Cisco ASR 1000 Series Fixed Ethernet Line Card Software Configuration Guide, Cisco IOS XE Everest 16.6

CONTENTS

Preface

This document describes the processes involved in configuring and troubleshooting the Cisco ASR 1000 Series Fixed Ethernet Line Cards that are supported on the Cisco ASR 1000 Series Aggregation Services Routers.

Note Unless otherwise noted in this document, the term Cisco ASR 1000 Series Fixed Ethernet Line Cards represent both the ASR1000-2T+20X1GE line card and the ASR1000-6TGE line card.

Document Revision History

The Document Revision History records the changes made to this document. The table shows the Cisco IOS XE software release number and document revision number pertaining to the change, the date of the change, and a brief summary of the change.

Release No.	Revision No.	Date	Change Summary
Cisco IOS XE Release 3.10S	OL-29860-01	July 30, 2013	First version of the document.

Release No.	Revision No.	Date	Change Summary
Cisco IOS XE Release 3.11S	OL-29860-02	November 15, 2013	Information about the support for the VLAN Unlimited, Fast Reroute (FRR), Configurable Pause Frame Thresholds, and Per Port Weight for Low Priority Traffic features was included.
Cisco IOS XE Release 3.12S	OL-29860-03	March 31, 2014	Information about the support for the ASR 1000-6x10GE line card was included.
Cisco IOS XE Release 3.13S	OL-29860-04	July 28, 2014	Information about modifying the minimum frame size to 68 bytes was included.
Cisco IOS XE Release 3.15	OL-29860-05	March 26, 2015	Added information pertaining to the support for the Cisco 1000BASET SFP Module (SFP-GLC-TE) on the ASR 1000 Series Routers.

Organization

This document contains the following chapters:

Chapter	Title	Description
Chapter 1	Using Cisco IOS XE Software	Provides an introduction to accessing the command-line interface (CLI) and using the Cisco IOS software and related tools.
Chapter 2	Overview of the Cisco ASR 1000 Series Fixed Ethernet Line Cards	Describes release history, feature and Management Information Base (MIB) support, and an introduction to the Cisco ASR 1000 Series Fixed Ethernet Line Card architecture on the Cisco ASR 1000 Series Aggregation Services Routers.

Chapter	Title	Description
Chapter 3	Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card	Describes the related configuration and verification information pertaining to the Cisco ASR 1000 Series Fixed Ethernet Line Card on the Cisco ASR 1000 Series Aggregation Services Routers.
Chapter 4	Troubleshooting the Cisco ASR 1000 Series Fixed Ethernet Line Card	Describes the techniques that you can use to troubleshoot the operation of the Cisco ASR 1000 Series Fixed Ethernet Line Card on the Cisco ASR 1000 Series Aggregation Services Routers.
Chapter 5	Upgrading Field-Programmable Devices	Provides information about upgrading field-programmable devices on the Cisco ASR 1000 Series Aggregation Services Routers.

Related Documentation

This section refers you to other documentation that might be useful as you configure your Cisco ASR 1000 Series Aggregation Services Routers.

Cisco IOS XE Features and Software Configuration

- Information about supported features and their configuration on the Cisco ASR 1000 Series Aggregation Services Routers are available in the Cisco IOS XE software configuration guides at:

http://www.cisco.com/en/US/products/ps9587/products_installation_and_configuration_guides_list.html

- A summary of the new features in a particular release can be found at:

http://www.cisco.com/en/US/products/ps9587/products_feature_guides_list.html

- Command documentation for the Cisco ASR 1000 Series Aggregation Services Routers is available at:

http://www.cisco.com/en/US/products/ps9587/prod_command_reference_list.html

Cisco ASR 1000 Series Aggregation Services Routers Documentation

Some of the following Cisco ASR 1000 Series Aggregation Services Router publications might be useful to you as you configure your Cisco ASR 1000 Series Aggregation Services Routers:

- Cisco ASR 1000 Series Aggregation Services Routers *Hardware Installation Guide* http://www.cisco.com/en/US/partner/docs/routers/asr1000/install/guide/asr1routers/asr1higV8.html

- Three Quick Start Guides:

  - *Cisco ASR 1004 Router Quick Start Guide* http://www.cisco.com/en/US/partner/docs/routers/asr1000/quick/start/guide/asr1_qs4.html

  - *Cisco ASR 1006 Router Quick Start Guide* http://www.cisco.com/en/US/partner/docs/routers/asr1000/quick/start/guide/asr1_qs6.html

  - *Cisco ASR 1013 Router Quick Start Guide* http://www.cisco.com/en/US/partner/docs/routers/asr1000/quick/start/guide/asr1_qs13.html

- Command Reference Guide:

  - *Cisco IOS Quality of Service Solutions Command Reference guide at the URL:* http://www.cisco.com/en/US/docs/ios/qos/command/reference/qos_book.html

- *Regulatory Compliance and Safety Information for the* Cisco ASR 1000 Series Aggregation Services Routers http://www.cisco.com/en/US/partner/docs/routers/asr1000/rcsi/asr1rcsi.html

- *Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide* http://www.cisco.com/en/US/partner/docs/routers/asr1000/configuration/guide/chassis/asrswcfg.html

- Cisco ASR 1000 Series Aggregation Services Routers *MIB Specifications Guide* http://www.cisco.com/en/US/partner/docs/routers/asr1000/mib/guide/asr1kmib.html

- *Release Notes for Cisco ASR 1000 Series Aggregation Services Routers* http://www.cisco.com/en/US/docs/routers/asr1000/release/notes/asr1k_rn_rel_notes.html

- Several other publications are also related to the Cisco ASR 1000 Series Aggregation Services Routers. For a complete reference of related documentation, see the Cisco ASR 1000 Series Aggregation Services Routers *Documentation Roadmap* located at the following URL: http://www.cisco.com/en/US/products/ps9343/products_documentation_roadmaps_list.html

Your router and the Cisco IOS software running on it contain extensive features. You can find documentation about Cisco products at the following URL:

http://www.cisco.com/cisco/web/psa/default.html?mode=prod

Document Conventions

Within the *Cisco ASR 1000 Fixed Ethernet Line Card 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. If you do, the string will include the quotation marks.

Command syntax descriptions use the following conventions:

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

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

Convention	Description
[x {y | z}]	Braces and a vertical line within square brackets indicate a required choice within an optional element.

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 that may not be contained in this manual.

Tip   Means *the following information will help you solve a problem* . The tips information might not be troubleshooting or even an action, but could be useful information, similar to a Timesaver.

Obtaining Documentation and Submitting a Service Request

For information on obtaining documentation, using the Cisco Bug Search Tool (BST), submitting a service request, and gathering additional information, see What's New in Cisco Product Documentation.

To receive new and revised Cisco technical content directly to your desktop, you can subscribe to the What's New in Cisco Product Documentation RSS feed. RSS feeds are a free service.

Using Cisco IOS XE Software

This chapter provides information to help you configure the Cisco ASR 1000 Series Fixed Ethernet Line Card using the Cisco IOS XE software. It includes the following sections:

Accessing the CLI Using a Router Console

The following sections describe how to access the command-line interface (CLI) using a directly-connected console or by using Telnet to obtain a remote console:

For detailed information about configuring and accessing a router through various services, refer to the http://www.cisco.com/en/US/docs/ios/termserv/configuration/guide/12_4/tsv_12_4_book.html Cisco IOS Terminal Services Configuration Guide and the http://www.cisco.com/en/US/docs/ios/12_2/termserv/command/reference/ftersv_r.html Cisco IOS Terminal Services Command Reference document.

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.

The console port on a Cisco ASR 1000 Series Router is an EIA/TIA-232 asynchronous, serial connection with no flow control and an RJ-45 connector. The console port is located on the front panel of each Route

Processor, as shown in Figure 1: Cisco ASR 1000 Series Aggregation Services Router Console Port Connector, on page 2.

Figure 1: Cisco ASR 1000 Series Aggregation Services Router Console Port Connector
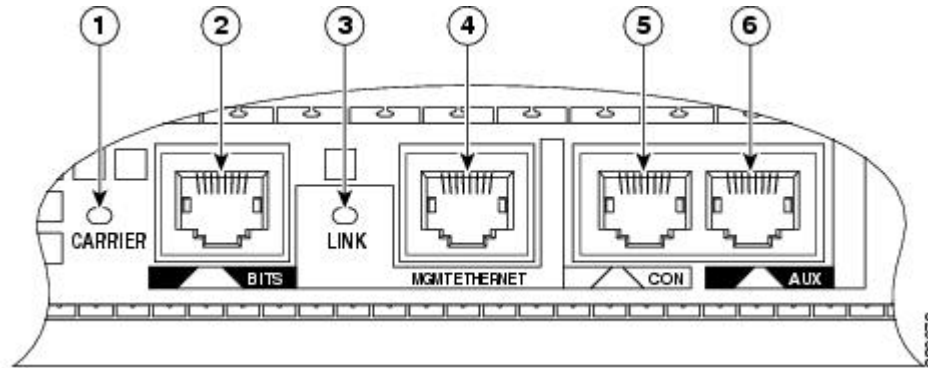
1	CARRIER LED	4	MGMT Ethernet connector
2	BITS connector	5	CON connector
3	LINK LED	6	AUX connector

Connecting to the Console Port

Before you connect to the console interface on a router through a terminal or a PC, perform the following steps:

SUMMARY STEPS

1. Configure your terminal emulation software with the following settings:
2. Connect to the console port using the RJ-45-to-RJ-45 cable and the RJ-45-to-DB-25 DTE adapter or by using the RJ-45-to-DB-9 DTE adapter (labeled terminal).

DETAILED STEPS

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

- 9600 bits per second (b/s)

- 8 data bits

- No parity

- 1-stop bit

- No flow control

Note The parameters listed above are the default serial communication parameters on a router. For information about how to change the default settings to meet the requirements of your terminal or host, refer to the http://www.cisco.com/en/US/docs/ios/termserv/configuration/guide/12_4/tsv_12_4_book.html Cisco IOS Terminal Services Configuration Guide .

Step 2 Connect to the console port using the RJ-45-to-RJ-45 cable and the RJ-45-to-DB-25 DTE adapter or by using the RJ-45-to-DB-9 DTE adapter (labeled terminal).

Accessing the CLI using the Console Interface

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

SUMMARY STEPS

1. After you attach the terminal hardware to the console port on a router and you configure your terminal emulation software with the correct settings.The following prompt appears:
2. Press **Return** to enter the user EXEC configuration mode. The following prompt appears:
3. From the user EXEC configuration mode, enter the **enable** command as shown in the following example:
4. At the password prompt, enter your system password, as shown here:
5. When your password is accepted, the privileged EXEC mode prompt appears:
6. You now have access to the CLI in privileged EXEC mode and you can enter the necessary commands to complete your desired tasks.
7. To exit the console session, enter the **quit** command as shown in the following example:

DETAILED STEPS

Step 1 After you attach the terminal hardware to the console port on a router and you configure your terminal emulation software with the correct settings.The following prompt appears:

Example:

```
Press Return for Console prompt
```

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

Example:

```
Router>
```

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

Example:

```
Router> enable
```

Step 4 At the password prompt, enter your system password, as shown here:

Example:

```
Password: enablepass
```

Step 5   When your password is accepted, the privileged EXEC mode prompt appears:

Example:

```
Router#
```

Step 6   You now have access to the CLI in privileged EXEC mode and you can 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:

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 a Router Console Using Telnet

Before you can access a router remotely using Telnet from a TCP/IP network, you need to configure a router to support virtual terminal lines using the **line vty** global configuration command. You should also configure the virtual terminal lines to required login.

