet greater than 1536 bytes. However, if you modify the maximum transmission unit (MTU) for the interface, this counter increments when you exceed the specified MTU for the interface.
throttles	Number of times the receiver on the port was disabled, possibly because of buffer or processor overload.
input errors	Includes runts, giants, no buffer, CRC, frame, overrun, and ignored counts. Other input-related errors can also cause the input errors count to be increased, and some datagrams may have more than one error; therefore, this sum may not balance with the sum of enumerated input error counts.
CRC	Cyclic redundancy check generated by the originating LAN station or far-end device does not match the checksum calculated from the data received. On a LAN, this usually indicates noise or transmission problems on the LAN interface or the LAN bus itself. A high number of CRCs is usually the result of collisions or a station transmitting bad data.
frame	Number of packets received incorrectly having a CRC error and a noninteger number of octets. On a LAN, this is usually the result of collisions or a malfunctioning Ethernet device.

Table 8-25 show interfaces fastethernet Field Descriptions—Fast Ethernet SPA (continued)

Field	Description
overrun	Number of times the receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data.
ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. These buffers are different than the system buffers. Broadcast storms and bursts of noise can cause the ignored count to be increased.
watchdog	Number of times the watchdog receive timer expired. Expiration happens when receiving a packet with a length greater than 2048 bytes.
input packets with dribble condition detected	Dribble bit error indicates that a frame is slightly too long. This frame error counter is incremented for informational purposes only; the router accepts the frame.
packets output	Total number of messages transmitted by the system.
bytes	Total number of bytes, including data and MAC encapsulation, transmitted by the system.
underruns	Number of times that the transmitter has been running faster than the router can handle.
output errors	Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this may not balance with the sum of the enumerated output errors, as some datagrams may have more than one error and others may have errors that do not fall into any of the specifically tabulated categories.
collisions	Number of messages retransmitted because of an Ethernet collision. This is usually the result of an overextended LAN (Ethernet or transceiver cable too long, more than two repeaters between stations, or too many cascaded multiport transceivers). A packet that collides is counted only once in output packets.
interface resets	Number of times an interface has been completely reset. This can happen if packets queued for transmission were not sent within several seconds. Interface resets can occur when an interface is looped back or shut down.
babbles	Transmit jabber timer expired.
late collision	Number of late collisions. Late collision happens when a collision occurs after transmitting the preamble.
deferred	Number of times that the interface had to defer while ready to transmit a frame because the carrier was asserted.
lost carrier	Number of times the carrier was lost during transmission.
no carrier	Number of times the carrier was not present during the transmission. **Note** This field does not apply to SPA interfaces.
output buffer failures, output buffers swapped out	These counters are not used by the 4-Port 10/100 Fast Ethernet SPA on the Cisco 7304 router.

Related Commands

Command	Description
show interfaces[1]	Displays statistics for the interfaces configured on a router or access server.
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.

1. Refer to the Cisco IOS Release 12.2 command reference and master index publications.

show interfaces gigabitethernet

To display information about the Gigabit Ethernet interfaces, use the **show interfaces gigabitethernet** command in privileged EXEC configuration mode.

show interfaces gigabitethernet *slot*/*subslot*/*port*

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
/*port*	(Optional) Port or interface number. Refer to the appropriate hardware manual for port information. For SPAs, refer to the corresponding "Specifying the Interface Address on a SPA" topics in the platform-specific SPA software configuration guide.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1 CC	This command was introduced.
12.1(3a)E	Support for the Cisco 7200-I/O-GE+E controller was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(20)S2	This command was integrated into Cisco IOS Release 12.2(20)S2 and introduced a new address format and output for interfaces on the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Examples

The following is sample output from the **show interfaces gigabitethernet** command for the first interface (port 0) in a 2-Port 10/100/1000 Gigabit Ethernet SPA located in the top subslot (0) of the MSC that is installed in slot 4 on a Cisco 7304 router:

```
Router# show interfaces gigabitethernet 4/0/0
GigabitEthernet4/0/0 is up, line protocol is down
  Hardware is SPA-2GE-7304, address is 00b0.64ff.5a80 (bia 00b0.64ff.5a80)
  MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
```

```
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
Half-duplex, 1000Mb/s, link type is auto, media type is RJ45
output flow-control is unsupported, input flow-control is unsupported
ARP type: ARPA, ARP Timeout 04:00:00
Last input never, output 00:00:09, 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
   0 packets input, 0 bytes, 0 no buffer
   Received 0 broadcasts (0 IP multicast)
   0 runts, 0 giants, 0 throttles
   0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
   0 watchdog, 0 multicast, 0 pause input
   109 packets output, 6540 bytes, 0 underruns
   0 output errors, 0 collisions, 2 interface resets
   0 babbles, 0 late collision, 0 deferred
   1 lost carrier, 0 no carrier, 0 PAUSE output
   0 output buffer failures, 0 output buffers swapped out
```

Note There are variations in the output for the **show interfaces** commands on Cisco Systems routers depending on the platform, type of interface, and also other features that you might have configured, such as Quality of Service (QoS). Therefore, some additional output fields might appear in your **show** command output. For more information about these fields, see the **show interfaces** command description in the *Cisco IOS Interface Command Reference*, Release 12.2.

Table 8-26 describes the fields shown in the display.

Table 8-26 show interfaces gigabitethernet Field Descriptions—Gigabit Ethernet SPA

Field	Description
GigabitEthernet...is up ...is administratively down	Indicates whether the interface hardware is currently active and if it has been taken down by an administrator.
line protocol is	Indicates whether the software processes that handle the line protocol consider the line usable or if it has been taken down by an administrator.
Hardware	Hardware type (for example, SPA-2GE-7304) and MAC address.
Description	Alphanumeric string identifying the interface. This only appears if the **description** interface configuration command has been configured on the interface.
Internet address	Internet address followed by subnet mask.
MTU	Maximum transmission unit of the interface. The default is 1500 bytes for the 2-Port 10/100/1000 Gigabit Ethernet SPA.
BW	Bandwidth of the interface in kilobits per second.
DLY	Delay of the interface in microseconds.
reliability	Reliability of the interface as a fraction of 255 (255/255 is 100 percent reliability), calculated as an exponential average over 5 minutes.

Table 8-26 show interfaces gigabitethernet Field Descriptions—Gigabit Ethernet SPA (continued)

Field	Description
txload, rxload	Load on the interface (in the transmit “tx” and receive “rx” directions) as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes.
Encapsulation	Encapsulation method assigned to the interface.
loopback	Indicates whether or not loopback is set.
Keepalive	Indicates whether or not keepalives are set, and the time interval.
Half-duplex, Full-duplex	Indicates the duplex mode for the interface.
1000Mb/s, 100Mb/s, 10Mb/s	Speed of the interface in megabits per second.
link type	Specifies whether or not autonegotiation is being used on the link.
media type	Interface port media type: RJ45, SX, LX, or ZX.
100BaseTX/FX	Media protocol standard.
ARP type:	Type of Address Resolution Protocol (ARP) assigned and the timeout period.
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface and processed locally on the router. Useful for knowing when a dead interface failed. This field is not updated by fast-switched traffic.
output	Number of hours, minutes, and seconds since the last packet was successfully transmitted by the interface. Useful for knowing when a dead interface failed.
output hang	Number of hours, minutes, and seconds (or never) since the interface was last reset because of a transmission that took too long. When the number of hours in any of the “last” fields exceeds 24 hours, the number of days and hours is displayed. If that field overflows, asterisks are printed. **Note** This field does not apply to SPA interfaces.
Last clearing	Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Note that variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared. A series of asterisks (***) indicates the elapsed time is too large to be displayed. 0:00:00 indicates the counters were cleared more than 2^{31} ms (and less than 2^{32} ms) ago.

Table 8-26 show interfaces gigabitethernet Field Descriptions—Gigabit Ethernet SPA (continued)

Field	Description
Input queue (size/max/drops/flushes)	Packet statistics on the input queue reported as: • Size—Number of packets in the input queue. • Max—Maximum size of the queue. • Drops—Number of packets dropped because of a full input queue. • Flushes—Number of packets dropped as part of selective packet discard (SPD). SPD implements a selective packet drop policy on the router's IP process queue. Therefore, it only applies to process-switched traffic.
Total output drops	Total number of packets dropped because of a full output queue.
Queueing strategy	Type of Layer 3 queueing active on this interface. The default is first-in, first-out (FIFO).
Output queue (size/max)	Number of packets in the output queue (size), and the maximum size of the queue (max).
5 minute input rate, 5 minute output rate	Average number of bits and packets transmitted per second in the last 5 minutes. If the interface is not in promiscuous mode, it senses network traffic it sends and receives (rather than all network traffic). The 5-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period.
packets input	Total number of error-free packets received by the system.
bytes	Total number of bytes, including data and MAC encapsulation, in the error-free packets received by the system.
Received...broadcasts	Total number of broadcast or multicast packets received by the interface.
runts	Number of packets that are discarded because they are smaller than the minimum packet size of the medium. For instance, any Ethernet packet that is smaller than 64 bytes is considered a runt.
giants	Number of packets that are discarded because they exceed the maximum packet size of the medium. For example, any Ethernet packet that is larger than 1536 bytes is considered a giant. **Note** For the 2-Port 10/100/1000 Gigabit Ethernet SPA, the default is that a giant is any packet greater than 1536 bytes. However, if you modify the maximum transmission unit (MTU) for the interface, this counter increments when you exceed the specified MTU for the interface.
throttles	Number of times the receiver on the port was disabled, possibly because of buffer or processor overload.

Table 8-26 show interfaces gigabitethernet Field Descriptions—Gigabit Ethernet SPA (continued)

Field	Description
input errors	Includes runts, giants, no buffer, CRC, frame, overrun, and ignored counts. Other input-related errors can also cause the input errors count to be increased, and some datagrams may have more than one error; therefore, this sum may not balance with the sum of enumerated input error counts.
CRC	Cyclic redundancy check generated by the originating LAN station or far-end device does not match the checksum calculated from the data received. On a LAN, this usually indicates noise or transmission problems on the LAN interface or the LAN bus itself. A high number of CRCs is usually the result of collisions or a station transmitting bad data.
frame	Number of packets received incorrectly having a CRC error and a noninteger number of octets. On a LAN, this is usually the result of collisions or a malfunctioning Ethernet device.
overrun	Number of times the receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data.
ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. These buffers are different than the system buffers. Broadcast storms and bursts of noise can cause the ignored count to be increased.
watchdog	Number of times the watchdog receive timer expired. Expiration happens when receiving a packet with a length greater than 2048 bytes.
input packets with dribble condition detected	Dribble bit error indicates that a frame is slightly too long. This frame error counter is incremented for informational purposes only; the router accepts the frame.
packets output	Total number of messages transmitted by the system.
bytes	Total number of bytes, including data and MAC encapsulation, transmitted by the system.
underruns	Number of times that the transmitter has been running faster than the router can handle.
output errors	Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this may not balance with the sum of the enumerated output errors, as some datagrams may have more than one error and others may have errors that do not fall into any of the specifically tabulated categories.
collisions	Number of messages retransmitted because of an Ethernet collision. This is usually the result of an overextended LAN (Ethernet or transceiver cable too long, more than two repeaters between stations, or too many cascaded multiport transceivers). A packet that collides is counted only once in output packets.
interface resets	Number of times an interface has been completely reset. This can happen if packets queued for transmission were not sent within several seconds. Interface resets can occur when an interface is looped back or shut down.

Table 8-26 show interfaces gigabitethernet Field Descriptions—Gigabit Ethernet SPA (continued)

Field	Description
babbles	Transmit jabber timer expired.
late collision	Number of late collisions. Late collision happens when a collision occurs after transmitting the preamble.
deferred	Number of times that the interface had to defer while ready to transmit a frame because the carrier was asserted.
lost carrier	Number of times the carrier was lost during transmission.
no carrier	Number of times the carrier was not present during the transmission. **Note** This field does not apply to SPA interfaces.
output buffer failures, output buffers swapped out	These counters are not used by the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Related Commands

Command	Description
show interfaces[1]	Displays statistics for the interfaces configured on a router or access server.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.

1. Refer to the Cisco IOS Release 12.2 command reference and master index publications.

show interfaces pos

To display configuration information and statistics for a Packet over SONET (POS) interface, use the **show interfaces pos** command in user EXEC or privileged EXEC mode.

Cisco 7000 and Cisco 7500 Series with VIPs

show interfaces pos [*slot*/*port-adapter*/*port*]

POS Shared Port Adapters

show interfaces pos [*slot/subslot/port*[/*sub_int*]]

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding “Identifying Slots and Subslots for MSCs and SPAs” topic in the platform-specific SPA software configuration guide.
/*port-adapter*	(Optional) Port adapter number. Refer to the appropriate hardware manual for information about port adapter compatibility.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding “Specifying the Interface Address on a SPA” topic in the platform-specific SPA software configuration guide for subslot information.
/*port*	(Optional) Port or interface number. Refer to the appropriate hardware manual for port information. For SPAs, refer to the corresponding “Specifying the Interface Address on a SPA” topics in the platform-specific SPA software configuration guide.
/sub_int	(Optional) Subinterface number.

Command Modes

User EXEC
Privileged EXEC

Command History

Release	Modification
11.2	The **show interface posi** command was introduced.
11.3	The name of the command was modified from **show interface posi** to **show interfaces pos**, and the sample output was updated.
12.2S	This command was integrated into Cisco IOS release 12.2S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router. The command was modified to support a new addressing format for SPAs.

Examples

Cisco 7513 Example

The following is sample output from the **show interfaces pos** command on a Cisco 7513 router with one Packet OC-3 Interface Processor (POSIP):

```
Router# show interfaces pos 2/0/0

POS2/0/0 is up, line protocol is up
  Hardware is cyBus Packet over Sonet
  Description: PRI-T1 net to zippy (4K) to Pac-Bell
  Internet address is 10.1.1.1/27
  MTU 4470 bytes, BW 1000 Kbit, DLY 40000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (3 sec)
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters 00:23:09
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 1 packets/sec
  5 minute output rate 1000 bits/sec, 1 packets/sec
     1046 packets input, 54437 bytes, 0 no buffer
     Received 485 broadcasts, 0 runts, 0 giants, 0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     4013 packets output, 1357412 bytes, 0 underruns
     0 output errors, 0 applique, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
```

POS Shared Port Adapter Example

The following is sample output from the **show interfaces pos** command on a Cisco 7304 router for POS interface 2/1/1 (which is the interface for port 1 of the SPA in subslot 1 of the MSC in chassis slot 2):

```
Router# show interfaces pos 2/1/1
POS3/0/0 is up, line protocol is up
  Hardware is Packet over Sonet
  MTU 4470 bytes, BW 622000 Kbit, DLY 100 usec,
     reliability 194/255, txload 1/255, rxload 1/255
  Encapsulation FRAME-RELAY, crc 16, loopback not set
  Keepalive set (10 sec)
  Scramble disabled
  LMI enq sent  18, LMI stat recvd 0, LMI upd recvd 0
  LMI enq recvd 1473, LMI stat sent  1473, LMI upd sent  0, DCE LMI up
  LMI DLCI 1023  LMI type is CISCO  frame relay DCE
  FR SVC disabled, LAPF state down
  Broadcast queue 0/256, broadcasts sent/dropped 2223/1, interface
broadcasts 1977
  Last input 00:00:05, output 00:00:05, output hang never
  Last clearing of "show interface" counters 04:46:02
  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
     47019 packets input, 163195100 bytes, 0 no buffer
     Received 0 broadcasts (0 IP multicast)
     14332 runts, 925 giants, 0 throttles
              0 parity
     17820 input errors, 1268 CRC, 0 frame, 0 overrun, 0 ignored, 10
abort
     49252 packets output, 170900767 bytes, 0 underruns
     0 output errors, 0 applique, 2 interface resets
     0 output buffer failures, 0 output buffers swapped out
     3 carrier transitions.
```

Table 8-27 describes the significant fields shown in these displays.

Table 8-27 show interfaces pos Field Descriptions

Field	Description
POSx/y/z is up, line protocol is up	Indicates whether the interface hardware is currently active and can transmit and receive or whether it has been taken down by an administrator.
Hardware is. . .	Hardware type: • For POSIP— cyBus Packet over Sonet • For POS SPAs—Packet over SONET
Internet address is	Internet address and subnet mask.
MTU	Maximum transmission unit of the interface.
BW	Bandwidth of the interface, in kilobits per second.
DLY	Delay of the interface, in microseconds.
Rely	Reliability of the interface as a fraction of 255 (255/255 is 100 percent reliability), calculated as an exponential average over 5 minutes.
Load	Load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes. The calculation uses the value from the **bandwidth** interface configuration command.
Encapsulation	Encapsulation method assigned to interface.
Loopback	Indicates whether loopbacks are set.
Keepalive	Indicates whether keepalives are set.
Scramble	Indicates whether or not SONET payload scrambling is enabled. SONET scrambling is disabled by default.
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface and processed locally on the router. Useful for knowing when a dead interface failed. This counter is updated only when packets are process-switched, not when packets are fast-switched.
(Last) output	Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface. This counter is updated only when packets are process-switched, not when packets are fast-switched.
(Last) output hang	Number of hours, minutes, and seconds (or never) since the interface was last reset because of a transmission that took too long. When the number of hours in any of the “last” fields exceeds 24 hours, the number of days and hours is printed. If that field overflows, asterisks are printed.