> **Note**   To prevent a login from being disabled on the line, specify a password with the **password** command when you configure the **login** line configuration command. If you are using authentication, authorization, and accounting (AAA), configure the **login authentication** line configuration command. To prevent login from being disabled on the line for AAA authentication 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 http://www.cisco.com/en/US/docs/ios/12_2/security/configuration/guide/scfaaa.html Cisco IOS Security Configuration Guide and the http://www.cisco.com/en/US/docs/ios/security/command/reference/sec_book.html Cisco IOS Security Command Reference   documents.

In addition, before you make a Telnet connection to a router, you must have a valid hostname for a router or have an IP address configured on a router. For more information about the requirements for connecting to a router using Telnet, information about customizing your Telnet services, and using Telnet key sequences, refer to the http://www.cisco.com/en/US/docs/ios/termserv/configuration/guide/12_4/tsv_12_4_book.html Cisco IOS Terminal Services Configuration Guide .

Using Telnet to Access a Console Interface

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

SUMMARY STEPS

1. From your terminal or PC, enter one of the following commands:
2. At the password prompt, enter your login password. If no password has been configured, press **Return**. The following example shows the use of the password mypass:
3. From the user EXEC mode, enter the **enable** command as shown in the following example:
4. At the password prompt, enter your system password. The following example shows the use of the password enablepass:
5. When the password is accepted, the privileged EXEC mode prompt appears:
6. You now have access to the CLI in the privileged EXEC mode.You can enter the necessary commands to complete your tasks.
7. To exit the Telnet session, use the **exit** or the **logout** command, as shown in the following example:

DETAILED STEPS

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

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

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

In this syntax, *host* is a router hostname 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, specify a valid port number such as **telnet 172.20.52.40 2004**, in addition to the hostname or IP address.

The following example shows how the **telnet** command is used to connect to a router named *router* :

Example:

```
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. If no password has been configured, press **Return**. The following example shows the use of the password mypass:

Example:

```
User Access Verification
Password: mypass
```

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

Example:

```
Router> enable
```

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

Example:

```
Password: enablepass
```

Step 5   When the password is accepted, the privileged EXEC mode prompt appears:

Example:

```
Router#
```

Step 6   You now have access to the CLI in the privileged EXEC mode.You can enter the necessary commands to complete your tasks.

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

Example:

```
Router# logout
```

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.

Table 1: Keyboard Shortcuts , on page 6 lists the keyboard shortcuts for entering and editing commands.

Table 1: Keyboard Shortcuts

Keystrokes	Purpose
Ctrl-B or the **Left Arrow** key[1]	Move the cursor back one character.
Ctrl-F orthe **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 2: History Substitution Commands, on page 7 lists the history substitution commands.

Table 2: History Substitution Commands

Command	Purpose
Ctrl-P or the **Up Arrow** key[2]	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.
`Router#` **show history**	While in the EXEC mode, list the last several commands you have just entered.

[2] The arrow keys function only on ANSI-compatible terminals such as VT100s.

Understanding Command Modes

Use the CLI to access Cisco IOS XE 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 the user EXEC mode, which contains only a limited subset of commands. To have access to all the 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 the 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 required, you can save the running configuration to the startup configuration. The changed commands are stored when the software is rebooted. To enter specific configuration modes, you must start at the global configuration mode. From the global configuration mode, you can enter the 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 XE 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 the ROM monitor mode.

Table 3: Accessing and Exiting Command Modes , on page 8 describes how to access and exit various common command modes of the Cisco IOS XE software. It also shows examples of the prompts displayed for each mode.

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

For more information on command modes, refer to the "Using the Command-Line Interface" chapter in the http://www.cisco.com/en/US/docs/ios/fundamentals/configuration/guide/12_4/cf_12_4_book.html Cisco IOS Configuration Fundamentals Configuration Guide .

Getting Help

You can get a list of keywords and arguments associated with a command by using the context-sensitive help feature.

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

Table 4: Help Commands and Purpose

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 the 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.)

Displaying Command Options: An Example

This section provides an example of how to display the syntax for a command. The syntax can consist of optional or required keywords and arguments. The Cisco IOS XE software displays a list and brief description of the available keywords and arguments. For example, if you were in the global configuration mode and wanted to see all the keywords or arguments for the **arap** command, you should type **arap ?**.

The "<cr>" symbol in the 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 5: Finding Command Options , on page 10 shows examples of how you can use the question mark (**?**) to assist you in entering commands.

Table 5: Finding Command Options

Command	Comment

`Router> `**`enable`**
`Password: <password>`
`Router#`
	Enter the **enable** command and password to access the privileged EXEC commands. You are in the privileged EXEC mode when the prompt changes to a # from the > . For example, Router> 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 the global configuration mode. You are in the global configuration mode when the prompt changes to Router(config)# .

`Router(config)# `**`interface serial ?`**
`  <0-6>     Serial interface number`
`Router(config)# `**`interface serial 4 ?`**
`  /`
`<cr>`
`Router(config)# `**`interface serial 4/0/0`**
`Router(config-if)#`
	Enter the 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 the interface configuration mode when the prompt changes to Router(config-if)# .

`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)#`
	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.

Command	Comment
| ```
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
``` | Enter the command that you want to configure for the interface. This example uses the **ip** command.<br><br>Enter **?** to display what you must enter next on the command line. This example shows only some of the available interface IP configuration commands. |
| ```
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.<br><br>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.<br><br>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.<br><br>Enter **?** to display what you must enter next on the command line. In this example, you must enter an IP subnet mask.<br><br>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.<br><br>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**.<br><br>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)#
``` | Press **Enter** 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 re-enable 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 re-enable IP routing, use the **ip routing** command. The Cisco IOS software command reference document provide the complete syntax for the configuration commands and describe what the **no** form of a command does.

Many CLI commands also have a **default** form. By issuing the command **default** *command-name* , you can configure the command to its default setting. The Cisco IOS software command reference document describes the function of the **default** form of the command when the **default** form performs a different function than the plain and **no** forms of the command. To see what **default** commands are available on your system, enter **default ?** in the appropriate command mode.

Saving Configuration Changes

Use the **copy running-config 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 running-config 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 the Output of the show and more Commands

You can search and filter the output of the **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 with which you want to search or filter (the expression is case sensitive):

show *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 interfaces** command when you want the output to include only the lines in which the expression "protocol" appears:

```
Router# show interfaces | 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 Configuration Guide .

Finding Support Information for Platforms and Cisco Software Images

Cisco 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 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 XE software image, you can use Cisco Feature Navigator or the software release notes.

Using the Cisco Feature Navigator

Use the Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access the 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 the appropriate button in the login dialog box and follow the instructions that appear.

Using the 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://tools.cisco.com/Support/Fusion/FusionHome.do

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

Using Software Release Notes

Cisco IOS XE 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. However, the information provided in these documents may not be cumulative in providing information about the features that first appeared in previous releases. Refer to the Cisco Feature Navigator for cumulative feature information.

C H A P T E R **2**

Overview of the Cisco ASR 1000 Series Fixed Ethernet Line Cards

This chapter provides an overview of the release history, and feature and MIB support for the Gigabit Ethernet and Cisco ASR 1000 Series Fixed Ethernet Line Cards on the Cisco ASR 1000 Series Aggregation Services Routers.

This chapter includes the following sections:

Supported Line Cards

This section lists and describes the line cards supported by the Cisco ASR 1000 Series Aggregation Services Routers.

ASR1000-2T+20X1GE

The Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE is a fixed-port Ethernet line card for the Cisco ASR 1000 Series Aggregation Services Routers, that is capable of 40-Gbps full-duplex traffic forwarding using a fixed-port interface design. This line card has twenty 1-GE ports and two 10-GE ports.

This line card is supported on the Cisco ASR 1004, Cisco ASR 1006, ASR 1006-X, ASR 1009-X, and Cisco ASR 1013 Routers with RP2 and above + ESP40 and above combinations.

ASR1000-6TGE

The Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-6TGE is a fixed-port Ethernet line card for the Cisco ASR 1000 Series Aggregation Services Routers. The line card is capable of 60-Gbps input traffic and 40-Gbps output traffic forwarding using a fixed-port interface design. This line card has six 10 GE ports.

The small form-factor pluggables (XFP modules) allow the line card to be configured for different optical requirements (single-mode fiber or multimode fiber), as available. There is one power LED, one line card status LED, and 6 port or link status LEDs.

This line card is supported on the Cisco ASR 1004, Cisco ASR 1006, ASR 1006-X, ASR 1009-X, and Cisco ASR 1013 Routers with RP2 and above + ESP40 and above combinations.

Release History

Release	Modification
Cisco IOS XE Release 3.10S	First release. Support for the Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.
Cisco IOS XE Release 3.11S	Support for the VLAN Unlimited, Fast Re-route (FRR), Configurable Pause Frame Thresholds, and Per Port Weight for Low Priority Traffic features was introduced.
Cisco IOS XE Release 3.12S	Support for the Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-6TGE was introduced on the Cisco ASR 1000 Series Aggregation Services Routers.
Cisco IOS XE Release 3.15	Added information pertaining to the support for the Cisco 1000BASET SFP Module (SFP-GLC-TE) on the ASR 1000 Series Routers.

Features Supported in Cisco IOS XE Release 3.12S

Table below lists of some of the significant hardware and software features supported by the Cisco ASR 1000 Series Fixed Ethernet Line Cards on the Cisco ASR 1000 Series Aggregation Services Routers using Cisco IOS XE Release 3.12S:

Table 6: Features Supported in Cisco IOS XE Release 3.12S

Feature Name	Description
Minimal Disruptive Restart (MDR) for ELCBase and ELCSPA	Effective from Cisco IOS XE Release 3.12S, the Cisco ASR 1000 Series Fixed Ethernet Line Card (ASR1000-2T+20X1GE) supports MDR for the ELCBase and ELCSPA packages. MDR support for ASR1000-2T+20X1GE is specifically available on the Cisco ASR 1006 Router and the Cisco ASR 1013 Router, both having RP 2. **Note** MDR is not supported on the Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-6TGE in Cisco IOS XE Release 3.12S. For more information on MDR, see the http://www.cisco.com/c/en/us/td/docs/routers/asr1000/configuration/guide/chassis/asrswcfg.html Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide .

Features Supported in Cisco IOS XE Release 3.11S

Table below lists of some of the significant hardware and software features supported by the Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE on the Cisco ASR 1000 Series Aggregation Services Routers using Cisco IOS XE Release 3.11S:

Table 7: Features Supported in Cisco IOS XE Release 3.11S

Feature Name	Description
VLAN Unlimited	The hw-module subslot ethernet vlan unlimited configuration command increases the system default and enables support for configuration of up to 4094 dot1q VLANs per port.
Fast Re-route (FRR)	Although this feature can be configured on Cisco IOS XE Release 3.10S, the FRR switchover time can be more than 50 ms.
Configurable PLIM QoS	• Configurable PLIM classification is supported. • Configurable policing for the packets classified as high-priority traffic using the plim qos input policer bandwidth command is not supported. • Configurable weights for the packets classified as low using the plim qos input weight command are not supported.

Feature Name	Description
Configurable pause frame thresholds	Configuration of threshold percentages at which the pause frames should be generated using the plim qos input queue *<queue #>* pause *<percent>* command is not supported.

Features Supported in Cisco IOS XE Release 3.10S

The following is a list of some of the significant hardware and software features supported by the Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE on the Cisco ASR 1000 Series Aggregation Services Routers using Cisco IOS XE Release 3.10S:

- Auto negotiation

- Auto MDI and MDIX detection. The SFP-GE-T module enables auto MDI and MDIX detection on the 1-GE ports on Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE and also on the built-in GE ports for the Cisco ASR 1000 Series Aggregation Services Routers.

- Full-duplex operation

- 802.1Q VLAN termination

- Support for jumbo frames (9216 bytes)

- Support for CLI-controlled online insertion and removal (OIR) of the Cisco ASR 1000 Series Fixed Ethernet Line Card.

- 802.3x flow control

- The following maximum number of VLANs are supported on each line card:

    ◦ Number of VLANs per port: 4096

    ◦ Number of VLANs per line card: 32768.

- Up to 20480 Media Access Controller (MAC) Accounting Entries per Fixed Ethernet Line Card (Source MAC Accounting on the ingress and Destination MAC Accounting on the egress)

- Per-port byte and packet counters for policy drops, oversubscription drops, Cyclic Redundancy Check (CRC) error drops, packet sizes, unicast, multicast, and broadcast packets

- Per-VLAN byte and packet counters for policy drops, oversubscription drops, unicast, multicast, and broadcast packets

- Per-port packet counters for good packets and dropped packets

- Multiprotocol Label Switching (MPLS)

- Quality of Service (QoS)

- Hot Standby Router Protocol (HSRP)

- L1 clock frequency distribution—In this mode, the Cisco ASR 1000 Series Fixed Ethernet Line Card recovers the received clock, synchronizes it to a traceable source, and uses it to transmit data to the next node.

- In order to maintain a communication channel in synchronous network connections, Ethernet relies on a channel called Ethernet Synchronization Messaging Channel (ESMC) based on the IEEE 802.3 Organization-Specific Slow Protocol. ESMC relays the synchronization status message code that represents the quality level of the Ethernet Equipment Clock (EEC) in a physical layer.

Note   The Ethernet hardware used for the Cisco ASR 1000 Series Fixed Ethernet Line Card can support a minimum Inter-Frame Gap (IFG) of 8 bytes for 1-GE ports, and 5 bytes for 10-GE ports.

Hardware Compatibility Matrix

Table 8: Hardware Compatibility Matrix, on page 19 shows the hardware compatibility matrix of the Cisco ASR 1000 Series Fixed Ethernet Line Card:

Table 8: Hardware Compatibility Matrix

Hardware	Support	Restrictions
Chassis Type	Supported on the Cisco ASR 1004, Cisco ASR 1006, Cisco ASR 1006-X, Cisco ASR 1009-X, and Cisco ASR 1013 Routers with RP2 and above + ESP40 and above combinations.	—
RP2 with ESP-40G, ESP-100G, ESP-200G	Supported	The combination of ESP-40G with the Ethernet Line Card in slot 4 or slot 5 of a Cisco ASR1013 is not supported. **Note** ESP-100G and ESP-200G are not supported on Cisco ASR1004 **Note** RP2 requires the minimum ROMMON version to be 15.2(01)r. For more information about ROMMON, see http://www.cisco.com/en/US/products/ps9343/prod_maintenance_guides_list.html
RP1, ESP-10G, ESP-20G	Not Supported	—
SFP-GE-T	Supported	Only 1-Gigabit Mode is supported in Cisco IOS XE Release 3.10S. 10 Mbps or 100 Mbps is supported from Cisco IOS XE Release 3.11S onwards.
SFP-GLC-TE	Supported	—
GLC-GE-100FX	Not Supported	Not supported in Cisco IOS XE Release 3.11S.

| Note | For the complete list of supported SFP modules, see the Cisco ASR 1000 Series Fixed Ethernet Line Card Hardware Installation Guide . |

Synchronous Ethernet

Synchronous Ethernet (SyncE) is a procedure in which a physical layer interface is used to pass timing from node to node in the same way that timing is passed in SONET or Synchronous Digital Hierarchy (SDH). SyncE, defined by ITU-T standards, such as G.8261, G.8262, G.8264, and G.781, leverages the physical (PHY) layer of Ethernet to transmit frequency to remote sites. SyncE over Ethernet provides a cost-effective alternative to the networks. For SyncE to work, each network element must, along with the synchronization path, support SyncE.

You can implement SyncE on the Cisco ASR 1000 Series Fixed Ethernet Line Card, with the following configuration:

Clock Recovery from SyncE—The system clock is recovered from the SyncE clocking source (Gigabit interface and 10-Gigabit interface only). The router uses this clock as the Tx clock for other SyncE interfaces, ATM, or Circuit Emulation over Packet (CEoP) interfaces.

Synchronization Status Message and ESMC

Network clocking uses these mechanisms to exchange the quality level of the clock between the network elements:

- Synchronization Status Message

- Ethernet Synchronization Messaging Channel (ESMC)

Synchronization Status Message

Network elements use synchronization status messages to inform the neighboring elements about the quality level of the clock. Non-Ethernet interfaces, such as optical interfaces and SONET/T1/E1 Fixed Ethernet Line Card framers, use synchronization status messages. The key benefits of the synchronization status messages are:

- Prevents timing loops.

- Provides quick recovery when a part of the network fails.

- Ensures that a node derives timing from the most reliable clock source.

Ethernet Synchronization Messaging Channel

In order to maintain a logical communication channel in synchronous network connections, Ethernet relies on a channel called ESMC based on IEEE 802.3 organization-specific slow protocol standards. ESMC relays

the synchronization status messages code that represents the quality level of the Ethernet Equipment Clock (EEC) in a physical layer.

The ESMC packets are received only for those ports configured as clock sources, and transmitted on all the SyncE interfaces in the system. These packets are then processed by the clock selection algorithm on a route processor. and are used to select the best clock. The Tx frame is generated based on the quality level value of the selected clock source, and sent to all the enabled SyncE ports.

Clock Selection Algorithm

The clock selection algorithm selects the best available synchronization source from the nominated sources. The algorithm has a nonrevertive behavior among clock sources with the same quality level value, and always selects the signal with the best quality level value. For clock option 1, the default is revertive, and for clock option 2, the default is nonrevertive.

The clock selection process works in the quality level-enabled and quality level-disabled modes. When multiple selection processes are present in a network element, all the processes work in the same mode.

Quality Level-Enabled Mode

In the quality level-enabled mode, the following parameters contribute to the selection process:

- Quality level

- Signal fail via quality level-FAILED

- Priority

- External commands.

Note If no external commands are active, the algorithm selects the reference (for clock selection) with the highest quality level that does not experience a signal fail condition. If multiple inputs have the same highest quality level, the input with the highest priority is selected. For multiple inputs having the same highest priority and quality level, the existing reference is maintained (if it belongs to this group). Otherwise, an arbitrary reference from this group is selected.

Quality Level-Disabled Mode

In quality level-disabled mode, the following parameters contribute to the selection process:

- Signal failure

- Priority

- External commands

Note If no external commands are active, the algorithm selects the reference (for clock selection) with the highest priority that does not experience a signal fail condition. For multiple inputs having the same highest priority, the existing reference is maintained (if it belongs to this group). Otherwise, an arbitrary reference from this group is selected

Ingress Over Subscription on the ASR1000-6TGE Line Card

The Cisco ASR 1000 Fixed Ethernet Line Card ASR1000-6TGE has two ESI links connected to the backplane. Each of these ESI links is capable of a 23-Gbps bidirectional throughput for a total of 46 Gbps. (The 46-Gbps throughput includes the additional ESI headers added to the traffic before sending the traffic to the forwarding processor.) This limits the total traffic-carrying capacity of the line card, even though there are six 10-GE interfaces available, resulting in oversubscribed traffic to the line card. This oversubscription architecture of the ASR1000-6TGE line card is useful for providing connectivity to end users by using the additional two ports that are provided.

Supported MIBs

The following MIBs are supported by the Cisco ASR 1000 Fixed Ethernet Line Cards on the router:

- ENTITY-MIB
- CISCO-ENTITY-SENSOR-MIB
- ENTITY-SENSOR-MIB
- CISCO-ENTITY-FRU-CONTROL-MIB
- CISCO-ENTITY-ALARM-MIB
- IF-MIB
- CISCO-IF-EXTENSION-MIB
- ETHERLIKE-MIB
- CISCO-ETHERLIKE-EXT-MIB
- CISCO-ENTITY-PERFORMANCE-MIB
- CISCO-CLASS-BASED-QOS-MIB
- ENTITY-STATE-MIB
- CISCO-ENTITY-VENDORTYPE-OID-MIB

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

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

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

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

To access the 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:

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

Restrictions

- When an ESP40 module is used with a Cisco ASR 1013 Router, the Fixed Ethernet Line Cards are not supported in slot 4 and slot 5 of the Cisco ASR 1013 Router.

- Synchronous Ethernet is not supported on SFP-GE-T on the ASR1000-2T+20X1GE Line Card.

Fixed Ethernet Line Card Architecture

This section provides an overview of the architecture of the Cisco ASR 1000 Series Fixed Ethernet Line Card and describes the path of a packet in the ingress and egress directions. Some of these areas of architecture are referenced in the Fixed Ethernet Line Card software and can be helpful to understand when performing troubleshooting tasks or interpreting some of the Fixed Ethernet Line Card CLI and **show** command output.

Every incoming and outgoing packet on the Cisco ASR 1000 Series Fixed Ethernet Line Card goes through the PHY SFP optics, the MAC, and a Layer 2 Filtering or Accounting Network Processor.

The Path of an Ingress Packet

The following steps describe the path of an ingress packet through the Cisco ASR 1000 Series Fixed Ethernet Line Card:

1 For a 1-GE port on the Cisco ASR 1000 Series Fixed Ethernet Line Card, the SFP optics receive incoming frames on a per-port basis from one of the optical fiber interface connectors.
2 For 10-GE port on the Cisco ASR 1000 Series Fixed Ethernet Line Card, the XFP PHY device processes the frame and sends it over a Media Independent Interface (MII) to the MAC device.
3 The MAC device receives the frame, strips the CRCs, and sends the packet to the Network Processor.
4 The Network Processor takes the packet from the MAC devices and classifies the Ethernet information. Content-addressable memory (CAM) lookups based on Ethertype, port, VLAN, and destination MAC address information determine whether a packet is dropped or forwarded to the Quantum Flow Processor (QFP).

The Path of an Egress Packet

The following steps describe the path of an egress packet through the Cisco ASR 1000 Series Fixed Ethernet Line Card:

1 The packet is sent to the Network Processor from QFP. The packets are received with Layer 2 and Layer 3 headers in addition to the packet data.
2 The Network Processor uses port number, destination MAC address, destination address type, and VLAN ID to perform CAM lookups. The Network Processor forwards the packet to the MAC device.
3 For the Cisco ASR 1000 Series Fixed Ethernet Line Card, the MAC device forwards the packets to the PHY laser-optic interface, which transmits the packet.