Table 8-27 show interfaces pos Field Descriptions (continued)

Field	Description
Last clearing	Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Note that variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared. *** indicates the elapsed time is too large to be displayed. 0:00:00 indicates the counters were cleared more than 22^{31} ms (and less than 2^{32} ms) ago.
Queueing strategy	First-in, first-out queueing strategy (other queueing strategies you might see are priority-list, custom-list, and weighted fair).
Output queue, drops input queue, drops	Number of packets in output and input queues. Each number is followed by a slash, the maximum size of the queue, and the number of packets dropped because a queue was full.
5 minute input rate 5 minute output rate	Average number of bits and packets received or transmitted per second in the last 5 minutes.
Packets input	Total number of error-free packets received by the system.
Bytes (input)	Total number of bytes, including data and MAC encapsulation, in the error-free packets received by the system.
No buffer	Number of received packets discarded because there was no buffer space in the main system. Compare with ignored count. Broadcast storms on Ethernets and bursts of noise on serial lines are often responsible for no input buffer events.
Broadcasts	Total number of broadcast or multicast packets received by the interface.
Runts	Number of packets that are discarded because they are smaller than the minimum packet size of the medium.
Giants	Number of packets that are discarded because they exceed the maximum packet size of the medium.
Parity	Report of the parity errors on the interface.
Input errors	Total number of no buffer, runts, giants, CRCs, frame, overrun, ignored, and abort counts. Other input-related errors can also increment the count, so that this sum might not balance with the other counts.
CRC	Cyclic redundancy checksum generated by the originating LAN station or far-end device does not match the checksum calculated from the data received. On a LAN, this usually indicates noise or transmission problems on the LAN interface or the LAN bus itself. A high number of CRCs is usually the result of collisions or a station transmitting bad data. On a serial link, CRCs usually indicate noise, gain hits or other transmission problems on the data link.
Frame	Number of packets received incorrectly having a CRC error and a noninteger number of octets. On a serial line, this is usually the result of noise or other transmission problems.

Table 8-27 show interfaces pos Field Descriptions (continued)

Field	Description
Overrun	Number of times the serial receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data.
Ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. These buffers are different than the system buffers mentioned previously in the buffer description. Broadcast storms and bursts of noise can cause the ignored count to be incremented.
Abort	Illegal sequence of one bits on the interface.
Packets output	Total number of messages transmitted by the system.
Bytes (output)	Total number of bytes, including data and MAC encapsulation, transmitted by the system.
Underruns	Number of times that the far-end transmitter has been running faster than the near-end router's receiver can handle.
Output errors	Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this might not balance with the sum of the enumerated output errors, as some datagrams can have more than one error, and others can have errors that do not fall into any of the specifically tabulated categories.
Applique	Indicates an unrecoverable error has occurred on the POSIP applique. The system then invokes an interface reset.
Interface resets	Number of times an interface has been completely reset. This can happen if packets queued for transmission were not sent within a certain interval. If the system notices that the carrier detect line of an interface is up, but the line protocol is down, it periodically resets the interface in an effort to restart it. Interface resets can also occur when an unrecoverable interface processor error occurred, or when an interface is looped back or shut down.
Carrier transitions	Number of times the carrier detect signal of the interface has changed state.

Related Commands

Command	Description
interface	Configures an interface type and enters interface configuration mode.

show interfaces serial

To display information about a serial interface, use the **show interfaces serial** command in privileged EXEC mode. When using Frame Relay encapsulation, use the **show interfaces serial** command in user EXEC or privileged EXEC mode to display information about the multicast data-link connection identifier (DLCI), the DLCIs used on the interface, and the DLCI used for the Local Management Interface (LMI).

Cisco 4000 Series

show interfaces serial [*number*[**:***channel-group*]] [**accounting**]

Cisco 7000 and Cisco 7500 Series with the RSP7000, RSP7000CI, or Ports on VIPs

show interfaces serial [*slot*/*port-adapter*/*port*]

Cisco 7500 Series

show interfaces serial [*slot*/*port*[**:***channel-group*]] [**accounting**]

Cisco 7500 Series with a CT3IP

show interfaces serial [*slot*/*port-adapter*/*port*][**:***t1-channel*] [**accounting** | **crb**]

Cisco AS5350 and Cisco AS5400 Universal Gateways

show interfaces serial *slot*/*port*

Cisco AS5800 Access Servers

show interfaces serial *dial-shelf*/*slot*/*t3-port***:***t1-num***:***chan-group*

T3/E3 Shared Port Adapters and 2-Port and 4-Port Channelized T3 SPA in Unchannelized Mode

show interfaces serial [*slot*/*subslot*/*port*]

Channelized T3 Shared Port Adapters

show interfaces serial [*slot*/*subslot*/*port*/*t1-num***:***channel-group*]

Syntax Description

number	(Optional) Number of the port being displayed.
:*channel-group*	(Optional) On the Cisco 4000 series with a Network Management Processor (NPM) or the Cisco 7500 series routers with a MultiChannel Interface Processor (MIP), specifies the T1 channel-group number in the range of 0 to 23 defined with the **channel-group** controller configuration command. For channelized T3 SPAs, number 0–23 of the DS0 link on the T1 channel.
accounting	(Optional) Displays the number of packets of each protocol type that have been sent through the interface.

slot	(Optional) Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
port	(Optional) Number of the port being displayed. Refer to the appropriate hardware manual for slot and port information.
port-adapter	(Optional) Number of the port adapter being displayed. Refer to the appropriate hardware manual for information about port adapter compatibility.
subslot	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
:*t1-channel*	(Optional) T1 channel number. For the CT3IP, the T1 channel is a number between 1 and 28. T1 channels on the CT3IP are numbered 1 to 28 rather than the more traditional zero-based scheme (0 to 27) used with other Cisco products. This scheme ensures consistency with telco numbering schemes for T1 channels within channelized T3 equipment.
crb	(Optional) Displays interface routing and bridging information.
dial-shelf	Dial-shelf chassis in the Cisco AS5800 access server that contains the CT3 interface card.
slot	Location of the CT3 interface card in the dial shelf chassis.
t3-port	T3 port number. The only valid value is 0.
:*t1-num*	T1 time slot in the T3 line. The value can be from 1 to 28.
:*chan-group*	Channel group identifier.

Defaults

No default behavior or values

Command Modes

User EXEC when Frame Relay encapsulation is used
Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced on the Cisco 4000 series routers.
11.0	This command was implemented on the Cisco 7000 series routers.
11.1CA	This command was modified to include sample output for the PA-2JT2, PA-E3, and PA-T3 serial port adapters.
11.3	This command was modified to include the CT3IP.
12.0(3)T	This command was implemented on the Cisco AS5800 access servers. This command was modified to include support for flow-based WRED.
12.0(4)T	This command was modified to include enhanced display information for dialer bound interfaces.

Release	Modification
12.0(7)T	This command was modified to include dialer as an interface type, and to reflect the default behavior.
12.2(11)T	This command was implemented on the Cisco AS5350 and Cisco AS5400.
12.2(13)T	This command was modified to display information about Frame Relay interface queueing and fragmentation.
12.2S	This command was integrated into Cisco IOS Release 12.2S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

Frame Relay

Use this command to determine the status of the Frame Relay link. This display also indicates Layer 2 status if switched virtual circuits (SVCs) are configured.

Channel Groups as Virtual Serial Interfaces

To find out about channel groups configured as virtual serial interfaces, to verify that the router has High-Level Data Link Control (HDLC) encapsulation on the interface, and to verify that the interface sees the loopback, use the **show interfaces serial** command in privileged EXEC mode.

Examples

Example of Synchronous Serial Interface

The following is sample output from the **show interfaces serial** command for a synchronous serial interface:

```
Router# show interfaces serial

Serial 0 is up, line protocol is up
   Hardware is MCI Serial
   Internet address is 192.168.10.203, subnet mask is 255.255.255.0
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
   Encapsulation HDLC, loopback not set, keepalive set (10 sec)
   Last input 0:00:07, output 0:00:00, output hang never
   Output queue 0/40, 0 drops; input queue 0/75, 0 drops
   Five minute input rate 0 bits/sec, 0 packets/sec
   Five minute output rate 0 bits/sec, 0 packets/sec
       16263 packets input, 1347238 bytes, 0 no buffer
       Received 13983 broadcasts, 0 runts, 0 giants
       2 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 2 abort
1 carrier transitions

     22146 packets output, 2383680 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets, 0 restarts
```

Table 8-28 describes significant fields shown in the display.

Table 8-28 show interfaces serial Field Descriptions—Synchronous Serial Interface

Field	Description
Serial ... is {up | down} ... is administratively down	Indicates whether the interface hardware is currently active (whether carrier detect is present), is currently inactive, or has been taken down by an administrator.
line protocol is {up | down}	Indicates whether the software processes that handle the line protocol consider the line usable (that is, whether keepalives are successful) or whether the line has been taken down by an administrator.
Hardware is	Specifies the hardware type.
Internet address is	Specifies the Internet address and subnet mask.
MTU	Maximum transmission unit of the interface.
BW	Indicates the value of the bandwidth parameter that has been configured for the interface (in kbps). If the interface is attached to a serial line with a line speed that does not match the default (1536 or 1544 kbps for T1 and 56 kbps for a standard synchronous serial line), use the **bandwidth** command to specify the correct line speed for this serial line.
DLY	Delay of the interface, in microseconds.
rely	Reliability of the interface as a fraction of 255 (255/255 is 100 percent reliability), calculated as an exponential average over 5 minutes.
load	Load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes.
Encapsulation	Encapsulation method assigned to interface.
loopback	Indicates whether or not loopback is set.
keepalive	Indicates whether or not keepalives are set.
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface and processed locally on the router. Useful for knowing when a dead interface failed. This counter is updated only when packets are process-switched, not when packets are fast-switched.
Last output	Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface. This counter is updated only when packets are process-switched, not when packets are fast-switched.
output hang	Number of hours, minutes, and seconds (or never) since the interface was last reset because of a transmission that took too long. When the number of hours in any of the "last" fields exceeds 24 hours, the number of days and hours is printed. If that field overflows, asterisks are printed.
Output queue, drops input queue, drops	Number of packets in output and input queues. Each number is followed by a slash, the maximum size of the queue, and the number of packets dropped because of a full queue.

Table 8-28 show interfaces serial Field Descriptions—Synchronous Serial Interface (continued)

Field	Description
5 minute input rate 5 minute output rate	Average number of bits and packets transmitted per second in the last 5 minutes. The 5-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period.
packets input	Total number of error-free packets received by the system.
bytes	Total number of bytes, including data and MAC encapsulation, in the error-free packets received by the system.
no buffer	Number of received packets discarded because there was no buffer space in the main system. Compare with ignored count. Broadcast storms on Ethernet networks and bursts of noise on serial lines are often responsible for no input buffer events.
Received... broadcasts	Total number of broadcast or multicast packets received by the interface.
runts	Number of packets that are discarded because they are smaller than the minimum packet size of the medium.
giants	Number of packets that are discarded because they exceed the maximum packet size of the medium.
input errors	Total number of no buffer, runts, giants, CRCs, frame, overrun, ignored, and abort counts. Other input-related errors can also increment the count, so that this sum might not balance with the other counts.
CRC	Cyclic redundancy checksum generated by the originating station or far-end device does not match the checksum calculated from the data received. On a serial link, CRCs usually indicate noise, gain hits, or other transmission problems on the data link.
frame	Number of packets received incorrectly having a CRC error and a noninteger number of octets. On a serial line, this is usually the result of noise or other transmission problems.
overrun	Number of times the serial receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data.
ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. Broadcast storms and bursts of noise can cause the ignored count to be increased.
abort	Illegal sequence of one bits on a serial interface. This usually indicates a clocking problem between the serial interface and the data link equipment.
carrier transitions	Number of times the carrier detect signal of a serial interface has changed state. For example, if data carrier detect (DCD) goes down and comes up, the carrier transition counter will increment two times. Indicates modem or line problems if the carrier detect line is changing state often.
packets output	Total number of messages transmitted by the system.

Table 8-28 show interfaces serial Field Descriptions—Synchronous Serial Interface (continued)

Field	Description
bytes output	Total number of bytes, including data and MAC encapsulation, transmitted by the system.
underruns	Number of times that the transmitter has been running faster than the router can handle. This might never be reported on some interfaces.
output errors	Sum of all errors that prevented the final transmission of datagrams out of the interface from being examined. Note that this might not balance with the sum of the enumerated output errors because some datagrams can have more than one error, and others can have errors that do not fall into any of the specifically tabulated categories.
collisions	Number of messages retransmitted because of an Ethernet collision. Some collisions are normal. However, if your collision rate climbs to around 4 or 5 percent, you should consider verifying that there is no faulty equipment on the segment and/or moving some existing stations to a new segment. A packet that collides is counted only once in output packets.
interface resets	Number of times an interface has been completely reset. This can happen if packets queued for transmission were not sent within several seconds' time. On a serial line, this can be caused by a malfunctioning modem that is not supplying the transmit clock signal or by a cable problem. If the system notices that the carrier detect line of a serial interface is up, but the line protocol is down, it periodically resets the interface in an effort to restart it. Interface resets can also occur when an interface is looped back or shut down.
restarts	Number of times the controller was restarted because of errors.
alarm indications, remote alarms, rx LOF, rx LOS	Number of CSU/DSU alarms and number of occurrences of receive loss of frame and receive loss of signal.
BER inactive, NELR inactive, FELR inactive	Status of G.703-E1 counters for bit -error rate (BER) alarm, near-end loop remote (NELR), and far-end loop remote (FELR). Note that you cannot set the NELR or FELR.

Example of PA-2JT2 Serial Interface

The following is sample output from the **show interfaces serial** command for a PA-2JT2 serial interface:

```
Router# show interfaces serial 3/0/0

Serial3/0/0 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 10.0.0.1/8
  MTU 1500 bytes, BW 6312 Kbit, DLY 20000 usec, rely 255/255, load 26/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 00:04:31, output 00:04:31, output hang never
  Last clearing of "show interface" counters 00:06:07
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 162000 bits/sec, 8 packets/sec
  5 minute output rate 162000 bits/sec, 8 packets/sec
     20005 packets input, 20080520 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     20005 packets output, 20080520 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
```

```
0 output buffer failures, 0 output buffers swapped out
0 carrier transitions
0 cv errors, 0 crc5 errors, 0 frame errors
rxLOS inactive, rxLOF inactive, rxPAIS inactive
rxAIS inactive, rxRAI inactive, rxHBER inactive
```

Table 8-29 describes significant fields shown in the display that are different from the fields described in Table 8-28.

Table 8-29 show interfaces serial Field Descriptions—PA-2JT2 Serial Interface

Field	Description
Last clearing of "show interface" counters	Time the counters were last cleared.
Queueing strategy	First-in, first-out queueing strategy (other queueing strategies that you might see are priority-list, custom-list, and weighted fair).
output buffer failures	Number of "no resource" errors received on the output.
output buffers swapped out	Number of packets swapped to DRAM.
carrier transitions	Number of times the carrier detect signal of a serial interface has changed state. For example, if data carrier detect (DCD) goes down and comes up, the carrier transition counter will increment two times. Indicates modem or line problems if the carrier detect line is changing state often.
cv errors	B8ZS/B6ZS (zero suppression) coding violation counter.
crc5 errors	CRC-5 error counter.
frame errors	Framing error counter.
rxLOS	Receive loss of signal alarm. Values are active or inactive.
rxLOF	Receive loss of frame alarm. Values are active or inactive.
rxPAIS	Receive loss of payload alarm indication signal (AIS). Values are active or inactive.
rxAIS	Receive loss of physical AIS. Values are active or inactive.
rxRAI	Receive remote AIS. Values are active or inactive.
rxHBER	Receive high bit-error rate alarm. Values are active or inactive.

Example of PA-E3 Serial Port Adapter

The following is sample output from the **show interfaces serial** command for a PA-E3 serial port adapter installed in chassis slot 2:

```
Router# show interfaces serial 2/0

Serial2/0 is up, line protocol is up
  Hardware is M1T-E3 pa
  Internet address is 172.17.1.1/24
  MTU 4470 bytes, BW 34010 Kbit, DLY 200 usec, rely 128/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 1w0d, output 00:00:48, output hang never
  Last clearing of "show interface" counters 1w0d
  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
```

```
      20 packets input, 2080 bytes, 0 no buffer
      Received 0 broadcasts, 0 runts, 0 giants, 0 parity
      0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
      11472 packets output, 3824748 bytes, 0 underruns
      0 output errors, 0 applique, 0 interface resets
      0 output buffer failures, 0 output buffers swapped out
      0 carrier transitions
    rxLOS inactive, rxLOF inactive, rxAIS inactive
    txAIS inactive, rxRAI inactive, txRAI inactive
```

Table 8-30 describes significant fields shown in the display that are different from the fields described in Table 8-28 on page 8-127.

Table 8-30 show interfaces serial Field Descriptions—PA-E3

Field	Description
Last clearing of "show interface" counters	Time the counters were last cleared.
Queueing strategy	First-in, first-out queueing strategy (other queueing strategies that you might see are priority-list, custom-list, and weighted fair).
parity	Number of the parity errors on the interface.
applique	Indicates that an unrecoverable error has occurred on the E3 applique. The router then invokes an interface reset.
output buffer failures	Number of "no resource" errors received on the output.
output buffers swapped out	Number of packets swapped to DRAM.
rxLOS, rxLOF, rxAIS	Receive loss of signal, loss of frame, and alarm indication signal status. Values are inactive or active.
txAIS, rxRAI, txRAI	Transmit alarm indication signal, receive remote alarm indicator, and transmit remote alarm indicator status. Values are inactive or active. When the router receives an LOS, LOF, or AIS, the txRAI is active. When the remote router receives an LOS, LOF, or AIS, the rxRAI is active.