Displaying the ASR 1000 Series Fixed Ethernet Line Card Hardware Type

To verify the Fixed Ethernet Line Card hardware type that is installed in your router, use the **show platform** command.

shows the hardware description that appears in the **show interfaces** command output for each Cisco ASR 1000 Series Fixed Ethernet Line Card that is supported on the router.

Table 9: Fixed Ethernet Line Card Hardware Descriptions in show interfaces Command Output

Fixed Ethernet Line Card	Description in the show interfaces Command
20-port GE and 2-port 10-GE Fixed Ethernet Line Card	Hardware is BUILT-IN-2T+20X1GE
Six 10 GE Fixed Ethernet Line Card	Hardware is BUILT-IN-6X10GE

The following is a sample output of the **show interfaces tengigabitethernet** command on a Cisco ASR 1000 Series Aggregation Services Router with a Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-2T+20X1GE installed in slot 1:

```
Router# show interfaces tengigabitEthernet 1/0/20
TenGigabitEthernet1/0/20 is up, line protocol is up
Hardware is BUILT-IN-2T+20X1GE, address is 70ca.9b6a.1b54 (bia 70ca.9b6a.1b54)
Internet address is 21.1.1.1/24
MTU 9216 bytes, BW 10000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 10000Mbps, link type is force-up, media type is 10GBase-LR
output flow-control is unsupported, input flow-control is unsupported
ARP type: ARPA, ARP Timeout 04:00:00
Last input never, output 00:03:22, output hang never
Last clearing of "show interfaces" counters never
Input queue: 0/375/0/0 (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 multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 0 multicast, 0 pause input
574 packets output, 46477 bytes, 0 underruns
0 output errors, 0 collisions, 2 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 pause output
0 output buffer failures, 0 output buffers swapped out
```

The following is a sample output of the **show interfaces tengigabitethernet** command on a Cisco ASR 1000 Series Aggregation Services Router with a Cisco ASR 1000 Series Fixed Ethernet Line Card ASR1000-6TGE installed in slot 1:

```
Router# show interfaces tengigabitEthernet 1/0/0
```

```
TenGigabitEthernet1/0/0 is up, line protocol is up
Hardware is BUILT-IN-6TGE, address is ecc8.8275.ee40 (bia ecc8.8275.ee40)
MTU 1500 bytes, BW 10000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 10000Mbps, link type is force-up, media type is 10GBase-SR/SW
output flow-control is on, input flow-control is on
ARP type: ARPA, ARP Timeout 04:00:00
Last input never, output 00:07:20, output hang never
Last clearing of "show interfaces" counters never
Input queue: 0/375/0/0 (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 multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 0 multicast, 0 pause input
0 packets output, 0 bytes, 0 underruns
0 output errors, 0 collisions, 3 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 pause output
0 output buffer failures, 0 output buffers swapped out
```

The following is a sample output of the **show interfaces gigabitethernet** command on a Cisco ASR 1000 Series Aggregation Services Router with a Cisco ASR 1000 Series Fixed Ethernet Line Card installed in slot 1:

```
Router# show interfaces gigabitEthernet 1/0/16
GigabitEthernet1/0/16 is up, line protocol is up
Hardware is BUILT-IN-2T+20X1GE, address is 70ca.9b6a.1b50 (bia 70ca.9b6a.1b50)
Internet address is 1.2.1.1/24
MTU 9216 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 1000Mbps, link type is auto, media type is SX
output flow-control is off, input flow-control is off
ARP type: ARPA, ARP Timeout 04:00:00
Last input 02:20:41, output 00:03:36, output hang never
Last clearing of "show interfaces" counters never
Input queue: 0/375/0/0 (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
595 packets input, 45373 bytes, 0 no buffer
Received 3 broadcasts (0 IP multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 569 multicast, 0 pause input
593 packets output, 47591 bytes, 0 underruns
0 output errors, 0 collisions, 2 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 pause output
0 output buffer failures, 0 output buffers swapped out
```

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

This chapter provides information about configuring the Cisco ASR 1000 Series Fixed Ethernet Line Cards on the Cisco ASR 1000 Series Aggregation Services Routers. It includes the following sections:

For more information about the commands used in this chapter, refer to the related Cisco IOS software command reference and master index publications *and the* publication that corresponds to your Cisco IOS XE software release. For more information about accessing these publications, see the "Related Documentation" section on page vi .

For information about managing your system images and configuration files, refer to the Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide *, the* Cisco IOS Configuration Fundamentals Configuration Guide *,* and the Cisco IOS Configuration Fundamentals Command Reference publications that correspond to your Cisco IOS software release.

Configuration Tasks

This section describes how to configure the Cisco ASR 1000 Series Fixed Ethernet Line Cards and includes information about verifying the configuration, and includes the following topics:

Mandatory Configuration Tasks

This section lists the mandatory configuration steps to configure the Cisco ASR 1000 Series Fixed Ethernet Line Card. Some of the mandatory configuration commands implement default values that might be appropriate for your network. If the default value is correct for your network, you do not have to configure the command. These commands are indicated by (As Required) in the Purpose column.

To configure the Cisco ASR 1000 Series Fixed Ethernet Line Card, complete the following steps:

SUMMARY STEPS

1. **configure terminal**
2. Do one of the following:

    • **interface gigabitethernet** *slot* /*subslot* /*port*

3. **ip address** *ip-address mask* [**secondary**] | **dhcp** {**client-id interface-name**}{**hostname host-name**}}
4. **mtu** *bytes*
5. **standby** [**group-number**] **ip** {**ip-address** [**secondary**]}
6. **no shutdown**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 2	Do one of the following: • **interface gigabitethernet** *slot* /*subslot* /*port* **Example:** Router(config)# **interface gigabitethernet** *2* /*0* /*0* **Example:** Router(config)# **interface tengigabitethernet** *1* /*0* /*20* **Example:**	Configures the Gigabit Ethernet or the 10-GE interface. Here: • *slot* /*subslot* /*port* —Specifies the location of the interface. See the Specifying the Interface Address on an Ethernet Line Card, on page 30. • *subinterface-number*—(Optional) Specifies a secondary interface (subinterface) number.
Step 3	**ip address** *ip-address mask* [**secondary**] | **dhcp** {**client-id interface-name**}{**hostname host-name**}}	Sets a primary or secondary IP address for an interface that is using IPv4. Here: • *ip-address* —Specifies the IP address for the interface. • *mask* —Specifies the mask for the associated IP subnet.

	Command or Action	Purpose
	Example: Router(config-if)# ip address **10.20.30.40 255.255.255.0**	• **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. • **dhcp**—Specifies that IP addresses will be assigned dynamically using DHCP. • **client-id** *interface-name*—Specifies the client identifier. The *interface-name* sets the client identifier to the hexadecimal MAC address of the named interface. • **hostname** *host-name*—Specifies the hostname for DHCP purposes. The *host-name* is the name of the host to be placed in the DHCP option 12 field.
Step 4	**mtu** *bytes* **Example:** Router(config-if)# **mtu** *1523*	(As required) Specifies the maximum packet size for an interface. Here: • *bytes*— Specifies the maximum number of bytes for a packet. The default is 1500 bytes; the range is 1500 to 9216 bytes.
Step 5	**standby** [**group-number**] **ip** {**ip-address** [**secondary**]} **Example:** Router(config-if)# standby 2 ip 10.20.30.40	(Required for HSRP configuration only) Creates (or enables) an HSRP group using its number and virtual IP address. Here: • (Optional) *group-number*—Specifies the group number on the interface for which HSRP is being enabled. The range is 0 to 255; the default is 0. If there is only one HSRP group, you do not have to enter a group number. • (Optional on all but one interface if configuring HSRP) *ip-address*—Specifies the virtual IP address of the hot standby router interface. You must enter the virtual IP address for at least one of the interfaces; it can be learned on the other interfaces. • (Optional) **secondary**—Specifies the IP address of a secondary hot standby router interface. If neither router is designated as a secondary or standby router and no priorities are set, the primary IP addresses are compared and the higher IP address is the active router, with the next highest as the standby router. This command enables HSRP but does not configure it further. For additional information on configuring HSRP, refer to the HSRP section of the Cisco IP Configuration Guide that corresponds to your Cisco IOS software release.
Step 6	**no shutdown** **Example:** Router(config-if)# **no shutdown**	Enables the interface.

Specifying the Interface Address on an Ethernet Line Card

To configure or monitor Ethernet Line Card interfaces, specify the physical location of the Ethernet Line Card, and interface in the CLI. The interface address format is slot/subslot/port. Here:

- slot—Specifies the chassis slot number in the Cisco ASR 1000 Series Aggregation Services Router on which the Ethernet Line Card is installed.

- subslot—Specifies the secondary slot number in the Cisco ASR 1000 Series Aggregation Services Router on which the Ethernet Line Card is installed. It is always specified as 0.

- port—Specifies the number of the individual interface port on an Ethernet Line Card.

The following example shows how to specify the first interface (0) on an Ethernet Line Card that is installed in chassis slot 0:

```
Router(config)# interface GigabitEthernet 0/0/0
interface GigabitEthernet0/0/0
no ip address
shutdown
negotiation auto
no cdp enable
```

Modifying the MAC Address on an Interface

The Cisco ASR 1000 Series Fixed Ethernet Line Cards use a default MAC address for each port that is derived from the base address that is stored in the EEPROM on the backplane of the Cisco ASR 1000 Series Aggregation Services Routers.

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

Command	Purpose
mac-address *ieee-address* Router(config-if)# **mac-address** 000a.f330.2e40	Modifies the default MAC address of an interface to a user-defined address. Here: - *ieee-address*— Specifies the 48-bit 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 this command.

Verifying a MAC Address

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

The following example shows that the MAC address is 000a.f330.2e40 for interface 1 on the Ethernet Line Card installed in slot 2 of a Cisco ASR 1000 Series Aggregation Services Router:

```
Router# show interfaces gigabitethernet 2/0/0
GigabitEthernet2/0/0 is administratively down, line protocol is down
  Hardware is BUILT-IN-2T+20X1GE, address is 000a.f330.2e40 (bia 000a.f330.2e40)
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not supported
  Full Duplex, 1000Mbps, link type is auto, media type is SX
  output flow-control is off, input flow-control is off
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 01:58:11, output hang never
  Last clearing of "show interfaces" counters never
  Input queue: 0/375/0/0 (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 multicasts)
     0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 0 multicast, 0 pause input
     80 packets output, 7560 bytes, 0 underruns
     0 output errors, 0 collisions, 18 interface resets
     0 unknown protocol drops
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier, 0 pause output
     0 output buffer failures, 0 output buffers swapped out
```

Gathering MAC Address Accounting Statistics

The **ip accounting mac-address** [**input** | **output**] command can be entered to enable MAC Address Accounting on an interface. After enabling MAC Address Accounting, MAC address statistics can be displayed by entering the **show interfaces mac-accounting** command.

The following example shows that the MAC accounting statistics for interface 1 on the Ethernet Line Card is installed in slot 1 of a Cisco ASR 1000 Series Aggregation Services Router:

```
Router# show interfaces TenGigabitEthernet1/0/0 mac-accounting
TenGigabitEthernet1/0/0
Input(494 free)
0000.0c5d.92f9(58 ): 1 packets, 106 bytes, last: 4038ms ago
0004.c059.c060(61 ): 0 packets, 0 bytes, last: 2493135ms ago
00b0.64bc.4860(64 ): 1 packets, 106 bytes, last: 20165ms ago
0090.f2c9.cc00(103): 12 packets, 720 bytes, last: 3117ms ago
Total: 14 packets, 932 bytes
Output (511 free)
0090.f2c9.cc00(103): 8 packets, 504 bytes, last: 4311ms ago
Total: 8 packets, 504 bytes
```

Configuring the Hot Standby Router Protocol

The Hot Standby Router Protocol (HSRP) provides high network availability because it routes IP traffic from hosts without relying on the availability of any single router. HSRP is used in a group of routers for selecting an active router and a standby router. (An *active* router is the router of choice for routing packets; a *standby* router is a router that takes over the routing duties when an active router fails, or when preset conditions are met).

Enable HSRP on an interface by entering the **standby** [*group-number*] **ip** [*ip-address* [**secondary**]] command. You can also use the **standby** command to configure various HSRP elements. This document does not discuss complex HSRP configurations. For additional information on configuring HSRP, refer to the HSRP section of the Cisco IP Configuration Guide publication that corresponds to your Cisco IOS XE software release. In the following HSRP configuration, standby group 2 on Gigabit Ethernet port 2/0/0 is configured with a priority of 110 and to have a preemptive delay for a switchover to occur:

```
Router(config)#
interface GigabitEthernet 2/0/0
Router(config-if)#
standby 2 ip 120.12.1.200
Router(config-if)#
standby 2 priority 110
Router(config-if)#
standby 2 preempt
```

Verifying HSRP

To verify HSRP information, use the show standby command in EXEC mode:

```
Router# show standby
GigabitEthernet2/0/0 - Group 1
  State is Active
    2 state changes, last state change 00:00:33
    Track object 1 (unknown)
  Virtual IP address is 172.16.16.254
  Active virtual MAC address is 0000.0c07.ac01 (MAC In Use)
    Local virtual MAC address is 0000.0c07.ac01 (v1 default)
  Hello time 3 sec, hold time 10 sec
    Next hello sent in 2.416 secs
  Preemption enabled
  Active router is local
  Standby router is unknown
  Priority 105 (configured 105)
  Group name is "hsrp-Gi2/0/0-1" (default)
```

Modifying the Interface MTU Size

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 Ethernet Line Card on the 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), the frame continues to process.

- IP MTU—Can be configured on an interface or subinterface. If an IP packet exceeds the IP MTU size, the packet is fragmented.

- Tag or Multiprotocol Label Switching (MPLS) MTU—Can be configured on an interface or 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 4-byte header, and each MPLS label adds a 4-byte header (*n* labels x 4 bytes).

For Cisco ASR 1000 Series Fixed Ethernet Line Cards on the Cisco ASR 1000 Series Aggregation Services Routers, the default MTU size is 1500 bytes. The maximum configurable MTU is 9216 bytes. The Ethernet Line Card automatically adds an additional 22 bytes to the configured MTU size to accommodate some of the additional overhead.

Note   You cannot set the MTU option at the subinterface level.

Interface MTU Configuration Guidelines

When configuring the interface MTU size of a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router, consider the following guidelines:

- The default interface MTU size accommodates a 1500-byte packet, plus 22 additional bytes to cover the following additional overhead:
    ◦ Layer 2 header—14 bytes
    ◦ Dot1q header—4 bytes
    ◦ CRC—4 bytes

- 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, 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 the interface configuration mode:

Command	Purpose
mtu *bytes* Router(config-if)# **mtu** *1523*	Configures the maximum packet size for an interface. Here: - *bytes*— Specifies the maximum number of bytes for a packet. The default is 1500 bytes and the maximum configurable MTU is 9216 bytes.

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

Verifying the MTU Size

To verify the MTU size for an interface, use the **show interfaces gigabitethernet** command in the 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 1 (the second port) on the Cisco ASR 1000 Series Fixed Ethernet Line Card installed in slot 2 of a Cisco ASR 1000 Series Aggregation Services Router:

```
Router# show interfaces gigabitethernet 2/0/1
GigabitEthernet2/0/1 is up, line protocol is up
Hardware is BUILT-IN-2T+20X1GE, address is 70ca.9b6a.1b50 (bia 70ca.9b6a.1b50)
Internet address is 1.2.1.1/24
MTU 9216 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 1000Mbps, link type is auto, media type is SX
output flow-control is off, input flow-control is off
ARP type: ARPA, ARP Timeout 04:00:00
Last input 02:20:41, output 00:03:36, output hang never
Last clearing of "show interfaces" counters never
Input queue: 0/375/0/0 (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
595 packets input, 45373 bytes, 0 no buffer
Received 3 broadcasts (0 IP multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 569 multicast, 0 pause input
593 packets output, 47591 bytes, 0 underruns
0 output errors, 0 collisions, 2 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 pause output
0 output buffer failures, 0 output buffers swapped out
```

QoS Classification

The physical level interface module (PLIM) is the hardware component in the data path between the media interface and the forwarding engine.

Use the following commands in the interface configuration mode to configure QoS:

Command	Purpose

`plim qos input map ip {precedence-based | precedence precedence-value queue {`**strict-priority | 0**`}}`
 	
`Router(config-if)# plim qos input map ip precedence-based`
 	
`Router(config-if)# plim qos input map ip precedence 5 queue strict-priority`
	Classifies incoming IP traffic according to the value of the IP precedence bits, and places the traffic into the appropriate queue.
	
	• *precedence-value*—Specifies the value of the IP precedence bits (0 to 7). You can specify a range of values separated by a dash or a list of values. By default, the Cisco ASR 1000 Series Fixed Ethernet Line Card classifies IP precedence range 6-7 as high priority.
	
	• **strict-priority**—Specifies the high-priority queue. Enter 0 for low priority.
	
	Use the **no** form of this command to remove the configured values.

`plim qos input map ipv6 all queue {`**strict-priority | 0**`}` `Router(config-if)# plim qos input map ipv6 all queue` **strict-priority**	Classifies all the IPv6 packets as high priority or low priority. • **strict-priority**—Specifies high-priority traffic. Enter 0 for low-priority. The **no** form of this command disables all IPv6 classification. By default, this command is disabled.
`plim qos input map ipv6 tc {`*tc-value | tc-range*`} queue {`**strict-priority | 0**`}` `Router(config-if)# plim qos input map ipv6 tc` *ef queue 0*	Classifies ingress IPv6 traffic based on the value of the traffic-class bits and places the traffic into the appropriate queue. • *tc-value | tc-range*—Specifies the value of the traffic class bits. You can specify a range of values separated by a dash or a list of values. • **strict-priority**—Specifies the high-priority queue. Enter 0 for the low priority queue. The **no** form of this command sets the classification according to default DSCP EF. By default, IPv6 traffic with a traffic-class value equal to EF uses the high-priority queue and all other traffic uses the low-priority queue. Only the most significant six bits of the traffic-class octet is used for the classification.

Command	Purpose
`plim qos input map mpls all queue` {**strict-priority** | **0}** `Router(config-if)# plim qos input map mpls all queue` **strict-priority**	Classifies all MPLS packets as high priority or low priority. • **strict-priority**—Specifies high-priority packets. Enter 0 for low-priority packets. The **no** form of this command disables MPLS classification. By default, this command is disabled.
`plim qos input map mpls exp` {*exp-value* | *exp-range}* `queue` {**strict-priority** | **0}** `Router(config-if)# plim qos input map mpls exp 5` *queue strict-priority*	Classifies incoming MPLS traffic according to the value of the **exp** bits and places the traffic into the appropriate queue. • *exp-value* | *exp-range*—Specifies which MPLS **exp** value or range to use. • **strict-priority**—Specifies high-priority MPLS traffic. Enter **0** for low-priority. By default, the Cisco ASR 1000 Series Fixed Ethernet Line Card classifies MPLS EXP range 6-7 as high-priority. The **no** form of this command sets the classification according to default **exp** range 6-7.
`plim qos input queue` {**strict-priority** | **0}** `pause enable | threshold percent]` `Router(config-if)# plim qos input queue` **strict-priority pause enable**	Enables Ethernet pause frame generation due to flow control status. • **strict-priority**—Specifies high-priority queue. Enter **0** for a low-priority queue. • **pause**—Sets up the queue threshold to send a pause frame, which is a percentage of queue limit for packet drop. • threshold—Specifies the amount of traffic required to generate the pause frame. The default threshold is 100 percent. This feature is supported from Cisco IOS XE Release 3.11S onwards. By default, pause frame generation is enabled for a **strict-priority** queue. The **no** form of this command disables pause generation for a queue.

Command	Purpose
`plim qos input map ip all queue {`**strict-priority** ` | ` **0}** `Router(config-if)# plim qos input map ip all queue ` **0**	Allows user to specify all IPv4 packets as high priority or low priority. • **strict-priority**—Specifies high-priority packets. Enter **0** for a low-priority packets The **no** form of this command disables all IPv4 classification. By default, this command is disabled.

`plim qos input map ip dscp-based`
 	
`Router(config-if)# plim qos input map ip dscp-based`
	Enables IP DSCP-based classification.
	
	By default, the Cisco ASR 1000 Series Fixed Ethernet Line Card enables IP precedence-based classification for the Cisco ASR 1000 Series Aggregation Services Routers.
	
	The **no** form of this command totally disables the IP DSCP-based classification.

`plim qos input map ip dscp {`*dscp-value* ` | ` *dscp-range}* **queue {strict-priority** ` | ` **0}** `Router(config-if)# plim qos input map ip dscp ` *af11 queue strict-priority*	Allows the user to specify an IP DSCP value or range. • **strict-priority**—Specifies high-priority IP DSCP value. Enter **0** for low-priority. By default, the Cisco ASR 1000 Series Fixed Ethernet Line Card classifies DSCP EF as high priority. The **no** form of this command removes the IP DSCP value or range.

`plim qos input [bandwidth value_in_Kbps [strict-priority]] [weight weight]`
 	
`Router(config-if)# plim qos input [bandwidth value_in_Kbps [strict-priority]] [weight weight]`
	Specifies the port regardless of priority, or specifies priority only (strict-priority) to receive the guaranteed minimum bandwidth, demanded minimum bandwidth, and assigned weight value for excess scheduling.
	
	The default mode (without using this command) is that the minimum scheduling is off, and only excess scheduling, which uses default weight proportional to the interface bandwidth, is in service.
	
	The **no** form of this command sets the interface to the default minimum bandwidth and weight.
	
	This feature is supported from Cisco IOS XE Release 3.11S onwards.

Configuring the Encapsulation Type

By default, the interfaces on the Cisco ASR 1000 Series Fixed Ethernet Line Cards support Advanced Research Projects Agency (ARPA) encapsulation. They do not support configuration of service access point or SNAP

encapsulation for transmission of frames; however, the interfaces will properly receive frames that use service access point and SNAP encapsulation.

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

Configuring Autonegotiation on an Interface

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.

For the Gigabit Ethernet interfaces on the Cisco ASR 1000 Series Aggregation Services Router, flow control is autonegotiated when autonegotiation is enabled. Autonegotiation is enabled by default.

The following guidelines should be followed regarding autonegotiation:

- If autonegotiation is disabled on one end of a link, it must be disabled on the other end of the link. If one end of a link has autonegotiation disabled while the other end of the link does not, the link will not come up properly on both ends.

- Flow control is enabled by default.

- Flow control will be on if autonegotiation is disabled on both ends of the link.