Example of 1-Port PA-T3 Serial Port Adapter Installed in a VIP2

The following is sample output from the **show interfaces serial** command for a 1-port PA-T3 serial port adapter installed in a VIP2 in chassis slot 1, in port adapter slot 0:

```
Router# show interfaces serial 1/0/0

Serial1/0/0 is up, line protocol is up
  Hardware is cyBus PODS3 Serial
  Internet address is 172.18.1.1/24
  MTU 4470 bytes, BW 44736 Kbit, DLY 200 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input 00:00:05, output 00:00:02, output hang never
  Last clearing of "show interface" counters 5d02h
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 27269 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     79039 packets input, 14195344 bytes, 0 no buffer
     Received 84506 broadcasts, 0 runts, 0 giants
              0 parity
     9574 input errors, 6714 CRC, 0 frame, 1 overrun, 0 ignored, 2859 abort
     62472 packets output, 13751644 bytes, 0 underruns
```

```
     0 output errors, 0 applique, 10 interface resets
     0 output buffer failures, 0 output buffers swapped out
     16 carrier transitions
   rxLOS inactive, rxLOF inactive, rxAIS inactive
   txAIS inactive, rxRAI inactive, txRAI inactive
```

Table 8-31 describes significant fields shown in the display that are different from the fields described in Table 8-28 on page 8-127.

Table 8-31 show interfaces serial Field Descriptions—PA-T3

Field	Description
Last clearing of "show interface" counters	Time the counters were last cleared.
Queueing strategy	First-in, first-out queueing strategy (other queueing strategies that you might see are priority-list, custom-list, and weighted fair).
parity	Number of the parity errors on the interface.
applique	Indicates that an unrecoverable error has occurred on the T3 applique. The router then invokes an interface reset.
output buffer failures	Number of "no resource" errors received on the output.
output buffers swapped out	Number of packets swapped to DRAM.
rxLOS, rxLOF, rxAIS	Receive loss of signal, loss of frame, and alarm indication signal status. Values are inactive or active.
txAIS, rxRAI, txRAI	Transmit alarm indication signal, receive remote alarm indicator, and transmit remote alarm indicator status. Values are inactive or active. When the router receives an LOS, LOF, or AIS, the txRAI is active. When the remote router receives an LOS, LOF, or AIS, the rxRAI is active.

Example of CT3IP Serial Interface

The following is sample output from the **show interfaces serial** command for the CT3IP serial interface:

```
Router# show interfaces serial 3/0/0:25

Serial3/0/0:25 is up, line protocol is up
  Hardware is cyBus T3
  Internet address is 10.25.25.2/24
  MTU 1500 bytes, BW 1536 Kbit, DLY 20000 usec, rely 255/255, load 12/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 00:19:01, output 00:11:49, output hang never
  Last clearing of "show interface" counters 00:19:39
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/64/0 (size/threshold/drops)
     Conversations 0/1 (active/max active)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 69000 bits/sec, 90 packets/sec
  5 minute output rate 71000 bits/sec, 90 packets/sec
     762350 packets input, 79284400 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     150 input errors, 0 CRC, 0 frame, 150 overrun, 0 ignored, 0 abort
     763213 packets output, 80900472 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions no alarm present
```

```
  Timeslot(s) Used:1-24, Transmitter delay is 0 flags, transmit queue length 5
  non-inverted data
```

Table 8-32 describes significant fields relevant to the CT3IP shown in the display that are different from the fields described in Table 8-28 on page 8-127.

Table 8-32 show interfaces serial Field Descriptions—CT3IP

Field	Description
Timeslot(s) Used	Number of time slots assigned to the T1 channel.
Transmitter delay	Number of idle flags inserted between each HDLC frame.
transmit queue length	Number of packets allowed in the transmit queue.
non-inverted data	Indicates whether or not the interface is configured for inverted data.

Example of an HDLC Synchronous Serial Interface on a Cisco 7500 Series Router

The following is sample output from the **show interfaces serial** command for an HDLC synchronous serial interface on a Cisco 7500 series router:

```
Router# show interfaces serial 1/0

Serial1/0 is up, line protocol is up
  Hardware is cxBus Serial
  Internet address is 172.19.190.203, subnet mask is 255.255.255.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input 0:00:07, output 0:00:00, output hang never
  Last clearing of “show interface” counters 2w4d
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  Five minute input rate 0 bits/sec, 0 packets/sec
  Five minute output rate 0 bits/sec, 0 packets/sec
     16263 packets input, 1347238 bytes, 0 no buffer
     Received 13983 broadcasts, 0 runts, 0 giants
     2 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 2 abort
     22146 packets output, 2383680 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets, 0 restarts
     1 carrier transitions
```

Table 8-28 on page 8-127 describes significant fields shown in the display.

Example of HDLC Encapsulation

The following example displays High-Level Data Link Control (HDLC) encapsulation on serial interface 0:

```
Router# show interfaces serial 0

Serial0 is up, line protocol is up (looped)
Hardware is HD64570
Internet address is 10.1.1.1, subnet mask is 255.255.255.0
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
Encapsulation HDLC, loopback set, keepalive set (10 sec)
```

Table 8-28 on page 8-127 describes significant fields shown in the display.

Example of a G.703 Interface with Framing

The following is sample output from the **show interfaces serial** command for a G.703 interface on which framing is enabled:

```
Router# show interfaces serial 2/3

Serial2/3 is up, line protocol is up
  Hardware is cxBus Serial
  Internet address is 10.4.4.1, subnet mask is 255.255.255.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 0:00:21, output 0:00:21, output hang never
  Last clearing of "show interface" counters never
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  Five minute input rate 0 bits/sec, 0 packets/sec
  Five minute output rate 0 bits/sec, 0 packets/sec
     53 packets input, 7810 bytes, 0 no buffer
     Received 53 broadcasts, 0 runts, 0 giants
     2 input errors, 2 CRC, 0 frame, 0 overrun, 0 ignored, 2 abort
     56 packets output, 8218 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets, 0 restarts
     1 carrier transitions
     2 alarm indications, 333 remote alarms, 332 rx LOF, 0 rx LOS
     RTS up, CTS up, DTR up, DCD up, DSR up
     BER inactive, NELR inactive, FELR inactive
```

Table 8-28 on page 8-127 describes significant fields shown in the display.

Example with Frame Relay Encapsulation

When using Frame Relay encapsulation, use the **show interfaces serial** command to display information on the multicast data-link connection identifier (DLCI), the DLCI of the interface, and the DLCI used for the Local Management Interface (LMI).

The multicast DLCI and the local DLCI can be set using the **frame-relay multicast-dlci** and **frame-relay local-dlci** configuration commands. The status information is taken from the LMI, when active.

The following is sample output from the **show interfaces serial** command when Frame Relay encapsulation and LMI are enabled:

```
Router# show interfaces serial

Serial 2 is up, line protocol is up
   Hardware type is MCI Serial
   Internet address is 172.20.122.1, subnet mask is 255.255.255.0
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
   Encapsulation FRAME-RELAY, loopback not set, keepalive set (10 sec)
   multicast DLCI 1022, status defined, active
   source DLCI    20, status defined, active
   LMI DLCI 1023, LMI sent 10, LMI stat recvd 10, LMI upd recvd 2
   Last input 7:21:29, output 0:00:37, output hang never
   Output queue 0/100, 0 drops; input queue 0/75, 0 drops
   Five minute input rate 0 bits/sec, 0 packets/sec
   Five minute output rate 0 bits/sec, 0 packets/sec
       47 packets input, 2656 bytes, 0 no buffer
       Received 5 broadcasts, 0 runts, 0 giants
       5 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 57 abort
       518 packets output, 391205 bytes
       0 output errors, 0 collisions, 0 interface resets, 0 restarts
       1 carrier transitions
```

In this display, the multicast DLCI has been changed to 1022 using the **frame-relay multicast-dlci** interface configuration command.

The display shows the statistics for the LMI as the number of status inquiry messages sent (LMI sent), the number of status messages received (LMI recvd), and the number of status updates received (upd recvd). Refer to the *Frame Relay Interface* specification for additional explanations of this output.

Example with Frame Relay Queueing and Fragmentation at the Interface

The following is sample output from the **show interfaces serial** command when low-latency queueing and FRF.12 end-to-end fragmentation are configured on a Frame Relay interface:

```
Router# show interfaces serial 3/2

Serial3/2 is up, line protocol is up
  Hardware is M4T
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation FRAME-RELAY, crc 16, loopback not set
  Keepalive set (10 sec)
  LMI enq sent  0, LMI stat recvd 0, LMI upd recvd 0, DTE LMI up
  LMI enq recvd 0, LMI stat sent  0, LMI upd sent  0
  LMI DLCI 1023  LMI type is CISCO  frame relay DTE
  Fragmentation type: end-to-end, size 80, PQ interleaves 0
  Broadcast queue 0/64, broadcasts sent/dropped 0/0, interface broadcasts 0
  Last input 2d15h, output 2d15h, output hang never
  Last clearing of "show interface" counters 00:01:31
  Input queue: 0/75/0/0 (size/max/drops/flushes); 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)
     Available Bandwidth 1094 kilobits/sec
  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, 1 interface resets
     0 output buffer failures, 0 output buffers swapped out
     1 carrier transitions     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

Table 8-33 describes significant fields shown in the display that are different from the fields described in Table 8-28 on page 8-127.

Table 8-33 show interfaces serial Field Descriptions—Frame Relay Interface Queueing and Fragmentation

Field	Description
txload	Interface load in the transmit direction.
rxload	Interface load in the receive direction.
crc	Number of Layer 1 checksum errors during reception.
LMI enq sent	Number of Frame Relay status inquiry messages sent.
LMI stat recvd	Number of Frame Relay status request messages received.
LMI upd recvd	Number of single PVC asynchronous status messages received.
DTE LMI up	LMI peers are synchronized.

Table 8-33 show interfaces serial Field Descriptions—Frame Relay Interface Queueing and Fragmentation (continued)

Field	Description
LMI enq recvd	Number of Frame Relay status inquiry messages received.
LMI stat sent	Number of Frame Relay status request messages sent.
LMI upd sent	Number of single PVC asynchronous status messages sent.
Fragmentation type	Type of fragmentation: end-to-end, Cisco, or VoFR
size	Fragmentation size.
PQ interleaves	Number of priority queue frames that have interleaved data fragments.
Broadcast queue	Number on queue/queue depth.
broadcasts sent/dropped	Number of broadcasts sent and dropped.
interface broadcasts	Number of broadcasts sent on interface.
Input queue	size—Current size of the input queue. max—Maximum size of the queue. drops—Number of messages discarded. flushes—Number of times that data on queue has been discarded.
Queueing strategy	Type of queueing configured on the interface.
Output queue	size—Current size of the output queue. max total—Maximum number of frames that can be queued. threshold—Congestive-discard threshold. Number of messages in the queue after which new messages for high-bandwidth conversations are dropped. drops—Number of dropped messages.
Conversations	active—Number of currently active conversations. max active—Maximum number of conversations that have ever occurred at one time. max total—Maximum number of active conversations allowed.
throttles	Number of times the receiver on the port was disabled, possibly because of processor or buffer overload.
output buffer failures	Number of “no resource” errors received on the output.
output buffers swapped out	Number of packets swapped to DRAM.

Example with ANSI LMI

For a serial interface with the ANSI Local Management Interface (LMI) enabled, use the **show interfaces serial** command to determine the LMI type implemented. The following is sample output from the **show interfaces serial** command for a serial interface with the ANSI LMI enabled:

```
Router# show interfaces serial

Serial 1 is up, line protocol is up
   Hardware is MCI Serial
   Internet address is 172.18.121.1, subnet mask is 255.255.255.0
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
   Encapsulation FRAME-RELAY, loopback not set, keepalive set
   LMI DLCI    0, LMI sent 10, LMI stat recvd 10
   LMI type is ANSI Annex D
   Last input 0:00:00, output 0:00:00, output hang never
```

```
   Output queue 0/40, 0 drops; input queue 0/75, 0 drops

   Five minute input rate 0 bits/sec, 1 packets/sec
   Five minute output rate 1000 bits/sec, 1 packets/sec
       261 packets input, 13212 bytes, 0 no buffer
       Received 33 broadcasts, 0 runts, 0 giants
       0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
       238 packets output, 14751 bytes, 0 underruns
       0 output errors, 0 collisions, 0 interface resets, 0 restarts
```

Notice that the **show interfaces serial** output for a serial interface with ANSI LMI shown in this display is very similar to that for encapsulation set to Frame Relay, as shown in the previous display. Table 8-34 describes the few differences that exist.

Table 8-34 show interfaces serial Field Descriptions—ANSI LMI

Field	Description
LMI DLCI	Identifies the DLCI used by the LMI for this interface. The default is 1023.
LMI sent	Number of LMI packets that the router sent.
LMI type is ANSI Annex D	Indicates that the interface is configured for the ANSI-adopted Frame Relay specification T1.617 Annex D.

Example with LAPB Encapsulation

Use the **show interfaces serial** command to display operation statistics for an interface that uses Link Access Procedure, Balanced (LAPB) encapsulation. The following is partial sample output from the **show interfaces serial** command for a serial interface that uses LAPB encapsulation:

```
Router# show interfaces serial 1

LAPB state is SABMSENT, T1 3000, N1 12056, N2 20, k7,Protocol ip
VS 0, VR 0, RCNT 0, Remote VR 0, Retransmissions 2
IFRAMEs 0/0 RNRs 0/0 REJs 0/0 SABMs 3/0 FRMRs 0/0 DISCs 0/0
```

Table 8-35 shows the fields relevant to all LAPB connections.

Table 8-35 show interfaces serial Field Descriptions—LAPB

Field	Description
LAPB state is	State of the LAPB protocol.
T1 3000, N1 12056, ...	Current parameter settings.
Protocol	Protocol encapsulated on a LAPB link; this field is not present on interfaces configured for multiprotocol LAPB or X.25 encapsulations.
VS	Modulo 8 frame number of the next outgoing information frame.
VR	Modulo 8 frame number of the next information frame expected to be received.
RCNT	Number of received information frames that have not yet been acknowledged.
Remote VR	Number of the next information frame that the remote device expects to receive.
Retransmissions	Count of current retransmissions because of expiration of T1.

Table 8-35 show interfaces serial Field Descriptions—LAPB (continued)

Field	Description
Window is closed	No more frames can be transmitted until some outstanding frames have been acknowledged. This message should be displayed only temporarily.
IFRAMEs	Count of information frames in the form of sent/received.
RNRs	Count of Receiver Not Ready frames in the form of sent/received.
REJs	Count of Reject frames in the form of sent/received.
SABMs	Count of Set Asynchronous Balanced Mode commands in the form of sent/received.
FRMRs	Count of Frame Reject frames in the form of sent/received.
DISCs	Count of Disconnect commands in the form of sent/received.

```
Router# show interfaces serial 1
```

Table 8-36 show the fields relevant to PPP connections.

Table 8-36 show interfaces serial Field Descriptions—PPP Encapsulation

Field	Description
lcp state	Link Control Protocol.
ncp ipcp state	Network Control Protocol Internet Protocol Control Protocol.
ncp osicp state	Network Control Protocol OSI (CLNS) Control Protocol.
ncp ipxcp state	Network Control Protocol IPX (Novell) Control Protocol.
ncp deccp state	Network Control Protocol DECnet Control Protocol.
ncp bridgecp state	Network Control Protocol Bridging Control Protocol.
ncp atalkcp state	Network Control Protocol AppleTalk Control Protocol.

Example with SDLC Connections

Use the **show interfaces serial** command to display the Synchronous Data Link Control (SDLC) information for a given SDLC interface. The following is sample output from the **show interfaces serial** command for an SDLC primary interface that supports the SDLLC function:

```
Router# show interfaces serial

Serial 0 is up, line protocol is up
Hardware is MCI Serial
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
Encapsulation SDLC-PRIMARY, loopback not set
    Timers (msec): poll pause 100 fair poll 500. Poll limit 1
    [T1 3000, N1 12016, N2 20, K 7] timer: 56608 Last polled device: none
    SDLLC [ma: 0000.0C01.14--, ring: 7 bridge: 1, target ring: 10
             largest token ring frame 2052]
SDLC addr C1 state is CONNECT
     VS 6, VR 3, RCNT 0, Remote VR 6, Current retransmit count 0
     Hold queue: 0/12 IFRAMEs 77/22 RNRs 0/0 SNRMs 1/0 DISCs 0/0
     Poll: clear, Poll count: 0, chain: p: C1 n: C1
     SDLLC [largest SDLC frame: 265, XID: disabled]
 Last input 00:00:02, output 00:00:01, output hang never
```

```
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
Five minute input rate 517 bits/sec, 30 packets/sec
Five minute output rate 672 bits/sec, 20 packets/sec
    357 packets input, 28382 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    926 packets output, 77274 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets, 0 restarts
    2 carrier transitions
```

Table 8-37 shows the fields relevant to all SDLC connections.

Table 8-37 show interfaces serial Field Descriptions—SDLC Enabled

Field	Description
Timers (msec): poll pause, fair poll, Poll limit	Current values of these timers for the primary SDLC interface.
T1, N1, N2, K	Values for these parameters for the primary SDLC interface.

Table 8-38 shows other data given for each SDLC secondary interface configured to be attached to the serial interface.

Table 8-38 SDLC Secondary Interface Descriptions

Field	Description
addr	Address of this SDLC secondary interface.
state is	Current state of this connection, which is one of the following: • DISCONNECT—No communication is being attempted to this secondary. • CONNECT—A normal connect state exists between this router and this secondary. • DISCSENT—This router has sent a disconnect request to this secondary and is awaiting its response. • SNRMSENT—This router has sent a connect request (SNRM) to this secondary and is awaiting its response. • THEMBUSY—This secondary has told this router that it is temporarily unable to receive any more information frames. • USBUSY—This router has told this secondary that it is temporarily unable to receive any more information frames. • BOTHBUSY—Both sides have told each other that they are temporarily unable to receive any more information frames. • ERROR—This router has detected an error and is waiting for a response from the secondary acknowledging this.
VS	Sequence number of the next information frame that this station sends.
VR	Sequence number of the next information frame from this secondary that this station expects to receive.

Table 8-38 SDLC Secondary Interface Descriptions (continued)

Field	Description
Remote VR	Last frame transmitted by this station that has been acknowledged by the other station.
Current retransmit count:	Number of times the current I-frame or sequence of I-frames has been retransmitted.
Hold queue	Number of frames in hold queue and maximum size of hold queue.
IFRAMEs, RNRs, SNRMs, DISCs	Sent/received count for these frames.
Poll	"Set" if this router has a poll outstanding to the secondary; "clear" if it does not.
Poll count	Number of polls in a row that have been given to this secondary at this time.
chain	Shows the previous (p) and next (n) secondary address on this interface in the *round robin loop* of polled devices.

Example with SDLLC

Use the **show interfaces serial** command to display the SDLLC statistics for SDLLC-configured interfaces. The following is sample output from the **show interfaces serial** command for a serial interface configured for SDLLC:

```
Router# show interfaces serial

Serial 0 is up, line protocol is up
   Hardware is MCI Serial
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
   Encapsulation SDLC-PRIMARY, loopback not set
       Timers (msec): poll pause 100 fair poll 500. Poll limit 1
       [T1 3000, N1 12016, N2 20, K 7] timer: 56608 Last polled device: none
       SDLLC [ma: 0000.0C01.14--, ring: 7 bridge: 1, target ring: 10
             largest token ring frame 2052]
   SDLC addr C1 state is CONNECT
       VS 6, VR 3, RCNT 0, Remote VR 6, Current retransmit count 0
       Hold queue: 0/12 IFRAMEs 77/22 RNRs 0/0 SNRMs 1/0 DISCs 0/0
       Poll: clear, Poll count: 0, chain: p: C1 n: C1
       SDLLC [largest SDLC frame: 265, XID: disabled]
   Last input 00:00:02, output 00:00:01, output hang never
   Output queue 0/40, 0 drops; input queue 0/75, 0 drops
   Five minute input rate 517 bits/sec, 30 packets/sec
   Five minute output rate 672 bits/sec, 20 packets/sec
       357 packets input, 28382 bytes, 0 no buffer
       Received 0 broadcasts, 0 runts, 0 giants
       0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
       926 packets output, 77274 bytes, 0 underruns
       0 output errors, 0 collisions, 0 interface resets, 0 restarts
       6608 Last polled device: none
       SDLLC [ma: 0000.0C01.14--, ring: 7 brid2 carrier transitions
```

Most of the output shown in the display is generic to all SDLLC-encapsulated interfaces and is described in the *Cisco IOS Bridging and IBM Networking Command Reference*, Volume 2 of 2: IBM Networking. Table 8-39 shows the parameters specific to SDLLC.

Table 8-39 SDLLC Parameter Descriptions

Field	Description
SDLLC ma	Lists the MAC address configured for this interface. The last byte is shown as "--" to indicate that it is filled in with the SDLC address of the connection.
ring, bridge, target ring	Lists the parameters as configured by the **sdllc traddr** command.
largest token ring frame	Shows the largest Token Ring frame that is accepted on the Logical Link control, type 2 (LLC2) side of the connection.
largest SDLC frame	Shows the largest SDLC frame that is accepted and will be generated on the SDLC side of the connection.
XID	Enabled or disabled: Shows whether XID processing is enabled on the SDLC side of the connection. If enabled, it will show the XID value for this address.

Example with X.25

The following is partial sample output from the **show interfaces serial** command for a serial X.25 interface:

```
Router# show interfaces serial 1

X25 address 000000010100, state R1, modulo 8, idle 0, timer 0, nvc 1
  Window size: input 2, output 2, Packet size: input 128, output 128
  Timers: T20 180, T21 200, T22 180, T23 180, TH 0
  Channels: Incoming-only none, Two-way 1-1024, Outgoing-only none
(configuration on RESTART: modulo 8,
  Window size: input 2 output 2, Packet size: input 128, output 128
  Channels: Incoming-only none, Two-way 5-1024, Outgoing-only none)
  RESTARTs 3/2 CALLs 1000+2/1294+190/0+0/ DIAGs 0/0
```

The stability of the X.25 protocol requires that some parameters not be changed without a restart of the protocol. Any change to these parameters is held until a restart is sent or received. If any of these parameters changes, information about the router configuration at restart will be displayed as well as the values that are currently in effect.

Table 8-40 describes significant fields shown in the display.

Table 8-40 show interfaces serial Field Descriptions—X.25 Enabled

Field	Description
X25 address	Address used to originate and accept calls.
state	State of the interface. Possible values follow: • R1 is the normal ready state. • R2 is the DTE restarting state. • R3 is the DCE restarting state. If the state is R2 or R3, the interface is awaiting acknowledgment of a Restart packet.
modulo	Modulo value; determines the packet sequence numbering scheme used.

Table 8-40 show interfaces serial Field Descriptions—X.25 Enabled (continued)

Field	Description
idle	Number of minutes for which the Cisco IOS software waits before closing idle virtual circuits that it originated or accepted.
timer	Value of the interface timer, which is zero unless the interface state is R2 or R3.
nvc	Default maximum number of simultaneous virtual circuits permitted to and from a single host for a particular protocol.
Window size: input, output	Default window sizes (in packets) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
Packet size: input, output	Default maximum packet sizes (in bytes) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
Timers:	Values of the X.25 timers: • T10 through T13 for a DCE device • T20 through T23 for a DTE device
TH	Packet acknowledgment threshold (in packets). This value determines how many packets are received before an explicit acknowledgment is sent. The default value (0) sends an explicit acknowledgment only when the incoming window is full.
Channels: Incoming-only, Two-way, Outgoing-only	Displays the virtual circuit ranges for this interface.
RESTARTs	Shows Restart packet statistics for the interface using the format Sent/Received.
CALLs	Successful calls sent + failed calls/calls received + calls failed/calls forwarded + calls failed. Calls forwarded are counted as calls sent.
DIAGs	Diagnostic messages sent and received.

Example with Accounting Option

The following example illustrates the **show interfaces serial** command with the **accounting** option on a Cisco 7500 series routers:

```
Router# show interfaces serial 1/0 accounting

Serial1/0
       Protocol    Pkts In   Chars In   Pkts Out  Chars Out
             IP       7344    4787842       1803    1535774
      Appletalk      33345    4797459      12781    1089695
        DEC MOP          0          0        127       9779
            ARP          7        420         39       2340
```

Table 8-41 describes the fields shown in the display.

Table 8-41 show interfaces serial Field Descriptions—Accounting

Field	Description
Protocol	Protocol that is operating on the interface.
Pkts In	Number of packets received for that protocol.
Chars In	Number of characters received for that protocol.
Pkts Out	Number of packets transmitted for that protocol.
Chars Out	Number of characters transmitted for that protocol.

Example with Cisco AS5800 Access Server

The following example shows the activity that occurred on the serial interface in shelf 1, slot 4, port 0 for time slot 2 in group 23:

```
Router# show interfaces serial 1/4/0:2:23

Serial1/4/0:2:23 is up, line protocol is up (spoofing)
 Hardware is DS-T1
 MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec, rely 255/255, load 1/255
 Encapsulation HDLC, loopback not set
 Last input 00:00:01, output 00:00:01, output hang never
 Last clearing of "show interface" counters 22:24:30
 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
     5274 packets input, 20122 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
     5274 packets output, 30836 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     2 carrier transitions no alarm present
 Timeslot(s) Used:24, subrate: 64Kb/s, transmit delay is 0 flags
```

Table 8-42 describes the significant fields shown in the display that are different from the fields described in Table 8-28 on page 8-127.

Table 8-42 show interfaces serial Field Descriptions—Cisco AS5800

Field	Description
Last clearing of "show interface" counters	Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) were last reset to zero.
Queueing strategy	Displays the type of queueing configured for this interface. In the example output, the type of queueing configured is FIFO.
throttles	Number of times that the receiver on the port was disabled, possibly because of buffer or processor overload.
output buffer failures	Number of times that the output buffer has failed.
output buffer swapped out	Number of times that the output buffer has been swapped out.
Timeslot(s) Used	Number of time slots assigned to the T1 channel.

Table 8-42 show interfaces serial Field Descriptions—Cisco AS5800 (continued)

Field	Description
subrate	Bandwidth of each time slot.
transmit delay is ...	Number of idle flags inserted between each frame.

Example with a T3/E3 Shared Port Adapter

The following example shows the interface statistics on the first port of a T3/E3 SPA installed in subslot 0 of the SIP located in chassis slot 5.

```
Router# show interfaces serial

Serial5/0/0 is up, line protocol is up
  Hardware is SPA-4T3E3
  Internet address is 110.1.1.2/24
  MTU 4470 bytes, BW 44210 Kbit, DLY 200 usec,
     reliability 255/255, txload 234/255, rxload 234/255
  Encapsulation HDLC, crc 16, loopback not set
  Keepalive set (10 sec)
  Last input 00:00:05, output 00:00:00, 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 40685000 bits/sec, 115624 packets/sec
  5 minute output rate 40685000 bits/sec, 115627 packets/sec
     4653081241 packets input, 204735493724 bytes, 0 no buffer
     Received 4044 broadcasts (0 IP multicast)
     0 runts, 0 giants, 0 throttles
              0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     4652915555 packets output, 204728203520 bytes, 0 underruns
     0 output errors, 0 applique, 4 interface resets
     0 output buffer failures, 0 output buffers swapped out
     2 carrier transitions
     rxLOS inactive, rxLOF inactive, rxAIS inactive
     txAIS inactive, rxRAI inactive, txRAI inactive
```

Table 8-43 describes the fields shown in the **show interfaces serial** output.

Note The fields appearing in the ouput will vary depending on card type, interface configuration, and the status of the interface.

Table 8-43 T3/E3 SPA—Command Field Descriptions

Field	Description
Serial	Name of the serial interface.
line protocol is	If the line protocol is up, the local router has received keepalive packets from the remote router. If the line protocol is down, the local router has not received keepalive packets form the remote router.
Hardware is	Designates the specific hardware type of the interface.
Internet address is	The IP address of the interface.

Table 8-43 T3/E3 SPA—Command Field Descriptions (continued)

Field	Description
MTU	The maximum packet size set for the interface.
BW	Bandwidth in kilobits per second.
DLY	Interface delay in microseconds.
reliability	Reliability of the interface as a fraction of 255 (255/255 is 100 percent reliability), calculated as an exponential average over 5 minutes.
txload	Transmit load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes.
rxload	Receive load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes.
encapsulation	Encapsulation method.
crc	CRC size in bits.
loopback	Indicates whether loopback is set or not.
keepalive	Indicates whether keepalives are set or not.
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface and processed locally on the router. Useful for knowing when a dead interface failed. This counter is updated only when packets are process switched, not when packets are fast switched.
Last ouput	Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface. Useful for knowing when a dead interface failed. This counter is updated only when packets are process-switched, not when packets are fast-switched.
output hang	Number of hours, minutes, and seconds (or never) since the interface was last reset because of a transmission that took too long. When the number of hours in any of the “last” fields exceeds 24 hours, the number of days and hours is printed. If that field overflows, asterisks are printed.
Last clearing of show interface	Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Note that variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared. *** indicates the elapsed time is too large to be displayed. 0:00:00 indicates the counters were cleared more than 231 ms (and less than 232 ms) ago.

Table 8-43 T3/E3 SPA—Command Field Descriptions (continued)

Field	Description
Input queue	*size*—Current size of the input queue. *max*—Maximum size of the input queue. *drops*—Packets dropped because the queue was full. *flushes*—Number of times that data on queue has been discarded.
Total output drops	Total number of dropped packets.
Queueing strategy	First-in, first-out queueing strategy (other queueing strategies you might see are priority-list, custom-list, and weighted fair).
Output queue	*size*—Current size of the output queue. *max*—Maximum size of the ouput queue.
5-minute input rate	Average number of bits and packets received per second in the last 5 minutes. If the interface is not in promiscuous mode, it senses network traffic it sends and receives (rather than all network traffic). The 5-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period.
5-minute output rate	Average number of bits and packets transmitted per second in the last 5 minutes. If the interface is not in promiscuous mode, it senses network traffic it sends and receives (rather than all network traffic). The 5-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period.
rxLOS	Receive loss of signal status. Values are inactive or active.
rxLOF	Receive loss of frame status. Values are inactive or active.
rxAIS	Receive alarm indication signal status. Values are inactive or active.
txAIS	Transmit alarm indication signal status. Values are inactive or active.
rxRAI	Receive remote alarm indication signal status. Values are inactive or active.
txRAI	Transmit remote alarm indication signal status. Values are inactive or active.

Related Commands

Command	Description
show controllers serial	Displays controller statistics.

show tcam-mgr subslot

To display ternary content addressable memory (TCAM) manager information for a SPA, use the **show tcam-mgr subslot** command in privileged EXEC configuration mode.

show tcam-mgr subslot *slot*/*subslot* **inst-info**

show tcam-mgr subslot *slot*/*subslot* **region** *region-number* [**config** | **statistics**]

show tcam-mgr subslot *slot*/*subslot* {**rx-dest-mac | rx-vlan**}{**alloc-mbus** [**summary**] | **table**}

show tcam-mgr subslot *slot*/*subslot* **statisitics**

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding “Identifying Slots and Subslots for MSCs and SPAs” topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding “Specifying the Interface Address on a SPA” topic in the platform-specific SPA software configuration guide for subslot information.
inst-info	Specifies the display of Instance Control Block information for the SPA.

region *region-number* [**config** | **statistics**]	Specifies the display of region-related TCAM manager information, with the following options: • **region** *region-number*—Displays TCAM manager information, where: – **region 0**—Specifies the destination MAC address TCAM region. – **region 1**—Specifies the VLAN ID TCAM region. • **config**—(Optional) Displays TCAM manager configuration information. • **statistics**—(Optional) Displays TCAM manager statistical information.
{**rx-dest-mac | rx-vlan**}{**alloc-mbus** [**summary**] | **table**}	Specifies the display of TCAM manager information related to the following areas: • **rx-dest-mac**—Destination MAC address filtering for received frames. • **rx-vlan**—VLAN filtering for received frames. • **alloc-mbus** [**summary**]—Displays allocated Mask Block Unit (MBU) entry information related to the MAC or VLAN TCAM filters. There is no difference between the **alloc-mbus** and **alloc-mbus summary** form of the command. • **table**—Displays table entries for the MAC or VLAN TCAM filters. **Note** The **label** and **free-mbus** [**summary**] forms of the command are not supported on SPAs.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(19)S	This command was introduced.
12.2(20)S2	This command was integrated into Cisco IOS Release 12.2(20)S2 and support for the **subslot**, **rx-dest-mac**, and **rx-vlan** keywords were added for SPAs on the Cisco 7304 router.

Usage Guidelines

Use the **show tcam-mgr subslot** command to display TCAM manager information for the destination MAC address and VLAN filter regions supported by the SPAs.

The TCAM manager allocates memory among the applications that it supports, in the form of regions. The SPAs support two TCAM regions, region 0 for destination MAC address filtering and region 1 for VLAN ID filtering of received frames.

Examples

The following examples provide sample output for several versions of the **show tcam-mgr subslot** command for a 4-Port 10/100 Fast Ethernet SPA located in the top subslot (0) of the MSC that is installed in slot 4 on a Cisco 7304 router:

- show tcam-mgr subslot inst-info Example, page 8-150
- show tcam-mgr subslot region Example, page 8-150
- show tcam-mgr subslot region statistics Example, page 8-151
- show tcam-mgr subslot rx-dest-mac table Example, page 8-151
- show tcam-mgr subslot rx-vlan table Example, page 8-152
- show tcam-mgr subslot statisitics Example, page 8-153

show tcam-mgr subslot inst-info Example

The following shows sample output from the **show tcam-mgr subslot inst-info** command:

```
Router# show tcam-mgr subslot 4/0 inst-info
Instance Control Block Information :

CAM name                    =  SPA 4xFE/2xGE CAM2
Maximum key length          =  72 bits
TBU (TCAM Base Unit) length =  72 bits
V2M Ratio                   =  8
TCAM Size                   =  8192 TBUs
SRAM Size                   =  0 words
Start index of first VC     =  0
Label table size            =  0
```

show tcam-mgr subslot region Example

The following shows sample output from the **show tcam-mgr subslot region** command for the destination MAC address TCAM region (0) for the SPA:

```
Router# show tcam-mgr subslot 4/0 region 0

Region Configuration :

 Region ID                   =  0
 Region name                 =  DA_FILTERING
 Fixed size                  =  no
 Region type (hash:mask    ) =  Partial_Order_Indep_Order_Dep_At_Bottom
 Application VMR V/M size    =  12
 Application VMR result size =  1
 Vc region size (percentage) =  50

Region Information :

 Region ID                  =   0
 Value cells size           =   4096
 Mask cells size            =   512
 MBUs size                  =   512
 Mask index start TBU       =   0
 Mask index end TBU         =   511
 First dynamic region       =   yes
 Last dynamic region        =   yes
 Size is fixed              =   yes
 Expansion unit MBUs        =   1
 Lower Limit, llimit_p      =   450A6CF0
 Upper Limit, ulimit_p      =   450AE4B4
 Lower limit pointer index  =   0
 Upper limit pointer index  =   511
```

```
 Lower next pointer index   =   0
 Upper next pointer index   =   4
 Lower free entries         =   1
 Upper free entries         =   507
 Bottom pointer index       =   510
 Free mask block units      =  508