Note For configuring any ASR1000 platform, ensure that auto negotiation is configured identically on both sides of the link. For example, if auto negotiation is disabled on one side of the link, the other end of the link must also have auto negotiation disabled. If the auto negotiation configuration does not match on both sides of the link, it may lead to connection failure.

Disabling Autonegotiation

Autonegotiation is automatically enabled and can be disabled on the Gigabit Ethernet interfaces on the Cisco ASR 1000 Series Fixed Ethernet Line Card. During autonegotiation, advertisement for flow control, speed, and duplex occurs, depending on the media (fiber or copper) in use. If the interface is connected to a link that has autonegotiation disabled, autonegotiation should either be re-enabled on the other end of the link or disabled on the Cisco ASR 1000 Series Fixed Ethernet Line Card, if possible. Both ends of the link will not come up properly if only one end of the link has disabled autonegotiation.

Speed and duplex configurations can be advertised using autonegotiation. However, the only values that are negotiated are:

- For Cisco ASR 1000 Series Fixed Ethernet Line Cards—100 Mbps for speed and full-duplex mode.

- For Cisco ASR 1000 Series Fixed Ethernet Line Cards using RJ-45 copper interfaces—1000 Mbps for speed and full-duplex mode. Link speed is not negotiated when using fiber interfaces.

From a user's perspective, these settings are not really negotiated, but rather, are enabled using autonegotiation. The SFPs for Cisco ASR 1000 Series Fixed Ethernet Line Cards support 1000Base-X, but the IEEE 1000Base-X standard for fiber does not support negotiation of link speed.

To disable autonegotiation, use the following command in the interface configuration mode:

Command	Purpose
no negotiation auto Router(config-if)# **no negotiation auto**	Disables autonegotiation on Cisco ASR 1000 Series Fixed Ethernet Line Card interfaces. No advertisement of flow control occurs.

Configuring Speed and Duplex

To configure the speed for a Gigabit Ethernet interface, use the **speed** command in the interface configuration mode. To return to the default setting, use the **no** form of this command.

Note   When using the SFP-GE-T, you must configure both the speed and duplex modes.

Note   Before configuring speed and duplex, disable autonegotiation on the interface. The **speed** and **duplex** commands are not available on the 10-GE interfaces.

Command	Purpose
speed {**10** ∣ **100** ∣ **1000**} Router(config-if)# **speed 100**	Configures the interface to transmit at 10 Mbps, 100 Mbps, or 1000 Mbps.

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

Command	Purpose
duplex {**full** ∣ **half**} Router(config-if)# **duplex full**	Specifies full-duplex or half-duplex operation.

Enabling Autonegotiation

To re-enable autonegotiation on a Gigabit Ethernet interface, use the following command in the interface configuration mode:

Command	Purpose
negotiation auto Router(config-if)# **negotiation auto**	Enables autonegotiation on a Cisco ASR 1000 Series Fixed Ethernet Line Card interface. Advertisement of flow control occurs.

Configuring a Subinterface on a VLAN

You can configure subinterfaces on the Cisco ASR 1000 Series Fixed Ethernet Line Card interfaces on a VLAN using IEEE 802.1Q encapsulation. Cisco Discovery Protocol is disabled by default on the Cisco ASR 1000 Series Fixed Ethernet Line Card interfaces and subinterfaces.

To configure an Ethernet Line Card subinterface on a VLAN, use the following commands in the global configuration mode:

SUMMARY STEPS

1. **hw-module subslot** slot/subslot **ethernet vlan unlimited**
2. Do one of the following:

    • **interface gigabitethernet** *slot* /*subslot* /*port* [*.*subinterface-number]

3. **encapsulation dot1q** *vlan-id*
4. **ip address** *ip-address mask* [**secondary]**}

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**hw-module subslot** slot/subslot **ethernet vlan unlimited** **Example:** `Router(config)# hw-module subslot slot/subslot ethernet vlan unlimited`	(Optional) Enables configuration of up to 4094 dot1q VLANs per port per Cisco ASR 1000 Fixed Ethernet Line Card. Here: • *slot* —Specifies the slot number of the chassis in which the Ethernet Line Card is installed. • *subslot* —Specifies the slot number of the Ethernet Line Card in which the Ethernet Line Card is installed. This feature is supported from Cisco IOS XE Release 3.11S onwards.
Step 2	Do one of the following: • **interface gigabitethernet** *slot* /*subslot* /*port* [*.*subinterface-number] **Example:** `Router(config)#` **interface gigabitethernet** *2* */0* */0.20* **Example:**	Specifies the Gigabit Ethernet interface to configure. Here: • *slot* /*subslot* /*port* —Specifies the location of the interface. See the Specifying the Interface Address on an Ethernet Line Card, on page 30. • *subinterface-number*—Specifies a secondary interface (subinterface) number.

Command or Action	Purpose

Example:
 	
Example:
 	
`Router(config)#` **interface tengigabitethernet**
`1`
`/0`
`/20.43`
 	
Example:	

Step 3 **encapsulation dot1q** *vlan-id* **Example:** `Router(config-subif)#` **encapsulation dot1q** `25`	Defines the encapsulation format as IEEE 802.1Q (dot1q), where *vlan-id* is the number of the VLAN. The valid value range is 1–4094.
Step 4 **ip address** *ip-address mask* [**secondary**]} **Example:** `Router(config-subif)#` `ip address` **10.20.30.40 255.255.255.0** **Example:**	Sets a primary or secondary IP address for an interface. Here: • *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.

VLAN Classification

This section describes how to configure the COS based classification rules at VLAN sub-interface level and L3 classification rules at main-interface level.

✎

Note When the **hardware-module subslot ethernet vlan unlimited** command is configured, the default classification of CoS bits 6 and 7 as high priority is supported. However, other user-defined CoS values for high-priority and low-priority classification using the **plim qos input map cos queue** command are not supported.

When the VLAN scale configuration is enabled using the **hw-module subslot** *slot/subslot* **ethernet vlan unlimited** command, the VLAN COS bits classification will be lost.

The following is a sample output of the **hw-module subslot** *slot/subslot* **ethernet vlan unlimited** command displaying a warning message.

```
Router(config)# hw-module subslot 1/3 ethernet vlan unlimited
```

```
%VLAN input classification in subslot 1/3 will not be available
```
To specify VLAN classification, use the following commands in the subinterface configuration mode:

Command	Purpose

`plim qos input map cos enable`
 	
`Router(config-subif)# plim qos input map cos enable`
	Enables packet classification based on 802.1q VLAN COS bits.
	
	By default, this command is enabled on the Cisco ASR 1000 Series Fixed Ethernet Line Card.
	
	The **no** form of this command totally disables the COS classification.
	
	The command is used in the dot1q subinterface configuration mode, which can be either under the main physical interface or the Gigabit EtherChannel link bundle.

`plim qos input map cos {`*cos-value* | *cos-range}*`queue {`**strict-priority** | **0**`}` `Router(config-subif)# plim qos input map cos`*3 queue strict-priority*	Allows a user to specify a COS value or a COS range. By default, without this command, COS bits value 6 and 7 is classified as high priority. Only the default behavior is supported when the **hw-module subslot ethernet vlan unlimited** command is configured. The **no** form of this command sets the classification according to the default value (COS priority value 6 and 7). This command is in the VLAN subinterface configuration mode under either the main physical interface or the Gigabit EtherChannel link bundle.

Classifying Inner and Outer VLAN COS Values

To enable packet classification based on VLAN COS values for Inner and Outer VLAN of a 802.1Q subinterface or qinq subinterface, execute the following set of commands from the qinq subinterface configuration mode:

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface gigabitEthernet 0/0/0.1**
4. **plim qos input map cos inner-based**
5. **plim qos input map cos inner {**$cos\text{-}value$ | $cos\text{-}range$**} queue {strict-priority | 0}**
6. **plim qos input map cos outer-based**
7. **plim qos input map cos outer {**$cos\text{-}value$ | $cos\text{-}range$**} queue {strict-priority | 0}**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. Enter your password when prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface gigabitEthernet 0/0/0.1** **Example:** `Router(config)# interface gigabitEthernet 0/0/0.1`	Enters subinterface mode for Gigabit Ethernet 0/0/0.1.
Step 4	**plim qos input map cos inner-based** **Example:** `Router(config-subif)# plim qos input map cos inner-based`	Enables and allows configuration for inner VLAN COS values. **Note** The VLAN COS values can be enabled by default by executing the **plim qos input map enable** command.
Step 5	**plim qos input map cos inner** {*cos-value* | *cos-range}* **queue {strict-priority | 0}** **Example:** `Router(config-subif)# plim qos input map cos inner 5 queue strict-priority`	Configures the COS values or the COS range of the inner VLAN of a qinq subinterface to high priority.
Step 6	**plim qos input map cos outer-based** **Example:** `Router(config-subif)# plim qos input map cos outer-based`	Enables configuration for outer VLAN COS values. **Note** The VLAN COS values can be enabled by default by executing the **plim qos input map enable** command.
Step 7	**plim qos input map cos outer** {*cos-value* | *cos-range}* **queue {strict-priority | 0}** **Example:** `Router(config-subif)# plim qos input map cos outer 4 queue strict-priority`	Configures the COS values or range for outer VLAN of a qinq subinterface to high priority.

Verifying a Subinterface Configuration on a VLAN

To verify the configuration of a subinterface and its status on the VLAN, use the show interfaces gigabitethernet 0/0/0.1 privileged EXEC command.

The following example shows the status of subinterface number 1 on port 0 on the Ethernet Line Card in VLAN number 200:

```
Router# show interfaces gigabitethernet 0/0/0.1
GigabitEthernet0/0/0.1 is up, line protocol is up
  Hardware is BUILT-IN-2T+20X1GE, address is badb.adbb.7a00 (bia badb.adbb.7a00)
  Internet address is 192.168.0.1/24
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation 802.1Q Virtual LAN, Vlan ID  2.
  ARP type: ARPA, ARP Timeout 04:00:00
  Keepalive not supported
  Last clearing of "show interfaces" counters never
Router#
```

Saving a Configuration

To save your running configuration to NVRAM, use the following command in privileged EXEC configuration mode:

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

For information about managing your system image and configuration files, refer to the Cisco IOS Configuration Fundamentals Configuration Guide   and Cisco IOS Configuration Fundamentals Command Reference publications that correspond to your Cisco IOS software release.

Shutting Down and Restarting an Interface on an Ethernet Line Card

You can shut down and restart any of the interface ports on a Cisco ASR 1000 Series Fixed Ethernet Line Card independent of each other. Shutting down an interface stops traffic and moves the interface into an administratively down state.

There are no restrictions for online insertion and removal (OIR) on the Cisco ASR 1000 Series Fixed Ethernet Line Cards.

If you are preparing for an OIR of an Ethernet line card, it is not necessary to independently shut down each of the interfaces prior to the deactivation of the Ethernet Line Card. The **hw-module slot <1> stop** command automatically stops traffic on the interfaces and deactivates them along with the Ethernet Line Card in preparation for OIR.

To shut down an interface on an Ethernet Line Card, use the following command in the interface configuration mode:

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

To restart an interface on an Ethernet Line Card, use the following command in interface configuration mode:

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

Modifying the Minimum Frame Size on a Gigabit Ethernet Interface

You can modify the minimum frame size of data that is transmitted on a Gigabit Ethernet interface from 64 bytes to 68 bytes, including the VLAN tag encapsulation.