 Region ID                   =  0
 Region expansion count      =  0
 Region Shifts             =  0
 Region expansion failures   =  0
 Invalid direction hits      =  0
 Invalid parameter hits      =  0
 No free entry failures      =  0
```

show tcam-mgr subslot region statistics Example

The following shows sample output from the **show tcam-mgr subslot region statistics** command for the destination MAC address TCAM region (0) for the SPA:

```
Router# show tcam-mgr subslot 4/0 region 0 statistics

 Region ID                   =  0
 Region expansion count      =  0
 Region Shifts             =  0
 Region expansion failures   =  0
 Invalid direction hits      =  0
 Invalid parameter hits      =  0
 No free entry failures      =  0
```

show tcam-mgr subslot rx-dest-mac table Example

The following shows partial output from the **show tcam-mgr subslot rx-dest-mac table** command:

```
Router# show tcam-mgr subslot 4/0 rx-dest-mac table

Dest mac filtering Table
-----------
 There are 15 entries in the table

 Entry# 1:
 Application ID              = 1
 Value                       =

                                0  0  0  0  0 4  0  0  0  0  0  0
 Mask                        =

                                0  0  0  0  0 C  0  0  0  0  0  0
 Result                      =

                                0
 Mask index                  = 511
 Mask Physical Address       = 4088
 Value cell index            = 7
 Value cell Physical address = 4095
 Allocation direction        = bottom

 Entry# 2:
 Application ID              = 1
 Value                       =

                                0  0  0  0  0  4  0  B0  64  FF  44  80
 Mask                        =

                                0  0  0  0  0  F  FF  FF  FF  FF  FF  FF
```

```
 Result                       =

                                 4
 Mask index                   = 2
 Mask Physical Address        = 16
 Value cell index             = 1
 Value cell Physical address = 17
 Allocation direction         = no direction

 Entry# 3:
 Application ID               = 1
 Value                        =

                                 0  0  0  0  0  4  FF  FF  FF  FF  FF  FF
 Mask                         =

                                 0  0  0  0  0  F  FF  FF  FF  FF  FF  FF
 Result                       =

                                 4
 Mask index                   = 2
 Mask Physical Address        = 16
 Value cell index             = 2
 Value cell Physical address = 18
 Allocation direction         = no direction
.
.
.
```

show tcam-mgr subslot rx-vlan table Example

The following shows partial output from the **show tcam-mgr subslot rx-vlan table** command:

```
Router# show tcam-mgr subslot 4/0 rx-vlan table

RX VLAN filtering Table
-----------
 There are 9 entries in the table

 Entry# 1:
 Application ID               = 2
 Value                        =

                                 0  0  0  0  0  8  0  0  0  0  0  0
 Mask                         =

                                 0  0  0  0  0  C  0  0  0  0  0  0
 Result                       =

                                 0
 Mask index                   = 1023
 Mask Physical Address        = 8184
 Value cell index             = 7
 Value cell Physical address = 8191
 Allocation direction         = bottom

 Entry# 2:
 Application ID               = 2
 Value                        =

                                 0  0  0  0  0  0  0  0  0  0  0  0
 Mask                         =

                                 0  0  0  0  0  F  0  0  0  0  0  0
```

```
 Result                      =

                                4
 Mask index                  = 512
 Mask Physical Address       = 4096
 Value cell index            = 0
 Value cell Physical address = 4096
 Allocation direction        = top
.
.
.
```

show tcam-mgr subslot statisitics Example

The following shows sample output from the **show tcam-mgr subslot statisitics** command:

```
Router# show tcam-mgr subslot 4/0 statisitics


 Application entry alloc failures            =  0
 TCAM entry alloc failures                   =  0
 TCAM driver failures                        =  0
 TCAM API invalid parameters                 =  0
 TCAM API application entry lookup failures  =  0
 TCAM API application entry mismatch failures=  0
 TCAM API label table occupied failures      =  0
 TCAM MGR free mbu vc failures               =  0
TCAM Mgr insertion/deletion time
  Insert  time: total:0.0000 num:0     avg:0.0000
    check dupl: total:0.0000 num:0     avg:0.0000
    alloc  mbu: total:0.0000 num:0     avg:0.0000
    queue appl: total:0.0000 num:0     avg:0.0000
    insert drv: total:0.0000 num:0     avg:0.0000
  Delete  time: total:0.0000 num:0     avg:0.0000
    delete drv: total:0.0000 num:0     avg:0.0000
    delete mbu: total:0.0000 num:0     avg:0.0000
    delete appl: total:0.0000 num:0     avg:0.0000

 Region ID                   =  0
 Region name                 =  DA_FILTERING
 Fixed size                  =  no
 Region type (hash:mask    ) =  Partial_Order_Indep_Order_Dep_At_Bottom
 Application VMR V/M size    =  12
 Application VMR result size =  1
 Vc region size (percentage) =  50
```

Related Commands

Command	Description
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.

show upgrade file

The **show upgrade file** command is replaced by the **show upgrade fpd file** command. See the **show upgrade fpd file** command for more information.

show upgrade fpd file

To display the contents of an FPD image package file, enter the **show upgrade fpd file** command in privileged EXEC configuration mode.

show upgrade fpd file *file-url*

Syntax Description

file-url	Specifies the location of the FPD image package file, beginning with the location or type of storage device (examples include **disk0**, **slot0**, **tftp**, or **ftp**) and followed by the path to the FPD image.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S6	This command was introduced.

Usage Guidelines

This command provides information related to the FPD image package file. Most of the information in this command is useful for customer support purposes only.

In Cisco IOS Releases 12.2(20)S2 through 12.2(20)S5, the output generated by entering this command can be generated by entering the **show upgrade file** command.

Examples

The output in the following example displays information about the FPD image package file stored in the disk0: Flash card memory:

```
Router# show upgrade fpd file disk0:spa-fpd.122-20.S6.pkg

% Extracting compressed bundle spa_4fe2ge-fpd.bndl.zip ...

Content for the "spa_4fe2ge-fpd.bndl" bundle file:

                     Bundle Name:4xFE/2xGE SPA FPD Bundle
                  Bundle Version:0.5
       Number of Supported Cards:2
          Supported Card Type(s):SPA-4FE-7304 (0x435)
                                  SPA-2GE-7304 (0x436)
    Bundle Header Format Version:4
            Bundle Header Length:128 bytes
              Bundle Data Length:4951592 bytes
             Bundle Magic Number:0xC5C0FBC0
               Bundle 32-Bit CRC:0x3B53C5C0
               Bundle Build Date:10/12/2004 (MM/DD/YYYY)
        Number of Images Bundled:1
              Bundle Name Prefix:spa_4fe2ge

Image #1:
```

```
        Name                 :Data & I/O FPGA
        ID                   :1
        Version              :4.17
        Minimal H/W Version  :0.0
        Order in Bundle      :1
        Header Length        :128 bytes
        Data Length          :4951464 bytes
        Total Length         :4951464 bytes (Data + Padding)
        Magic Number         :0xC5C0FDC0
        32-Bit CRC           :0x14613280
        Build Date           :10/12/2004 (MM/DD/YYYY)
        Image Format         :XSVF
        Upgrade Path         :By Host
        Upgrade Path Info    :0
        Control Flag Value   :0x1
        Estimated Upgrade Time:420 seconds
```

The output in the following example displays information about the FPD image package file stored at a TFTP server location:

```
Router# show upgrade fpd file tftp://mytftpserver/myfpdpkgd/spa-fpd.122-20.S6.pkg
Loading myfpdpkgd/spa-fpd.122-20.S6.pkg from 223.255.254.254 (via FastEthernet0):!

% Extracting compressed bundle spa_4fe2ge-fpd.bndl.zip
...!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

Content for the "spa_4fe2ge-fpd.bndl" bundle file:

                     Bundle Name:4xFE/2xGE SPA FPD Bundle
                  Bundle Version:0.5
       Number of Supported Cards:2
          Supported Card Type(s):SPA-4FE-7304 (0x435)
                                 SPA-2GE-7304 (0x436)
    Bundle Header Format Version:4
            Bundle Header Length:128 bytes
              Bundle Data Length:4951592 bytes
             Bundle Magic Number:0xC5C0FBC0
               Bundle 32-Bit CRC:0x3B53C5C0
               Bundle Build Date:10/12/2004 (MM/DD/YYYY)
        Number of Images Bundled:1
              Bundle Name Prefix:spa_4fe2ge

Image #1:
        Name                 :Data & I/O FPGA
        ID                   :1
        Version              :4.17
        Minimal H/W Version  :0.0
        Order in Bundle      :1
        Header Length        :128 bytes
        Data Length          :4951464 bytes
        Total Length         :4951464 bytes (Data + Padding)
        Magic Number         :0xC5C0FDC0
        32-Bit CRC           :0x14613280
        Build Date           :10/12/2004 (MM/DD/YYYY)
        Image Format         :XSVF
        Upgrade Path         :By Host
        Upgrade Path Info    :0
        Control Flag Value   :0x1
        Estimated Upgrade Time:420 seconds

[OK - 703488 bytes]
```

Related Commands

Command	Description
upgrade hw-module subslot	Manually upgrades the current FPD image on the specified SPA.
upgrade fpd auto	Configures the router to automatically upgrade the FPD image when an FPD version incompatability is detected.
upgrade fpd path	Specifies the location from where the FPD image package should be loaded when an automatic FPD upgrade is initiated by the router.
show hw-module subslot fpd	Displays the FPD version on each SPA in the router.
show upgrade fpd package default	Displays which FPD image package is needed for the router to properly support the SPAs.
show upgrade fpd progress	Displays the progress of the FPD upgrade while an FPD upgrade is taking place.
show upgrade fpd table	Displays various information used by the Cisco IOS software to manage the FPD image package file.

show upgrade fpd package default

To display which FPD image package is needed for the router to properly support the SPAs for the running Cisco IOS software release, enter the **show upgrade fpd package default** command in privileged EXEC configuration mode.

show upgrade fpd package default

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S6	This command was introduced.

Usage Guidelines

It is important to note that the output from this command is generated from the Cisco IOS image and provides information regarding the default FPD image package file that is needed for your particular Cisco IOS release. This command also lists the SPAs supported by the default FPD image package file for the running Cisco IOS image.

In Cisco IOS Releases 12.2(20)S2 through 12.2(20)S5, the output generated by entering this command can be generated by entering the **show upgrade package default** command.

Examples

In the following example, the **show upgrade fpd package default** command output shows that the spa_fpd.122-20-S6.pkg FPD image package file is required if you install the SPA-4FE-7304 or the SPA-2GE-7304 on this particular router with this particular Cisco IOS release:

```
Router# show upgrade fpd package default

*************************************************************************
This IOS release supports the following default FPD Image Package(s) for
automatic upgrade:
*************************************************************************

SPA FPD Image Package:spa_fpd.122-20.S6.pkg

        List of SPAs supported in this package:

                                       Minimal
                 No. SPA Name          HW Ver.
                ---- ----------------- -------
                  1) SPA-4FE-7304        0.0
                  2) SPA-2GE-7304        0.0
                ---- ----------------- -------
```

Related Commands

Command	Description
upgrade hw-module subslot	Manually upgrades the current FPD image on the specified SPA.
upgrade fpd auto	Configures the router to automatically upgrade the FPD image when an FPD version incompatability is detected.
upgrade fpd path	Specifies the location from where the FPD image package should be loaded when an automatic FPD upgrade is initiated by the router.
show hw-module subslot fpd	Displays the FPD version on each SPA in the router.
show upgrade fpd file	Displays the contents of an FPD image package file.
show upgrade fpd progress	Displays the progress of the FPD upgrade while an FPD upgrade is taking place.
show upgrade fpd table	Displays various information used by the Cisco IOS software to manage the FPD image package file.

show upgrade fpd progress

To view the progress of an FPD upgrade while an FPD upgrade is taking place, enter the **show upgrade fpd progress** command in privileged EXEC configuration mode.

show upgrade fpd progress

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S6	This command was introduced.

Usage Guidelines

In Cisco IOS Releases 12.2(20)S2 through 12.2(20)S5, the output generated by entering this command can be generated by entering the **show upgrade progress** command.

Examples

The following example shows the type of information this command displays:

```
Router# show upgrade fpd progress

FPD Image Upgrade Progress Table:

 ==== =================== ====================================================
                          Field Programmable    Time
 Slot Card Description    Device :"ID-Name"    Needed   Time Left  State
 ==== =================== ================== ========== ========== ===========
  2/0 SPA-2GE-7304        1-4FE/2GE FPGA      00:06:00   00:05:17  Updating...
 ---- ------------------- ------------------ ----------- --------- -----------
  2/1 SPA-4FE-7304        1-4FE/2GE FPGA      --:--:--   --:--:--  Waiting...
 ==== =================== ====================================================
```

Related Commands

Command	Description
upgrade hw-module subslot	Manually upgrades the current FPD image on the specified SPA.
upgrade fpd auto	Configures the router to automatically upgrade the FPD image when an FPD version incompatability is detected.
upgrade fpd path	Specifies the location from where the FPD image package should be loaded when an automatic FPD upgrade is initiated by the router.
show hw-module subslot fpd	Displays the FPD version on each SPA in the router.
show upgrade fpd file	Displays the contents of an FPD image package file.

Command	Description
show upgrade fpd package default	Displays which FPD image package is needed for the router to properly support the SPAs.
show upgrade fpd table	Displays various information used by the Cisco IOS software to manage the FPD image package file.

show upgrade fpd table

To view various information used by the Cisco IOS software to manage the FPD image package file, enter the **show upgrade fpd table** command in privileged EXEC configuration mode.

show upgrade fpd table

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S6	This command was introduced.

Usage Guidelines

This command provides version information used by the Cisco IOS image to manage the FPD image package file and to locate the correct FPD image within the FPD image package file to perform an FPD upgrade. Most of the information provided by this command is useful for customer support purposes.

In Cisco IOS Releases 12.2(20)S2 through 12.2(20)S5, the output generated by entering this command can be generated by entering the **show upgrade table** command.

Examples

The following example displays various FPD information for Cisco IOS Release 12.2(20)S6:

```
Router# show upgrade fpd table

Field Programmable Devices (FPD) Bundle Information Table:
==========================================================


Table Entry #1:

       Bundle Card Type:SPA-4FE-7304 (0x435)
        Platform Family:0x0
     Bundle Name Prefix:spa_4fe2ge
         Bundle Version:0.5
    Minimal H/W Version:0.0
        FPD Image Count:1
     FPD Image Required:
                                                        Min. Required
                         FPD ID FPD Name                    Version
                         ------ ------------------------ -------------
                            1   Data & I/O FPGA              4.17
                         ------ ------------------------ -------------

Table Entry #2:
```

```
   Bundle Card Type:SPA-2GE-7304 (0x436)
    Platform Family:0x0
 Bundle Name Prefix:spa_4fe2ge
     Bundle Version:0.5
Minimal H/W Version:0.0
    FPD Image Count:1
 FPD Image Required:
                                                  Min. Required
                      FPD ID FPD Name                Version
                      ------ ----------------------- -------------
                         1   Data & I/O FPGA            4.17
                      ------ ----------------------- -------------
```

Related Commands

Command	Description
upgrade hw-module subslot	Manually upgrades the current FPD image on the specified SPA.
upgrade fpd auto	Configures the router to automatically upgrade the FPD image when an FPD version incompatability is detected.
upgrade fpd path	Specifies the location from where the FPD image package should be loaded when an automatic FPD upgrade is initiated by the router.
show hw-module subslot fpd	Displays the FPD version on each SPA in the router.
show upgrade fpd file	Displays the contents of an FPD image package file.
show upgrade fpd package default	Displays which FPD image package is needed for the router to properly support the SPAs.
show upgrade fpd progress	Displays the progress of the FPD upgrade while an FPD upgrade is taking place.

show upgrade package default

The **show upgrade package default** command is replaced by the **show upgrade fpd package default** command. See the **show upgrade fpd package default** command for more information.

show upgrade progress

The **show upgrade progress** command is replaced by the **show upgrade fpd progress** command. See the **show upgrade fpd progress** command for more information.

show upgrade table

The **show upgrade table** command is replaced by the **show upgrade fpd table** command. See the **show upgrade fpd table** command for more information.

speed

To configure the speed for a Fast Ethernet or Gigabit Ethernet interface, use the **speed** command in interface configuration mode. To return to the default setting, use the **no** form of this command.

speed {**10** | **100** | **1000** | **auto**}

no speed

Syntax Description

10	Configures the interface to transmit at 10 Mbps.
100	Configures the interface to transmit at 100 Mbps.
1000	Configures the interface to transmit at 1000 Mbps. This keyword is valid only for interfaces that support Gigabit Ethernet.
auto	Enables autonegotiation. The interface automatically operates at 10 Mbps or 100 Mbps depending on environmental factors, such as the type of media and transmission speeds for the peer routers, hubs, and switches used in the network configuration. This is the default.

Defaults

auto

Command Modes

Interface configuration

Command History

Release	Modification
11.2(10)P	This command was introduced.
12.1(7)E	The **1000** keyword was added for Gigabit Ethernet interfaces.
12.2 S	This command was integrated into Cisco IOS Release 12.2 S.
12.2(20)S2	This command was implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Usage Guidelines

The **speed** command applies to SPA interfaces that are using RJ-45 media. Gigabit Ethernet interfaces using fiber media support 1000-Mbps speed only, and use the **negotiation** command to enable and disable autonegotiation.

To enable the autonegotiation capability on an RJ-45 interface, you must set either the **speed** command or the **duplex** command to **auto**. The default configuration is that both commands are set to **auto**.

Table 8-44 describes the interface behavior for different combinations of the **duplex** and **speed** command settings. The specified **duplex** command configured with the specified **speed** command produces the resulting system action.

If you specify both a **duplex** and **speed** setting other than **auto** on an RJ-45 interface, then autonegotiation is disabled for the interface.

Note If you need to force an interface port to operate with certain settings and therefore disable autonegotiation, you must be sure that the remote link is configured for compatible link settings for proper transmission. This includes support of flow control on the link.

Note Every interface on a 4-Port 10/100 Fast Ethernet SPA and 2-Port 10/100/1000 Gigabit Ethernet SPA supports transmission of pause frames to stop packet flow when the MSC is full. You cannot disable flow control for an interface on the 4-Port 10/100 Fast Ethernet SPA or 2-Port 10/100/1000 Gigabit Ethernet SPA. Therefore, flow control support is not configurable, but it is advertised during autonegotiaton.

If you disable autonegotiation, then you must be sure that the remote device is configured to support flow control because flow control is automatically enabled for all interfaces on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA.

Table 8-44 Relationship Between duplex and speed Commands

duplex Command	speed Command	Resulting System Action
duplex auto	**speed auto**	Autonegotiates both speed and duplex mode. The interface advertises capability for the following link settings: • 10 Mbps and half duplex • 10 Mbps and full duplex • 100 Mbps and half duplex • 100 Mbps and full duplex • 1000 Mbps and half duplex (Gigabit Ethernet only) • 1000 Mbps and full duplex (Gigabit Ethernet only)
duplex auto	**speed 10** or **speed 100** or **speed 1000**	Autonegotiates the duplex mode. The interface advertises capability for the configured speed with capability for both half-duplex or full-duplex mode. For example, if the **speed 100** command is configured with **duplex auto**, then the interface advertises the following capability: • 100 Mbps and half duplex • 100 Mbps and full duplex

Table 8-44 Relationship Between duplex and speed Commands (continued)

duplex Command	speed Command	Resulting System Action
duplex half or **duplex full**	**speed auto**	Autonegotiates the speed. The interface advertises capability for the configured duplex mode with capability for both 10-Mbps or 100-Mbps operation for Fast Ethernet interfaces, and 10-Mbps, 100-Mbps, and 1000-Mbps for Gigabit Ethernet interfaces. For example, if the **duplex full** command is configured with the **speed auto** command, then the interface advertises the following capability: • 10 Mbps and full duplex • 100 Mbps and full duplex • 1000 Mbps and full duplex (Gigabit Ethernet interfaces only)
duplex half	**speed 10**	Forces 10-Mbps and half-duplex operation, and disables autonegotiation on the interface.
duplex full	**speed 10**	Forces 10-Mbps and full-duplex operation, and disables autonegotiation on the interface.
duplex half	**speed 100**	Forces 100-Mbps and half-duplex operation, and disables autonegotiation on the interface.
duplex full	**speed 100**	Forces 100-Mbps and full-duplex operation, and disables autonegotiation on the interface.
duplex half	**speed 1000**	Forces 1000-Mbps and half-duplex operation, and disables autonegotiation on the interface (Gigabit Ethernet only).
duplex full	**speed 1000**	Forces 1000-Mbps and full-duplex operation, and disables autonegotiation on the interface (Gigabit Ethernet only).

Examples

The following example specifies advertisement of 10 Mbps operation only, and either full-duplex or half-duplex capability during autonegotiation for the second interface (port 1) on the SPA located in the bottom subslot (1) of the MSC that is installed in slot 2 of the Cisco 7304 router:

```
Router# configure terminal
Router(config)# interface fastethernet 2/1/1
Router(config-if)# speed 10
Router(config-if)# duplex auto
```

With this configuration, the interface advertises the following capabilities during autonegotiation:

- 10 Mbps and half duplex
- 10 Mbps and full duplex

Note Flow control support is always advertised when autonegotiation is enabled.

Related Commands

Command	Description
duplex	Configures the duplex operation on an interface.
interface fastethernet	Selects a particular Fast Ethernet interface for configuration.
interface gigabitethernet	Selects a particular Gigabit Ethernet interface for configuration.
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show interfaces fastethernet	Displays information about the Fast Ethernet interfaces.
show interfaces gigabitethernet	Displays information about the Gigabit Ethernet interfaces.

t1 framing

To specify the type of framing used by T1 channels, use the **t1 framing** command in controller configuration mode.

Cisco 7500 Series Routers with Channelized T3 Interface Processor

t1 *channel* **framing** {**esf** | **sf**}

Channelized T3/E3 Shared Port Adapters

t1 *channel* **framing** {**esf** | **sf** [**hdlc-idle** {**0x7e** | **0xff**}] [**mode** {**j1**}]}

no t1 *channel* **framing** {**esf** | **sf** [**hdlc-idle** {**0x7e** | **0xff**}] [**mode** {**j1**}]}

Syntax Description

channel	Number indicating the T1 channel. • On the CT3IP—1 to 28 • On the CT3 SPA—0 to 23
esf	Specifies that Extended Super Frame (ESF) is used as the T1 framing type. This is the default for the CT3IP.
sf	Specifies that Super Frame (SF) is used as the T1 framing type. This is the default for the T3/E3 SPA.
hdlc-idle {**0x7e** | **0xff**}	(Optional) Sets the idle pattern for the T1 interface to either **0x7e** (the default) or **0xff**.
mode {**j1**}	(Optional) Specifies the JT-G704 Japanese frame type.

Defaults

esf (for C3TIP)

sf (for T3/E3 SPA)

Command Modes

Controller configuration

Command History

Release	Modification
11.3	This command was introduced.
12.0(14)S	This command was integrated into Cisco IOS Release 12.0(14)S. The **hdlc-idle** keyword option was added.
12.2S	This command was integrated into Cisco IOS Release 12.2S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE to support SPAs on the Cisco 7304 router. The **mode** keyword option was added.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

If you do not specify the **t1 framing** command, the default ESF is used.

Note T1 channels on the CT3IP are numbered 1 to 28 rather than the more traditional zero-based scheme (0 to 27) used with other Cisco products. This numbering scheme ensures consistency with telco numbering schemes for T1 channels within channelized T3 equipment.

To return to the default mode, use the **no** form of this command. This command does not have a **no** form on the Cisco 7500 series router with the CT3IP.

Examples

The following example shows how to set the framing for the T1 6 and T1 8 on the CT3IP to Super Frame:

```
Router(config)# controller t3 9/0/0
Router(config-controller)# t1 6 framing sf
Router(config-controller)# t1 8 framing sf
```

Related Commands

Command	Description
controller	Configures a T1, E1, or T3 controller and enters controller configuration mode.
show controller	Displays controller configuration.

test hw-module subslot c2w

To test the Cisco 2 wire (c2w) device on a SPA, use the **test hw-module subslot c2w** command in privileged EXEC configuration mode.

test hw-module subslot *slot*/*subslot* **c2w** {**read** *device-address port subaddress bytes* | **write** *device-address port subaddress bytes*}

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
read	Reads from the specified c2w device.
write	Writes to the specified c2w device.
device-address	Specifies the hexadecimal address (0–FF) of the c2w device.
port	Specifies the hexadecimal address (0–FF) of the c2w port.
subaddress	Specifies the hexadecimal subaddress (0–FF) of the c2w device.
bytes	Specifies the number of bytes (1–8) to read or write.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

The **test hw-module subslot c2w** command is implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Caution The **test hw-module subslot c2w** command is not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. This command can produce unexpected operation of your SPA.

This command does not have a **no** form.

When you run any of the **test hw-module subslot** commands on a SPA, you will be warned that the command is not intended for use on a production network and that the command should be reserved for use only with Cisco Systems technical support personnel.

Because the **test hw-module subslot** commands can produce unexpected operation of your SPA, the system issues a confirmation prompt that defaults to “N” to deny execution of the command. The command is not executed if you press **Enter** or type “**n**.”

To run the command, type “**y**” at the confirmation prompt.

To restore the default SPA configuration and remove any changes to the SPA settings that you made using a **test hw-module subslot c2w** command, perform the following steps:

1. Use the **hw-module subslot stop** command to deactivate the SPA and all of its interfaces.
2. Use the **hw-module subslot start** command to reactivate the SPA and all of its interfaces.

Examples

The following output provides an example of the **test hw-module subslot c2w** command and the warning statement and confirmation prompt that appears with it:

```
Router# test hw-module subslot 4/0 c2w read 00 00 00 1
This command is not intended for production use
and should be used only under the supervision of
Cisco Systems technical support personnel.

This command can produce unexpected operation of your SPA.
Are you sure you want to continue? [N]n
```

test hw-module subslot failed

To send a failed event on a SPA, use the **test hw-module subslot failed** command in privileged EXEC configuration mode.

test hw-module subslot *slot*/*subslot* **failed** *failure-code*

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
failed *failure-code*	Tests the specified failure code in the hexadecimal range 0–FFFFFFFF.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

The **test hw-module subslot failed** command is implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Caution The **test hw-module subslot failed** command is not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. This command can produce unexpected operation of your SPA.

This command does not have a **no** form.

When you run any of the **test hw-module subslot** commands on a SPA, you will be warned that the command is not intended for use on a production network and that the command should be reserved for use only with Cisco Systems technical support personnel.

Because the **test hw-module subslot** commands can produce unexpected operation of your SPA, the system issues a confirmation prompt that defaults to "N" to deny execution of the command. The command is not executed if you press **Enter** or type "**n**."

To run the command, type "**y**" at the confirmation prompt.

To restore the default SPA configuration and remove any changes to the SPA settings that you made using a **test hw-module subslot failed** command, perform the following steps:

1. Use the **hw-module subslot stop** command to deactivate the SPA and all of its interfaces.
2. Use the **hw-module subslot start** command to reactivate the SPA and all of its interfaces.

Examples

The following output provides an example of the **test hw-module subslot failed** command and the warning statement and confirmation prompt that appears with it:

```
Router# test hw-module subslot 4/0 failed 00000000
This command is not intended for production use
and should be used only under the supervision of
Cisco Systems technical support personnel.

This command can produce unexpected operation of your SPA.
Are you sure you want to continue? [N]n
```

test hw-module subslot mac

To test the Media Access Control (MAC) device on a SPA, use the **test hw-module subslot mac** command in privileged EXEC configuration mode.

test hw-module subslot *slot*/*subslot* **mac config** *port* {**1000mbps-gmii** | **1000mbps-rgmii** | **100mbps** | **10mbps**} {**full** | **half**} {**copper** | **fiber**}

test hw-module subslot *slot*/*subslot* **mac crc** *port* {**enable** | **disable**}

test hw-module subslot *slot*/*subslot* **mac loopback** *port* {**line** | **none** | **spi3**}

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding “Identifying Slots and Subslots for MSCs and SPAs” topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding “Specifying the Interface Address on a SPA” topic in the platform-specific SPA software configuration guide for subslot information.
config *port*	Tests a configuration value on the MAC device, where *port* is the number of the interface that you want to select on the SPA: • On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 • On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1
{**1000mbps-gmii** | **1000mbps-rgmii** | **100mbps** | **10mbps**}	Specifies a speed value to test on the MAC device of the selected interface on the SPA, where: • **1000mbps-gmii**—Specifies 1000-Mbps speed using the Gigabit Media Independent Interface (GMII). This option is only available for the Gigabit Ethernet SPAs. • **1000mbps-rgmii**—Specifies 1000-Mbps speed using the Reduced Gigabit Media Independent Interface (RGMII). This option is only available for Gigabit Ethernet SPAs. • **100mbps**—Specifies 100-Mbps speed. • **10mbps**—Specifies 10-Mbps speed.
{**full** | **half**}	Specifies the duplex mode to test on the MAC device of the selected interface on the SPA.
{**copper** | **fiber**}	Specifies the media type to test on the MAC device of the selected interface on the SPA, where: • **copper**—Specifies the copper media type, which is used by the RJ-45 interface connector. • **fiber**—Specifies a fiber media type, which is used by the Gigabit Interface Converter (GBIC) interface connector.

crc *port* {**enable** | **disable**}	Enables or disables appending of a cyclic redundancy check (CRC) on frames for the MAC device, where *port* is the number of the interface that you want to select on the SPA: • On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 • On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1
loopback *port* {**line** | **none** | **spi3**}	Specifies a loopback option on the MAC device of the selected interface, where: • *port*—Number of the interface that you want to select on the SPA: – On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 – On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1 • **line**—Specifies a loopback at the MAC device toward the line on the selected interface. • **none**—Disables loopback at the MAC device on the selected interface. • **spi3**—Specifies a loopback at the MAC device on the System Packet Interface Level 3 (SPI3) path between the MAC device and field-programmable gate array (FPGA) device. This is sometimes referred to as an internal loopback.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

The **test hw-module subslot mac** command is implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Caution The **test hw-module subslot mac** command is not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. This command can produce unexpected operation of your SPA.

This command does not have a **no** form.

When you run any of the **test hw-module subslot** commands on a SPA, you will be warned that the command is not intended for use on a production network and that the command should be reserved for use only with Cisco Systems technical support personnel.

Because the **test hw-module subslot** commands can produce unexpected operation of your SPA, the system issues a confirmation prompt that defaults to “N” to deny execution of the command. The command is not executed if you press **Enter** or type “**n**.”

To run the command, type "**y**" at the confirmation prompt.

To restore the default SPA configuration on an interface and remove any changes to the SPA settings that you made using a **test hw-module subslot mac** command, perform the following steps:

1. Use the **shutdown** command to disable the affected interface.
2. Use the **no shutdown** command to reenable the interface.

Examples

The following output provides an example of the **test hw-module subslot mac** command and the warning statement and confirmation prompt that appears with it:

```
Router# test hw-module subslot 4/0 mac config 0 10mbps full copper
This command is not intended for production use
and should be used only under the supervision of
Cisco Systems technical support personnel.

This command can produce unexpected operation of your SPA.
Are you sure you want to continue? [N]n
```

Related Commands

Command	Description
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show hw-module subslot	Displays diagnostic information about internal hardware devices for SPAs.
show interfaces fastethernet	Displays the status and configuration settings for the Fast Ethernet interfaces.
show interfaces gigabitethernet	Displays the status and configuration settings for Gigabit Ethernet interfaces.

test hw-module subslot mdio

To read or write to the PHY device registers through the MAC MII data input/output (MDIO) interface on a SPA, use the **test hw-module subslot mdio** command in privileged EXEC configuration mode.

test hw-module subslot *slot*/*subslot* **mdio** {**read** *phy-number phy-register-address* | **write** *phy-number phy-register-address*}

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/subslot	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
read	Reads from the specified PHY device.
write	Writes to the specified PHY device.
phy-number	Number of the interface PHY device that you want to select on the SPA: • On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 • On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1
phy-register-address	Address of the register (0–31) on the selected PHY device.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

The **test hw-module subslot mdio** command is implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Caution The **test hw-module subslot mdio** command is not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. This command can produce unexpected operation of your SPA.

This command does not have a **no** form.

When you run any of the **test hw-module subslot** commands on a SPA, you will be warned that the command is not intended for use on a production network and that the command should be reserved for use only with Cisco Systems technical support personnel.

Because the **test hw-module subslot** commands can produce unexpected operation of your SPA, the system issues a confirmation prompt that defaults to "N" to deny execution of the command. The command is not executed if you press **Enter** or type "**n**."

To run the command, type "**y**" at the confirmation prompt.

To restore some of the default register values on a SPA interface that you made using a **test hw-module subslot mdio** command, perform the following steps:

1. Use the **shutdown** command to disable the affected interface.
2. Use the **no shutdown** command to reenable the interface.

To restore the default SPA configuration and remove any changes to the SPA settings that you made using a **test hw-module subslot mdio** command, perform the following steps:

1. Use the **hw-module subslot stop** command to deactivate the SPA and all of its interfaces.
2. Use the **hw-module subslot start** command to reactivate the SPA and all of its interfaces.

Examples

The following output provides an example of the **test hw-module subslot mdio** command and the warning statement and confirmation prompt that appears with it:

```
Router# test hw-module subslot 4/0 mdio read 0 31
This command is not intended for production use
and should be used only under the supervision of
Cisco Systems technical support personnel.

This command can produce unexpected operation of your SPA.
Are you sure you want to continue? [N]n
```

Related Commands

Command	Description
show hw-module subslot	Displays diagnostic information about internal hardware devices for SPAs.
show interfaces fastethernet detail	Displays low-level diagnostic information for the Fast Ethernet interfaces.
show interfaces gigabitethernet detail	Displays low-level diagnostic information for the Gigabit Ethernet interfaces.

test hw-module subslot pause

To enable, disable, and set the pause frame-related configuration on a SPA, use the **test hw-module subslot pause** command in privileged EXEC configuration mode.

test hw-module subslot *slot*/*subslot* **pause** *port* {**disable** | **enable** | **set** { **threshold** {**fpga** *fpga-pause-threshold-value* | **mac** *mac-pause-threshold-value* } **timer** *pause-timer-value*}}

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding “Identifying Slots and Subslots for MSCs and SPAs” topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding “Specifying the Interface Address on a SPA” topic in the platform-specific SPA software configuration guide for subslot information.
pause *port*	Specifies pause frame-related configuration on the router, where *port* is the number of the interface that you want to select on the SPA: • On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 • On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1
disable	Disables pause frame flow control.
enable	Enables pause frame flow control.
set threshold	Specifies that a threshold register (either FPGA or MAC, as specified in the command line) will be set.
fpga *fpga-pause-threshold-value*	Configures the pause threshold register value in the SPA FPGA. The *fpga-pause-threshold* is expressed in usecs.
mac *mac-pause-threshold-value*	Configures the pause threshold register in the MAC. The *mac-pause-threshold-value* is expressed in bit times.
timer *pause-timer-value*	Configures the MAC pause timer value. The *pause-timer-value* is expressed in bit times.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S5	This command was introduced.

Usage Guidelines

Issuing this command could result in unexpected behaviors. It should not be used by end users.

Examples

The following output shows how to enable pause frame flow control and the warning statement and confirmation prompt that appears with it:

```
Router# test hw-module subslot 4/1 pause 1 enable
WARNING: This command is not intended for production use
and should be used only under the supervision of
Cisco Systems technical support personnel.

This command can produce unexpected operation of the SPA.
Are you sure you want to continue? [N]n
```

The following output shows how to set the pause threshold register value in the SPA FPGA and the warning statement and confirmation prompt that appears with it:

```
Router# test hw-module subslot 4/1 pause 1 set threshold fpga 4000
WARNING: This command is not intended for production use
and should be used only under the supervision of
Cisco Systems technical support personnel.

This command can produce unexpected operation of the SPA.
Are you sure you want to continue? [N]n
```

Related Commands

Command	Description
show hw-module subslot	Displays diagnostic information about internal hardware devices for SPAs.

test hw-module subslot phy

To test the physical interface (PHY) device on a SPA, use the **test hw-module subslot phy** command in privileged EXEC configuration mode.

test hw-module subslot *slot*/*subslot* **phy config** *port* {**copper** | **fiber**} {**1000mbps** | **100mbps** | **10mbps** | **auto**} {**auto** | **full** | **half**} {**autoneg** | **force**}

test hw-module subslot *slot*/*subslot* **phy crossover** *port* {**auto** | **mdi** | **mdix**}

test hw-module subslot *slot*/*subslot* **phy loopback** *port* {**internal** | **line** | **none**}

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding “Identifying Slots and Subslots for MSCs and SPAs” topic in the platform-specific SPA software configuration guide.
/subslot	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding “Specifying the Interface Address on a SPA” topic in the platform-specific SPA software configuration guide for subslot information.
config *port*	Tests a configuration value on the PHY device, where *port* is the number of the interface that you want to select on the SPA: • On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 • On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1
{**copper** | **fiber**}	Specifies the media type to test on the PHY device of the selected interface on the SPA, where: • **copper**—Specifies the copper media type, which is used by the RJ-45 interface connector. • **fiber**—Specifies a fiber media type, which is used by the Gigabit Interface Converter (GBIC) interface connector.
{**1000mbps** | **100mbps** | **10mbps** | **auto**}	Specifies a speed value to test on the PHY device of the selected interface on the SPA, where: • **1000mbps**—Advertises 1000-Mbps speed only during autonegotiation when used with the **autoneg** keyword, or configures 1000 Mbps speed when used with the **force** keyword. This option is only supported for Gigabit Ethernet interfaces. • **100mbps**—Advertises 100-Mbps speed only during autonegotiation when used with the **autoneg** keyword, or configures 100 Mbps speed when used with the **force** keyword. • **10mbps**—Advertises 10-Mbps speed only during autonegotiation when used with the **autoneg** keyword, or configures 10 Mbps speed when used with the **force** keyword. • **auto**—Advertises all of the supported speeds for autonegotiation for the selected interface when used with the **autoneg** keyword.

{**auto** | **full** | **half**}	Specifies the duplex mode to test on the PHY device of the selected interface on the SPA, where: • **auto**—Advertises both the full- and half-duplex modes during autonegotiation when used with the **autoneg** keyword. • **full**—Advertises full-duplex mode only during autonegotiation when used with the **autoneg** keyword, or configures full-duplex mode when used with the **force** keyword. • **half**—Advertises half-duplex mode only during autonegotiation when used with the **autoneg** keyword, or configures half-duplex mode when used with the **force** keyword.
{**autoneg** | **force**}	Specifies that the PHY device of the selected interface on the SPA is enabled overall for autonegotiation of transmission characteristics, or whether these values are forced to a particular value, where: • **autoneg**—Advertises the configured speed and duplex values. • **force**—Disables autonegotiation. Configures the PHY device for the specified speed and duplex values.
crossover *port* {**auto** | **mdi** | **mdix**}	Specifies the type of cable to test on the PHY device of the selected interface on the SPA, where: • *port*—Number of the interface that you want to select on the SPA: – On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 – On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1 • **auto**—Specifies that the PHY device automatically detects the type of cable on the specified interface. • **mdi**—Specifies that the PHY device on the specified interface is configured for a media dependent interface (MDI) cable (a straight-through cable). • **mdix**—Specifies that the PHY device on the specified interface is configured for media dependent interface crossover (MDI-X) cable.
loopback *port* {**internal** | **line** | **none**}	Specifies a loopback option on the PHY device of the selected interface on the SPA, where: • *port*—Number of the interface that you want to select on the SPA: – On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 – On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1 • **internal—**Specifies internal loopback on the PHY device toward the MAC device on the SPA. • **line**—Specifies a loopback at the PHY device toward the line on the selected interface. • **none**—Disables loopback at the PHY device on the selected interface.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

The **test hw-module subslot phy** command is implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Caution The **test hw-module subslot phy** command is not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. This command can produce unexpected operation of your SPA.

This command does not have a **no** form.

When you run any of the **test hw-module subslot** commands on a SPA, you will be warned that the command is not intended for use on a production network and that the command should be reserved for use only with Cisco Systems technical support personnel.

Because the **test hw-module subslot** commands can produce unexpected operation of your SPA, the system issues a confirmation prompt that defaults to "N" to deny execution of the command. The command is not executed if you press **Enter** or type "**n**."

To run the command, type "**y**" at the confirmation prompt.

To restore some of the default values on a SPA interface that you made using a **test hw-module subslot phy** command, perform the following steps:

1. Use the **shutdown** command to disable the affected interface.
2. Use the **no shutdown** command to reenable the interface.

To restore the default SPA configuration and remove any changes to the SPA settings that you made using a **test hw-module subslot phy** command, perform the following steps:

1. Use the **hw-module subslot stop** command to deactivate the SPA and all of its interfaces.
2. Use the **hw-module subslot start** command to reactivate the SPA and all of its interfaces.

Examples

The following output provides an example of the **test hw-module subslot phy** command and the warning statement and confirmation prompt that appears with it:

```
Router# test hw-module subslot 4/0 phy crossover 0 mdix
This command is not intended for production use
and should be used only under the supervision of
Cisco Systems technical support personnel.

This command can produce unexpected operation of your SPA.
Are you sure you want to continue? [N]n
```

Related Commands

Command	Description
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show hw-module subslot	Displays diagnostic information about internal hardware devices for SPAs.

test hw-module subslot policyram

To test the policy table used by the field programmable gate array (FPGA) device for ternary content addressable memory (TCAM) lookup on a SPA, use the **test hw-module subslot policyram** command in privileged EXEC configuration mode.

test hw-module subslot *slot*/*subslot* **policyram** {**read** *ram-virtual-address* | **write** {*ram-data* | [{**deny** | **permit**} [**tunnel** [**ignoreda**]]]}

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
read *ram-virtual-address*	Reads from the specified RAM address.
write	Writes to the specified RAM address.
ram-data	Value (0–15) to be written in the policy table.
{**deny** | **permit**}	Specifies the corresponding RAM data value to deny or permit traffic.
tunnel	Specifies use of Layer 2 tunneling.
ignoreda	Specifies that the destination MAC address is ignored.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

The **test hw-module subslot policyram** command is implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Caution The **test hw-module subslot policyram** command is not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. This command can produce unexpected operation of your SPA.

This command does not have a **no** form.

When you run any of the **test hw-module subslot** commands on a SPA, you will be warned that the command is not intended for use on a production network and that the command should be reserved for use only with Cisco Systems technical support personnel.

Because the **test hw-module subslot** commands can produce unexpected operation of your SPA, the system issues a confirmation prompt that defaults to "N" to deny execution of the command. The command is not executed if you press **Enter** or type "**n**."

To run the command, type "**y**" at the confirmation prompt.

To restore some of the default values on a SPA interface that you made using a **test hw-module subslot policyram** command, perform the following steps:

1. Use the **shutdown** command to disable the affected interface.
2. Use the **no shutdown** command to reenable the interface.

To restore the default SPA configuration and remove any changes to the SPA settings that you made using a **test hw-module subslot policyram** command, perform the following steps:

1. Use the **hw-module subslot stop** command to deactivate the SPA and all of its interfaces.
2. Use the **hw-module subslot start** command to reactivate the SPA and all of its interfaces.

Examples

The following output provides an example of the **test hw-module subslot policyram** command and the warning statement and confirmation prompt that appears with it:

```
Router# test hw-module subslot 4/0 policyram read 101
This command is not intended for production use
and should be used only under the supervision of
Cisco Systems technical support personnel.

This command can produce unexpected operation of your SPA.
Are you sure you want to continue? [N]n
```

Related Commands

Command	Description
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show tcam-mgr subslot	Displays TCAM manager information for SPAs.
test hw-module subslot tcam	Tests the TCAM device on a SPA.

test hw-module subslot tcam

To test the ternary content addressable memory (TCAM) device on a SPA, use the **test hw-module subslot tcam** command in privileged EXEC configuration mode.

test hw-module subslot *slot*/*subslot* **tcam insert** *port* {**dmac addr** *hex-mac-address* **mask** *hex-mask* | **vlan** *vlan-id*} {**deny** | **permit**}

test hw-module subslot *slot*/*subslot* **tcam lookup** *port* {**dmac addr** *hex-mac-address* **mask** *hex-mask* | **vlan** *vlan-id*}

test hw-module subslot *slot*/*subslot* **tcam read** *tcam-virtual-address*

test hw-module subslot *slot*/*subslot* **tcam remove** {**dmac addr** *hex-mac-address* **mask** *hex-mask* | **vlan** *vlan-id*}

test hw-module subslot *slot*/*subslot* **tcam write** {**mask** |**value**} *tcam-virtual-address port lookup-type* {**dmac** *hex-mac-address* | **vlan** *vlan-id*}

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding “Identifying Slots and Subslots for MSCs and SPAs” topic in the platform-specific SPA software configuration guide.
/subslot	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding “Specifying the Interface Address on a SPA” topic in the platform-specific SPA software configuration guide for subslot information.
insert *port* {**dmac addr** *hex-mac-address* **mask** *hex-mask* | **vlan** *vlan-id*} {**deny** | **permit**}	Tests the addition of a TCAM table entry on a SPA, where: • *port*—Number of the interface that you want to select on the SPA: – On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 – On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1 • **dmac addr** *hex-mac-address* **mask** *hex-mask*—Specifies the addition of a 48-bit destination MAC address (in hexadecimal) and its hexadecimal mask value to the TCAM table. • **vlan** *vlan-id*—Specifies the addition of a virtual LAN (VLAN) identifier (0–4095) to the TCAM table. • **deny**—Configures the TCAM table entry to deny traffic to the specified destination MAC address or VLAN identifier on the selected interface. • **permit**—Configures the TCAM table entry to allow traffic to be passed to the specified destination MAC address or VLAN identifier on the selected interface.

lookup *port* {**dmac addr** *hex-mac-address* **mask** *hex-mask* | **vlan** *vlan-id*}	Tests the reading of a TCAM table entry on a SPA, where: • *port*—Number of the interface that you want to select on the SPA: – On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 – On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1 • **dmac addr** *hex-mac-address* **mask** *hex-mask*—Specifies the 48-bit destination MAC address (in hexadecimal) and its hexadecimal mask value that you want to read from the TCAM table. • **vlan** *vlan-id*—Specifies the virtual LAN (VLAN) identifier (0–4095) that you want to read from the TCAM table.
read *tcam-virtual-address*	Tests the reading of a TCAM table entry, where *tcam-virtual-address* is an address in the range 0–4294967295.
remove {**dmac addr** *hex-mac-address* **mask** *hex-mask* | **vlan** *vlan-id*}	Tests the deletion of a TCAM table entry on a SPA, where: • *port*—Number of the interface that you want to select on the SPA: – On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 – On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1 • **dmac addr** *hex-mac-address* **mask** *hex-mask*—Specifies the deletion from the TCAM table of the specified 48-bit destination MAC address (in hexadecimal) and its hexadecimal mask value. • **vlan** *vlan-id*—Specifies the deletion from the TCAM table of a virtual LAN (VLAN) identifier in the range 0–4095.
write *tcam-virtual-address*	Tests writing to a TCAM table entry, where *tcam-virtual-address* is an address in the range 0–4294967295.
write {**mask** |**value**} *tcam-virtual-address port lookup-type* {**dmac** *hex-mac-address* | **vlan** *vlan-id*}	Tests writing to a TCAM table entry, where: • **mask**—Specifies writing of a mask cell. • **value**—Specifies writing of a value cell. • *tcam-virtual-address*—Specifies the virtual address of the TCAM table entry in the range 0–65535. • *port*—Number of the interface that you want to select on the SPA: – On the 4-Port 10/100 Fast Ethernet SPA—0, 1, 2, or 3 – On the 2-Port 10/100/1000 Gigabit Ethernet SPA—0 or 1 • *lookup-type*—Specifies the type (1 or 2) of TCAM lookup for the write operation. A value of “1” designates a destination MAC address lookup type, and a value of “2” designates a VLAN lookup type. **Note** Values 0 and 3 are not supported on SPAs. • **dmac** *hex-mac-address*—Writes the specified 48-bit destination MAC address (in hexadecimal) to the TCAM table. • **vlan** *vlan-id*—Writes the specified VLAN ID in the range 0–4095.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

The **test hw-module subslot tcam** command is implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Caution The **test hw-module subslot tcam** command is not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. This command can produce unexpected operation of your SPA.

This command does not have a **no** form.

When you run any of the **test hw-module subslot** commands on a SPA, you will be warned that the command is not intended for use on a production network and that the command should be reserved for use only with Cisco Systems technical support personnel.

Because the **test hw-module subslot** commands can produce unexpected operation of your SPA, the system issues a confirmation prompt that defaults to "N" to deny execution of the command. The command is not executed if you press **Enter** or type "**n**."

To run the command, type "**y**" at the confirmation prompt.

To restore some of the default values on a SPA interface that you made using a **test hw-module subslot tcam** command, perform the following steps:

1. Use the **shutdown** command to disable the affected interface.
2. Use the **no shutdown** command to reenable the interface.

To restore the default SPA configuration and remove any changes to the SPA settings that you made using a **test hw-module subslot tcam** command, perform the following steps:

1. Use the **hw-module subslot stop** command to deactivate the SPA and all of its interfaces.
2. Use the **hw-module subslot start** command to reactivate the SPA and all of its interfaces.

Examples

The following output provides an example of the **test hw-module subslot tcam** command and the warning statement and confirmation prompt that appears with it:

```
Router# test hw-module subslot 4/0 tcam remove 0 vlan 0
This command is not intended for production use
and should be used only under the supervision of
Cisco Systems technical support personnel.

This command can produce unexpected operation of your SPA.
Are you sure you want to continue? [N]n
```

Related Commands

Command	Description
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show tcam-mgr subslot	Displays TCAM manager information for SPAs.
test hw-module subslot policyram	Tests the policy RAM on a SPA.

test hw-module subslot temperature

To read temperature sensors on a SPA, use the **test hw-module subslot temperature** command in privileged EXEC configuration mode.

test hw-module subslot *slot*/*subslot* **temperature** *sensor-number*

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
temperature *sensor-number*	Reads the specified sensor (1 or 2) on the SPA.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

The **test hw-module subslot temperature** command is implemented on the 4-Port 10/100 Fast Ethernet SPA and the 2-Port 10/100/1000 Gigabit Ethernet SPA on the Cisco 7304 router.

Caution The **test hw-module subslot temperature** command is not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. This command can produce unexpected operation of your SPA.

This command does not have a **no** form.

When you run any of the **test hw-module subslot** commands on a SPA, you will be warned that the command is not intended for use on a production network and that the command should be reserved for use only with Cisco Systems technical support personnel.

Because the **test hw-module subslot** commands can produce unexpected operation of your SPA, the system issues a confirmation prompt that defaults to "N" to deny execution of the command. The command is not executed if you press **Enter** or type "**n**."

To run the command, type "**y**" at the confirmation prompt.

The **test hw-module subslot temperature** command does not modify any configuration settings. Therefore, you do not need to restore any default values after using the command.

Examples

The following output provides an example of the **test hw-module subslot temperature** command and the warning statement and confirmation prompt that appears with it:

```
Router# test hw-module subslot 4/0 temperature 1
This command is not intended for production use
and should be used only under the supervision of
Cisco Systems technical support personnel.