Restrictions

The following are the restrictions for modifying the minimum frame size on a Gigabit Ethernet interface:

- This modification is specific to the interface level, and configuration changes are applied to all packet sizes that are less than 64 bytes.

- This type of modification is supported only on the ASR1000-2T+20X1GE and ASR1000-6TGE Cisco ASR 1000 Series Fixed Ethernet Line Cards.

Modifying the Minimum Frame Size to 68 Bytes

To configure the minimum frame size to 68 bytes, use the following command in privileged EXEC configuration mode:

Command	Purpose
plim min-frame-length *<68byte>* Router(config-if)# **plim min-frame-length 68byte**	Configures the minimum frame size to 68 bytes.

To disable the minimum frame size configuration, use the following command in privileged EXEC configuration mode:

Command	Purpose
no plim min-frame-length *<68byte>* `Router(config-if)#` **no plim min-frame-length 68byte**	Disables the 68-byte minimum frame size configuration.

Examples

The following example shows how to modify the minimum frame size from 64 bytes to 68 bytes:

```
Router(config-if)# plim min-frame-length ?
64 byte - Default:64 byte
Router(config-if)# plim min-frame-length 68byte
Router(config-if)# plim min-frame-length ?
68 byte - Default:64 byte
Router(config-if)# no plim min-frame-length 68byte
Router(config-if)# plim min-frame-length ?
64 byte - Default:64 byte
```

Verifying an Interface Configuration

Besides using the **show running-configuration** command to display your Cisco ASR 1000 Series Aggregation Services Router configuration settings, you can use the **show interfaces gigabitethernet | tengigabitethernet** command to get detailed information on a per-port basis for your Cisco ASR 1000 Series Fixed Ethernet Line Cards.

Verifying Per-Port Interface Status

To find detailed interface information on a per-port basis for the Cisco ASR 1000 Series Fixed Ethernet Line Cards, use the **show interfaces gigabitethernet** command.

The following example provides a sample output for interface port 1 on the Ethernet Line Card that is installed in slot 2 of a Cisco ASR 1000 Series Aggregation Services Router:

```
Router# show interfaces gigabitethernet 2/0/1
GigabitEthernet2/0/1 is up, line protocol is up
Hardware is BUILT-IN-2T+20X1GE, address is 70ca.9b6a.1b50 (bia 70ca.9b6a.1b50)
Internet address is 1.2.1.1/24
MTU 9216 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 1000Mbps, link type is auto, media type is SX
output flow-control is off, input flow-control is off
ARP type: ARPA, ARP Timeout 04:00:00
Last input 02:20:41, output 00:03:36, output hang never
Last clearing of "show interfaces" counters never
Input queue: 0/375/0/0 (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
595 packets input, 45373 bytes, 0 no buffer
Received 3 broadcasts (0 IP multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 569 multicast, 0 pause input
593 packets output, 47591 bytes, 0 underruns
0 output errors, 0 collisions, 2 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 pause output
0 output buffer failures, 0 output buffers swapped out
```

Using show Commands to Check SFP Module and XFP Module Status

You can use various **show** commands to view information specific to Small Form-Factor Pluggable (SFP), 10-G Small Form Factor (XFP), Coarse Wavelength Division Multiplex (CWDM), and Dense Wavelength Division Multiplex (DWDM) optical transceiver modules.

To check or verify the status of an SFP module or XFP module, use the following **show** commands:

- show hw-module *slot/subslot* transceiver *port* **idprom detail**

- show hw-module *slot/subslot* transceiver *port* **idprom brief**

- show hw-module *slot/subslot* transceiver *port* **idprom dump**

- show hw-module *slot/subslot* transceiver *port* **idprom status**

The following is a list of sample output of several **show** commands for SFP modules and XFP modules.

The following show hw-module subslot command sample output is for SFP-GE-S:

```
Router# show hw-module subslot 2/0 transceiver 0 idprom
IDPROM for transceiver GigabitEthernet2/0/0:Description = SFP optics (type 3)Transceiver
Type: = GE SX (19)Product Indentifier (PID) = FTRJ8519P1BNL-C6Vendor Revision = ASerial
Number (SN) = FNS1037R8DHVendor Name = CISCO-FINISARVendor OUI (IEEE company ID) = 00.90.65
 (36965)CLEI code = IPUIALJRAACisco part number = 10-2143-01Device State = Enabled.Date
code (yy/mm/dd) = 06/09/14Connector type = LC.Encoding = 8B10BNRZNominal bitrate = GE (1300
 Mbits/s)Minimum bit rate as % of nominal bit rate = not specifiedMaximum bit rate as % of
 nominal bit rate = not specified
```
The following show hw-module subslot command sample output is for CWDM 1490:

```
Router# show hw-module subslot 2/0 transceiver 2 idpromIDPROM for transceiver
GigabitEthernet2/0/2:Description = SFP optics (type 3)Transceiver Type: = GE CWDM 1490
(28)Product Indentifier (PID) = FWDM-16217D49CSCVendor Revision = CSerial Number (SN) =
FNS10500HA9Vendor Name = CISCO-FINISARVendor OUI (IEEE company ID) = 00.90.65 (36965)CLEI
code = CNTRVX0FAACisco part number = 10-1884-01Device State = Enabled.Date code (yy/mm/dd)
 = 06/12/12Connector type = LC.Encoding = 8B10BNRZNominal bitrate = (2700 Mbits/s)Minimum
bit rate as % of nominal bit rate = not specifiedMaximum bit rate as % of nominal bit rate
 = not specified
```

The following show hw-module subslot command sample output is for an XFP module:

```
Router# show
 hw-module subslot 4/0 transceiver 21 id briefIDPROM for transceiver TenGigabitEthernet4/0/21:

  Description                           = XFP optics (type 6)
  Transceiver Type:                     = OC192 + 10GBASE-L (173)
  Product Identifier (PID)              = XFP-10GLR-OC192SR
  Vendor Revision                       = 02
```

```
        Serial Number (SN)                      = ONT1233101Y
        Vendor Name                             = CISCO-OPNEXT
        Vendor OUI (IEEE company ID)            = 00.0B.40 (2880)
        CLEI code                               = WMOTBEVAAB
        Cisco part number                       = 10-1989-02
        Device State                            = Disabled.
        Date code (yy/mm/dd)                    = 08/08/13
        Connector type                          = LC.
        Encoding                                = 64B/66B
                                                  SONET Scrambled
                                                  NRZ
        Minimum bit rate                        = 9900 Mbits/s
        Maximum bit rate                        = 11100 Mbits/s
Router#
```

The following show hw-module subslot command sample output is for SFP-GE-SX:

```
Router# show hw-module subslot 4/0 transceiver 21 id dumpIDPROM for transceiver
TenGigabitEthernet4/0/21:
        Description                             = XFP optics (type 6)
        Transceiver Type:                       = OC192 + 10GBASE-L (173)
        Product Identifier (PID)                = XFP-10GLR-OC192SR
        Vendor Revision                         = 02
        Serial Number (SN)                      = ONT1233101Y
        Vendor Name                             = CISCO-OPNEXT
        Vendor OUI (IEEE company ID)            = 00.0B.40 (2880)
        CLEI code                               = WMOTBEVAAB
        Cisco part number                       = 10-1989-02
        Device State                            = Disabled.
        XFP IDPROM Page 0x0:
              000:       06 00 5A 00 F6 00 55 00 FB 00
              010:       00 00 00 00 00 00 00 00 FD E8
              020:       13 88 EA 60 17 70 3D E8 04 EA
              030:       27 10 07 CB 31 2D 00 B5 2B D4
              040:       01 20 89 EE 77 E2 87 5A 7A 75
              050:       00 00 00 00 00 00 00 00 00 00
              060:       00 00 00 00 00 00 00 00 00 00
              070:       00 00 00 00 00 00 00 00 00 00
              080:       05 00 05 00 C3 00 00 00 00 00
              090:       00 00 00 00 00 00 22 00 00 00
              100:       00 62 00 00 07 E1 7F 22 00 00
              110:       E8 C0 00 00 00 00 00 00 00 00
              120:       00 00 00 00 00 00 00 01
        XFP IDPROM Page 0x1:
              128:       06 58 07 40 40 00 00 40 00 00
              138:       00 B0 63 6F 0A 00 00 00 00 40
              148:       43 49 53 43 4F 2D 4F 50 4E 45
              158:       58 54 20 20 20 20 E0 00 0B 40
              168:       54 52 46 35 30 31 32 41 4E 2D
              178:       4C 41 30 30 30 20 30 32 66 58
              188:       0F A0 46 DA 7D 96 06 00 4F 4E
              198:       54 31 32 33 33 31 30 31 59 20
              208:       20 20 20 20 30 38 30 38 31 33
              218:       20 20 08 40 70 8A 00 00 11 B2
              228:       F3 42 3A A7 5A 7A 09 60 23 94
              238:       B5 22 68 BD 42 00 00 00 00 00
              248:       00 00 00 00 CC 4E 65 D5
        XFP IDPROM Page 0x2:
              128:       57 4D 4F 54 42 45 56 41 41 42
              138:       31 30 2D 31 39 38 39 2D 30 32
              148:       56 30 32 20 01 00 00 00 00 00
              158:       00 00 00 B9 00 00 00 00 00 00
              168:       00 00 58 AF 60 61 70 8F 92 D5
              178:       00 00 1F 00 69 8A 14 84 00 D8
              188:       00 00 AA AA 58 46 50 2D 31 30
              198:       47 4C 52 2D 4F 43 31 39 32 53
              208:       52 20 20 20 00 00 00 00 00 00
              218:       00 00 00 00 00 C1 32 35 35 34
              228:       36 36 35 30 00
Router#
```

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

The Cisco ASR 1000 Series Fixed Ethernet Line Card supports time, phase, and frequency awareness through Ethernet networks. The Cisco ASR 1000 Series Fixed Ethernet Line Card enables clock selection and translation between the various clock frequencies. If the Cisco ASR 1000 Series Fixed Ethernet Line Card interoperates with devices that do not support synchronization, synchronization features can be disabled or partially enabled to maintain backward compatibility.

Note   For additional details to understand how SyncE feature is implemented on Cisco ASR 1000 Series Aggregation Services Routers using four different configuration, see the chapter "Synchronous Ethernet Support On Cisco ASR 1000 Series Aggregation Services Routers" in the Cisco ASR 1000 Series Aggregation Services Routers Software Configuration Guide .