This command can produce unexpected operation of your SPA.
Are you sure you want to continue? [N]n
```

Related Commands

Command	Description
show environment	Displays power supply, fan, voltage, and temperature information for the router.

test tcam-mgr subslot

To test the ternary content addressable memory (TCAM) manager for a SPA, use the **test tcam-mgr subslot** command in privileged EXEC configuration mode.

test tcam-mgr subslot *slot*/*subslot* {**delete** | **empty** | **fill**}{**rx-dest-mac** | **rx-vlan**} *value*

test tcam-mgr subslot *slot*/*subslot* **insert** [**bottom** | **top**]{**rx-dest-mac** | **rx-vlan**} *value*

test tcam-mgr subslot *slot*/*subslot* **fulltcam** {**off** | **on**}

test tcam-mgr subslot *slot*/*subslot* **off**

test tcam-mgr subslot *slot*/*subslot* **read mc-index** *value* **vc-index** *value*

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/subslot	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
{**delete** | **empty** | **fill**}	Specifies one of the following operations on the destination MAC address or VLAN TCAM tables for filtering received frames: • **delete**—Removes a TCAM region entry. • **empty**—Empties a TCAM region by deleting entries. • **fill**—Inserts entries into a TCAM region by replicating the value that you specify throughout the region.
{**rx-dest-mac** | **rx-vlan**} *value*	Specifies which TCAM region upon which to perform the operation, where: • **rx-dest-mac**—Destination MAC address region for filtering received frames. • **rx-vlan**—VLAN ID region for filtering received frames. • *value*—Hexadecimal value of the entry on which to perform the specified insertion or deletion operation.

insert [**bottom** | **top**]	Specifies the addition of a single TCAM entry to the specified region, where: • **bottom**—(Optional) Inserts the specified value at the bottom of the selected TCAM region. • **top**—(Optional) Inserts the specified value at the top of the selected TCAM region. If you do not specify one of the optional keywords, then the entry is inserted anywhere in the middle of the TCAM region.
fulltcam {**off** | **on**}	Turns TCAM simulation off or on for all TCAM regions.
off	Disables the TCAM manager.
read mc-index *value* **vc-index** *value*	Reads the specified index *value*, where: • **mc-index**—Mask cell index. • **vc-index**—Value cell index, where *value* is in the range of 0 to 7. To find the range of mask indexes, use the **show tcam-mgr subslot region** command. To find the mask and value cell index values for a particular entry, use the **show tcam-mgr subslot table** command.

Defaults

No default behavior or values

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0 S	This command was introduced.
12.2(20)S2	This command was integrated into Cisco IOS Release 12.2(20)S2 and support for the **subslot**, **rx-dest-mac**, and **rx-vlan** keywords were added for SPAs on the Cisco 7304 router.

Usage Guidelines

Use the **test tcam-mgr subslot** command to test the TCAM manager for the destination MAC address and VLAN filter regions supported by the SPAs.

The TCAM manager allocates memory among the applications that it supports, in the form of regions. The SPAs support two TCAM regions, region 0 for destination MAC address filtering and region 1 for VLAN ID filtering of received frames.

Caution The **test tcam-mgr subslot** command is not intended for production use and should be used only under the supervision of Cisco Systems technical support personnel. This command can produce unexpected operation of your SPA.

Unlike when you run the **test hw-module subslot** commands for a SPA, when you run the **test tcam-mgr**

subslot commands the SPA *does not* provide a warning that the command is not intended for use on a production network and that the command should be reserved for use only with Cisco Systems technical support personnel.

This command does not have a **no** form.

You can obtain information about the TCAM region entries using the **show tcam-mgr subslot** privileged EXEC command.

To restore the default SPA configuration and remove any changes to the SPA settings that you made using a **test tcam-mgr subslot** command, perform the following steps:

1. Use the **hw-module subslot stop** command to deactivate the SPA and all of its interfaces.
2. Use the **hw-module subslot start** command to reactivate the SPA and all of its interfaces.

Examples

The following example removes the entry with the value 00112233 from the destination MAC address TCAM region for a SPA located in the top subslot (0) of the MSC that is installed in slot 4 on a Cisco 7304 router:

```
Router# test tcam-mgr subslot 4/0 delete rx-dest-mac 00112233
```

Related Commands

Command	Description
show controllers fastethernet	Displays Fast Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show controllers gigabitethernet	Displays Gigabit Ethernet interface information, transmission statistics and errors, and applicable MAC destination address and VLAN filtering tables.
show tcam-mgr subslot	Displays TCAM manager information for SPAs.
test hw-module subslot policyram	Tests the policy table used by the FPGA device for TCAM lookup on a SPA.
test hw-module subslot tcam	Tests the TCAM device on a SPA.

ttb

To send a trace trail buffer in E3 g832 framing mode, use the **ttb** command in interface configuraton mode. To disable the trace, use the **no** form of this command.

ttb {**country** | **rnode** | **serial** | **snode** | **soperator** | **x**} *line*

no ttb {**country** | **rnode** | **serial** | **snode** | **soperator** | **x**} *line*

Syntax Description

country *line*	Two-character country code.
rnode *line*	Receive node code.
serial *line*	M.1400 Serial
snode *line*	Sending Town/Node ID code.
soperator *line*	Sending Operator code.
x *line*	XO

Defaults

No default behavior or values

Command Modes

Interface configuration

Command History

Release	Modification
12.2S	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.0(31)S	This command was integrated into Cisco IOS Release 12.0(31)S.
12.2(25)S3	This command was integrated into Cisco IOS Release 12.2(25)S3.

Usage Guidelines

Use the **ttb** command to attach a header that contains fields to send to a remote device.

Examples

The following example starts a TTB message on the first port on slot 5.

```
Router# configure terminal
Router(config)# int serial 5/0/0
Router(config-if)# ttb country us
Router(config-if)# ttb snode 123
Router(config-if)# ttb rnode rn
Router(config-if)# ttb x 9
Router(config-if)# ttb serial 432
```

Related Commands

Command	Description
show controller serial	Displays controller statistics.

upgrade fpd auto

To configure the router to automatically upgrade the current FPD images on a SPA when an FPD version incompatibly is detected, enter the **upgrade fpd auto** global configuration command. To disable automatic FPD image upgrades, use the **no** form of this command.

upgrade fpd auto

no upgrade fpd auto

Syntax Description

This command has no arguments or keywords.

Defaults

This command is enabled by default if your router has any installed SPAs. The router will check the SPA FPD image during bootup or after an insertion of a SPA into an MSC subslot. If the router detects an incompatibility between an FPD image and a SPA, an automatic FPD upgrade attempt will occur unless the user has disabled automatic FPD upgrades by entering the **no upgrade fpd auto** command.

By default, the **upgrade fpd auto** will search the router's primary Flash file system for the FPD image package file. If you would like the router to search for the FPD image package file in a location other than the router's primary Flash file system when an FPD incompatibility is detected, enter the **upgrade fpd path** *fpd-pkg-dir-url* command to specify the location where the router should search for the FPD image package file. Once the FPD image package file is successfully located, the FPD upgrade process begins automatically.

Command Modes

Global configuration

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

This command is enabled by default. In most cases, this default configuration should be retained.

By default, the **upgrade fpd auto** command instructs the router to search its primary Flash file system (for example, disk0:) for the FPD image package file. If you would like the router to search for the FPD image package file in a different location when an FPD incompatibility is detected, enter the **upgrade fpd path** command to have the router find the FPD image package file in a different location.

If this command is disabled but an FPD upgrade is required, the **upgrade hw-module subslot** command can be used to upgrade the SPA FPD image manually after the SPA is disabled because of the existing FPD incompatibility.

Upgrading the FPD image on a SPA places the SPA offline while the upgrade is taking place. The time required to complete an FPD image upgrade can be lengthy. The **show upgrade progress** command can be used to gather more information about estimated FPD download times for a particular SPA.

Examples

The following example shows the output displayed when a SPA requires an FPD image upgrade and the **upgrade fpd auto** command is *enabled*. The incompatible FPD image is automatically upgraded.

```
% Uncompressing the bundle ...  [OK]
*Jan 13 22:38:47:%FPD_MGMT-3-INCOMP_FPD_VER:Incompatible 4FE/2GE FPGA (FPD ID=1) image
version detected for SPA-4FE-7304 card in subslot 2/0. Detected version = 4.12, minimal
required version = 4.13. Current HW version = 0.32.
*Jan 13 22:38:47:%FPD_MGMT-5-FPD_UPGRADE_ATTEMPT:Attempting to automatically upgrade the
FPD image(s) for SPA-4FE-7304 card in subslot 2/0 ...

*Jan 13 22:38:47:%FPD_MGMT-6-BUNDLE_DOWNLOAD:Downloading FPD image bundle for SPA-4FE-7304
card in subslot 2/0 ...
*Jan 13 22:38:49:%FPD_MGMT-6-FPD_UPGRADE_TIME:Estimated total FPD image upgrade time for
SPA-4FE-7304 card in subslot 2/0 = 00:06:00.
*Jan 13 22:38:49:%FPD_MGMT-6-FPD_UPGRADE_START:4FE/2GE FPGA (FPD ID=1) image upgrade in
progress for SPA-4FE-7304 card in subslot 2/0. Updating to version 4.13. PLEASE DO NOT
INTERRUPT DURING THE UPGRADE PROCESS (estimated upgrade completion time = 00:06:00)
...[................................................................................
(part of the output has been removed for brevity)
...........................................................................................
...........................................................................................
........]
SUCCESS - Completed XSVF execution.

*Jan 13 22:44:33:%FPD_MGMT-6-FPD_UPGRADE_PASSED:4FE/2GE FPGA (FPD ID=1) image upgrade for
SPA-4FE-7304 card in subslot 2/0 has PASSED. Upgrading time = 00:05:44.108
*Jan 13 22:44:33:%FPD_MGMT-6-OVERALL_FPD_UPGRADE:All the attempts to upgrade the required
FPD images have been completed for SPA-4FE-7304 card in subslot 2/0. Number of
successful/failure upgrade(s):1/0.
*Jan 13 22:44:33:%FPD_MGMT-5-CARD_POWER_CYCLE:SPA-4FE-7304 card in subslot 2/0 is being
power cycled for the FPD image upgrade to take effect.
```

Related Commands

Command	Description
upgrade hw-module subslot	Manually upgrades the current FPD image on the specified SPA.
upgrade fpd path	Specifies the location from where the FPD image package should be loaded when an automatic FPD upgrade is initiated by the router.
show hw-module subslot fpd	Displays the FPD version on each SPA in the router.
show upgrade fpd file	Displays the contents of an FPD image package file.
show upgrade fpd package default	Displays which FPD image package is needed for the router to properly support the SPAs.
show upgrade fpd progress	Displays the progress of the FPD upgrade while an FPD upgrade is taking place.
show upgrade fpd table	Displays various information used by the Cisco IOS software to manage the FPD image package file.

upgrade fpd path

To configure the router to search for an FPD image package file in a location other than the router's primary Flash file system during an automatic FPD upgrade, enter the **upgrade fpd path** global configuration command to specify the new location that should be searched for an FPD image package file when an automatic FPD upgrade occurs. To return to the default setting of the router searching for the FPD image package file in the router's primary Flash file system when an automatic FPD upgrade is triggered, use the **no** form of this command.

upgrade fpd path *fpd-pkg-dir-url*

no upgrade fpd path *fpd-pkg-dir-url*

Syntax Description

fpd-pkg-dir-url	Specifies the location of the FPD image package file, beginning with the location or type of storage device (examples include disk0, slot0, tftp, or ftp) and followed by the path to the FPD image package file. It is important to note that the name of the FPD image package file should not be specified as part of *fpd-pkg-dir-url*; the Cisco IOS will automatically download the correct FPD image package file once directed to the proper location.

Defaults

By default, the router checks its primary Flash file system for an FPD image package file when an incompatibility between an FPD image on the SPA and the running Cisco IOS image is detected. The **upgrade fpd path** command is used to specify a new location for a router to locate the FPD image package file if you want to store the FPD image package file in a location other than the router's default Flash file system for automatic FPD upgrades.

Command Modes

Global configuration

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

When specifying the path to the location of the new FPD image package file, do not include the filename in the path. The Cisco IOS will automatically download the correct FPD image package file once directed to the proper location, even if multiple FPD image package files of different versions are stored in the same location.

If the **upgrade fpd path** command is not entered, the router will search the default primary Flash file system for the FPD image.

Examples

In the following example, the FPD image package file that is stored on the TFTP server using the path johnstftpserver/fpdfiles will now be scanned for the latest FPD image package file when an automatic FPD upgrade occurs.

```
upgrade fpd path tftp://johnstftpserver/fpdfiles/
```

In the following example, the FPD package file that is stored on the FTP server using the path johnsftpserver/fpdfiles will now be scanned for the latest FPD image package when an automatic FPD upgrade occurs. In this example, john is the username and XXXXXXX is the FTP password.

```
upgrade fpd path ftp://john:XXXXXXX@johnsftpserver/fpdfiles/
```

Related Commands

Command	Description
upgrade hw-module subslot	Manually upgrades the current FPD image on the specified SPA.
upgrade fpd auto	Configures the router to automatically upgrade the FPD image when an FPD version incompatability is detected.
show hw-module subslot fpd	Displays the FPD version on each SPA in the router.
show upgrade fpd file	Displays the contents of an FPD image package file.
show upgrade fpd package default	Displays which FPD image package is needed for the router to properly support the SPAs.
show upgrade fpd progress	Displays the progress of the FPD upgrade while an FPD upgrade is taking place.
show upgrade fpd table	Displays various information used by the Cisco IOS software to manage the FPD image package file.

upgrade hw-module subslot

To manually upgrade the current FPD image package on a SPA, enter the **upgrade hw-module subslot** command in privileged EXEC configuration mode.

upgrade hw-module subslot *slot*/*subslot* **file** *file-url* [**force**]

Syntax Description

slot	Chassis slot number. Refer to the appropriate hardware manual for slot information. For MSCs, refer to the platform-specific SPA hardware installation guide or the corresponding "Identifying Slots and Subslots for MSCs and SPAs" topic in the platform-specific SPA software configuration guide.
/*subslot*	Secondary slot number on a MSC where a SPA is installed. Refer to the platform-specific SPA hardware installation guide and the corresponding "Specifying the Interface Address on a SPA" topic in the platform-specific SPA software configuration guide for subslot information.
file	Specifies that a file will be downloaded.
file-url	Specifies the location of the FPD image package file, beginning with the location or type of storage device (examples include disk0, slot0, tftp, or ftp) and followed by the path to the FPD image package file.
force	Forces the update of all compatible FPD images in the indicated FPD image package on the SPA that meet the minimal version requirements. Without this option, the manual upgrade will only upgrade incompatible FPD images.

Defaults

No default behavior or values, although it is important to note that the router containing the SPA is configured, by default, to upgrade the FPD images when it detects a version incompatibility between a the FPD image on the SPA and the FPD image required to run the SPA with the running Cisco IOS image. The **upgrade hw-module subslot** command is used to manually upgrade the FPD images; therefore, the **upgrade hw-module subslot** command should only be used when the automatic upgrade default configuration fails to find a compatible FPD image for one of the SPAs or when the automatic upgrade default configuration has been manually disabled. The **no upgrade fpd auto** command can be entered to disable automatic FPD upgrades.

If no FPD incompatibility is detected, this command will not upgrade SPA FPD images unless the **force** option is entered.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(20)S2	This command was introduced.

Usage Guidelines

This command is used to manually upgrade the FPD images on a SPA. In most cases, the easiest and recommended method of upgrading FPD images is the automatic FPD upgrade, which is enabled by default. The automatic FPD upgrade will detect and automatically upgrade all FPD images when an FPD incompatibility is detected.

A manual FPD upgrade is usually used in the following situations:

- The target SPA was disabled by the system because of an incompatible FPD image (the system could not find the required FPD image package file).
- A recovery upgrade must be performed.
- A special bug fix to an FPD image is provided in the FPD image package file.

The FPD image upgrade process places the SPA offline. The time required to complete an FPD image upgrade can be lengthy. The **show upgrade progress** command can be used to gather more information about estimated FPD download times for a particular SPA.

Examples

The following example shows a sample manual FPD upgrade:

```
Router# upgrade hw-module subslot 2/0 file disk0:spa_fpd.122-20.S2.pkg
% Uncompressing the bundle ...  [OK]


% The following FPD(s) will be upgraded for card in subslot 2/0 :

         ================== =========== =========== ============
         Field Programmable   Current     Upgrade   Estimated
         Device:"ID-Name"     Version     Version   Upgrade Time
         ================== =========== =========== ============
         1-Data & I/O FPGA     4.12        4.13      00:06:00
         ================== =========== =========== ============


% Are you sure that you want to perform this operation? [no]:y
% Restarting the target card (subslot 2/0) for FPD image upgrade. Please wait ...

Router#
*Jan 14 00:37:17:%FPD_MGMT-6-FPD_UPGRADE_TIME:Estimated total FPD image upgrade time for
SPA-4FE-7304 card in subslot 2/0 = 00:06:00.
*Jan 14 00:37:17:%FPD_MGMT-6-FPD_UPGRADE_START:4FE/2GE FPGA (FPD ID=1) image upgrade in
progress for SPA-4FE-7304 card in subslot 2/0. Updating to version 4.13. PLEASE DO NOT
INTERRUPT DURING THE UPGRADE PROCESS (estimated upgrade completion time = 00:06:00)
...[........................(part of the output has been removed for brevity)....
..................................................................................]
SUCCESS - Completed XSVF execution.

*Jan 14 00:42:59:%FPD_MGMT-6-FPD_UPGRADE_PASSED:4FE/2GE FPGA (FPD ID=1) image upgrade for
SPA-4FE-7304 card in subslot 2/0 has PASSED. Upgrading time = 00:05:42.596
*Jan 14 00:42:59:%FPD_MGMT-6-OVERALL_FPD_UPGRADE:All the attempts to upgrade the required
FPD images have been completed for SPA-4FE-7304 card in subslot 2/0. Number of
successful/failure upgrade(s):1/0.
*Jan 14 00:42:59:%FPD_MGMT-5-CARD_POWER_CYCLE:SPA-4FE-7304 card in subslot 2/0 is being
power cycled for the FPD image upgrade to take effect.
```

Related Commands

Command	Description
upgrade fpd auto	Configures the router to automatically upgrade the FPD image when an FPD version incompatability is detected.
upgrade fpd path	Specifies the location from where the FPD image package should be loaded when an automatic FPD upgrade is initiated by the router.
show hw-module subslot fpd	Displays the FPD version on each SPA in the router.
show upgrade fpd file	Displays the contents of an FPD image package file.
show upgrade fpd package default	Displays which FPD image package is needed for the router to properly support the SPAs.
show upgrade fpd progress	Displays the progress of the FPD upgrade while an FPD upgrade is taking place.
show upgrade fpd table	Displays various information used by the Cisco IOS software to manage the FPD image package file.

INDEX

FINAL DRAFT - CISCO CONFIDENTIAL

FINAL DRAFT - CISCO CONFIDENTIAL

FINAL DRAFT - CISCO CONFIDENTIAL

L

M

N

FINAL DRAFT - CISCO CONFIDENTIAL

O

P

Q

R

S

FINAL DRAFT - CISCO CONFIDENTIAL

X