The Synchronous Ethernet can be configured in global configuration mode and interface configuration mode:

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series
Aggregation Services Router

Configuring Synchronous Ethernet in Global Configuration Mode

Use the following commands to configure Synchronous Ethernet in global configuration mode on a Cisco
ASR 1000 Series Fixed Ethernet Line Card:

Command	Purpose
network-clock synchronization automatic Router(config)# **network-clock synchronization automatic**	Enables G.781-based automatic clock selection process. G.781 is the ITU-T recommendation that specifies the synchronization layer functions. The **no** form of this command disables the G.781-based automatic clock selection process.
network-clock eec {1 | 2} Router(config)# network-clock eec 1	Configures the clocking system hardware with the desired parameters. These are the options: • For option 1, the default value is EEC-Option 1 (2048). • For option 2, the default value is EEC-Option 2 (1544). The **no** form of this command reverses the command configuration.
network-clock synchronization ssm option {1| 2 {GEN1 | GEN2}} Router(config)# network-clock synchronization ssm option 2 GEN1	Configures the router to work in a synchronized network mode, as described in G.781. The following are the options: • Option 1: Refers to synchronization networks designed for Europe (SDH/ E1 framings are compatible with this option). • Option 2: Refers to synchronization networks designed for the U.S. (SONET/T1 framings are compatible with this option). The default option is 1. While choosing option 2, you must specify whether it is second-generation message (GEN2) or first-generation message (GEN1). **Note** Network clock configurations that are not common between options should be configured again. The **no** form of this command reverses the command configuration.
network-clock synchronization mode QL-enabled Router(config)# **network-clock synchronization mode QL-enabled**	

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

Command	Purpose
	Configures the automatic selection process for quality level-enabled mode. **Note** Quality level-enabled mode succeeds only if there are synchronization interfaces that are capable of sending SSM. The **no** form of this command disables the automatic selection process for quality level-enabled mode.
esmc process `Router(config)# ` **esmc process**	Enables the ESMC process at the system level. **Note** This command fails if no SyncE-capable interface is installed on the platform. The **no** form of this command disables the ESMC process at the system level.
network-clock hold-off {0 | <50-10000>} global `Router(config)# network-clock hold-off 75 global`	Configures general hold-off timer in milliseconds (ms). The default value is 300 ms. **Note** Displays a warning message for values below 300 ms and above 1800 ms.
network-clock wait-to-restore <0-86400> global `Router(config)# network-clock ` **wait-to-restore** ` 1000 global`	Sets the value for the wait-to-restore timer globally. The wait-to-restore-time is configurable in the range of 0 to 86400 seconds. The default value is 300 seconds. **Caution** Ensure that you set the wait-to-restore values above 50 seconds to avoid a timing flap.
network-clock input-source <priority> {interface interface_name slot/card/port} `Router(config)# network-clock input-source 23 interface gigabitethernet 2/0/0`	Priority is a number between 1 and 250. **Note** The no version of this command reverses the command configuration, implying that the priority has changed to undefined, and the state machine is informed.
network-clock revertive `Router(config)# ` **network-clock revertive**	Specifies whether or not the clock source is revertive. Clock sources with the same priority are always nonrevertive. The default value is nonrevertive. In nonrevertive switching, a switch to an alternate reference is maintained even after the original reference recovers from the failure that caused the switch. In revertive switching, the clock switches back to the original reference after that reference recovers from the failure, independent of the condition of the alternate reference. The no form of this command changes the clock to nonrevertive mode.

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

Command	Purpose
network-clock synchronization participate slot number `Router(config)#` **network-clock synchronization participate** `2`	Enables or disables a slot from participating in network-clock algorithm. By default, all the slots are participating slots. **Note** A slot cannot be disabled from participation if it's primary source or secondary source is valid. The **no** form of this command disables the slot from participating in network-clock algorithm.

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

Configuring Synchronous Ethernet in Interface Configuration Mode

Use the following commands in interface configuration mode to configure Synchronous Ethernet and timers on a Cisco ASR 1000 Series Aggregation Services Router.

Command	Purpose
synchronous mode `Router(config-if)#` **synchronous mode**	Configures the Ethernet interface to synchronous mode, and this automatically enables the ESMC and quality-level processes on the interface. **Note** This command is applicable to Synchronous Ethernet-capable interfaces. The default value is asynchronous mode.
esmc mode [tx | rx] `Router(config-if)#` **esmc mode tx**	Enables or disables the ESMC process on the interface. **Note** If the interface is configured as line source but does not receive the ESMC message from the peer node on the interface, the interface is removed from the selectable clock source list. By default, this is enabled for the synchronous mode and disabled for the asynchronous mode. **Note** This command is not supported on nonsynchronous Ethernet interfaces.
network-clock source quality-level value {tx | rx} `Router(config-if)#` **network-clock source quality-level** `QL-PRC tx`	The command forces the quality-level value to the local clock selection process and is considered by the clock selection process as a value from network. The value is based on the global interworking option. • If Option 1 is configured, the available values are QL-PRC, QL-SSU-A, QL-SSU-B, QL-SEC, and QL-DNU. • If Option 2 is configured with GEN 2, the available values are QL-PRS, QL-STU, QL-ST2, QL-TNC, QL-ST3, QL-SMC, QL-ST4, and QL-DUS. • If option 2 is configured with GEN1, the available values are QL-PRS, QL-STU, QL-ST2, QL-SMC, QL-ST4, and QL-DUS **Note** This command is applicable to synchronous Ethernet-capable interfaces.

`network-clock hold-off 0 | 50-10000`
 	
`Router(config-if)#` **network-clock hold-off** `1000`
	Configures the hold-off timer for the interface. The default value is 300 ms.
	
	Note Displays a warning for values below 300 ms and above 1800 ms.

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

Command	Purpose
network-clock wait-to-restore 0-86400 `Router(config-if)#` **network-clock wait-to-restore** `1000`	Configures the wait-to-restore timer on the SyncE interface. **Caution** Ensure that you set the wait-to-restore values above 50 seconds to avoid timing flap.
esmc mode ql-disabled `Router(config-if)#` **esmc mode ql-disabled**	Disables the quality-level mode. The default mode for synchronous Ethernet is quality level-enabled. **Note** This command is not supported on nonsynchronous Ethernet interfaces. The **no** form of this command enables the quality-level mode.

Managing Synchronization

You can manage synchronization using the following management commands:

Command	Purpose

`network-clock set lockout {interface`
`interface_name slot/card/port}`
 	
`Router(config)# network-clock set lockout`
`interface GigabitEthernet 0/0/0`
 	
`Router(config)# network-clock clear lockout`
`interface GigabitEthernet 0/0/0`
	Locks out a clock source. A clock source flagged as lockout is not selected for SyncE.
	
	To clear the lockout on a source, use the network-clock clear lockout {interface interface_name slot/card/port} command.
	
	Note Lockout takes precedence over force switch, and force switch overrides the manual switch.

`network-clock switch force {interface`
`interface_name slot/card/port |` **T0**`}`
 	
`Router(config)# network-clock switch force`
`interface` **GigabitEthernet** `0/0/0`
	Forcefully selects a synchronization source irrespective of whether the source is available and is within the range.

`network-clock switch manual {interface`
`interface_name slot/card/port |` **T0**`}`
 	
`Router(config)# network-clock switch manual`
`interface GigabitEthernet 0/0/0`
	Manually selects a synchronization source, provided the source is available and is within the range.

`network-clock clear switch {T0}`
 	
`Router(config)# network-clock clear switch`
`T0`
	Clears the forced switch and manual switch commands.

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

Examples

The following example shows how to configure quality level-enabled mode clock selection:

```
network-clock synchronization automatic
network-clock synchronization mode QL-enabled
network-clock input-source 1 interface GigabitEthernet2/0/0
!
interface GigabitEthernet2/0/0
 no ip address
 clock source line
 synchronous mode
end
!
```

Verifying a Synchronous Ethernet Configuration

Use the show network-clocks synchronization command to display the sample output, as shown here:

```
Router#show network-clocks synchronization
Router# show network-clocks synchronization
Symbols:    En - Enable, Dis - Disable, Adis - Admin Disable
            NA - Not Applicable
            *  - Synchronization source selected
            #  - Synchronization source force selected
            &  - Synchronization source manually switched
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Enable
ESMC : Enabled
SSM Option : 1
T0 : GigabitEthernet1/0/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 30 sec
Tsm Delay : 180 ms
Revertive : No
Nominated Interfaces
 Interface        SigType      Mode/QL     Prio  QL_IN  ESMC Tx   ESMC Rx
 Internal         NA           NA/Dis      251   QL-SEC  NA        NA
*Gi1/0/0          NA           Sync/En     1     QL-PRC  -         -
```

Use the show network-clocks synchronization detail command to display all the details of the Synchronous Ethernet synchronization parameters at the global and interface levels, as shown here:

```
Router# show network-clocks synchronization detail
Symbols:    En - Enable, Dis - Disable, Adis - Admin Disable
            NA - Not Applicable
            *  - Synchronization source selected
            #  - Synchronization source force selected
            &  - Synchronization source manually switched
Automatic selection process : Enable
Equipment Clock : 2048 (EEC-Option1)
Clock Mode : QL-Enable
ESMC : Enabled
SSM Option : 1
T0 : GigabitEthernet1/0/0
Hold-off (global) : 300 ms
Wait-to-restore (global) : 30 sec
Tsm Delay : 180 ms
Revertive : No
Force Switch: FALSE
Manual Switch: FALSE
Number of synchronization sources: 2
sm(netsync NETCLK_QL_ENABLE), running yes, state 1A
Last transition recorded: (ql_mode_enable)-> 1A (begin)-> 1A (sf_change)-> 1A (sf_change)->
 1A (ql_change)-> 1A (ql_change)-> 1A (ql_change)-> 1A (ql_change)-> 1A
```

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

```
Nominated Interfaces
 Interface          SigType     Mode/QL     Prio  QL_IN  ESMC Tx  ESMC Rx
 Internal           NA          NA/Dis      251   QL-SEC    NA       NA
*Gi1/0/0            NA          Sync/En     1     QL-PRC    -        -
 External 1/3/0     E1 CRC4     NA/En       2     QL-FAILED NA       NA
Interface:
---------------------------------------------
Local Interface: Internal
Signal Type: NA
Mode: NA(Ql-enabled)
SSM Tx: DISABLED
SSM Rx: DISABLED
Priority: 251
QL Receive: QL-SEC
QL Receive Configured: -
QL Receive Overrided: -
QL Transmit: -
QL Transmit Configured: -
Hold-off: 0
Wait-to-restore: 30
Lock Out: FALSE
Signal Fail: FALSE
Alarms: FALSE
Slot Disabled: FALSE
Local Interface: Gi1/0/0
Signal Type: NA
Mode: Synchronous(Ql-enabled)
ESMC Tx: ENABLED
ESMC Rx: ENABLED
Priority: 1
QL Receive: QL-PRC
QL Receive Configured: -
QL Receive Overrided: -
QL Transmit: QL-DNU
QL Transmit Configured: -
Hold-off: 300
Wait-to-restore: 30
Lock Out: FALSE
Signal Fail: FALSE
Alarms: FALSE
Slot Disabled: FALSE
```

Use the show interfaces accounting command to display packet accounting statistics, as shown here:

```
Router# show interfaces GigabitEthernet 2/0/0 accounting
GigabitEthernet2/0/0
            Protocol    Pkts In    Chars In   Pkts Out  Chars Out
            DEC MOP          14        1134         14       1806
               ARP           0           0          2        224
               CDP         145       55970        145      63049
              ESMC        3246      194760       7099     823484
```

Use the show esmc command to display the sample output, as shown here:

```
Router#show esmc
SYNCE-2RU#show esmc
Interface: GigabitEthernet2/0/0
  Administative configurations:
    Mode: Synchronous
    ESMC TX: Enable
    ESMC RX: Enable
    QL TX: -
    QL RX: -
  Operational status:
    Port status: UP
    QL Receive: QL-DNU
    QL Transmit: QL-SEC
    QL rx overrided: QL-DNU
    ESMC Information rate: 1 packet/second
    ESMC Expiry: 5 second
Interface: GigabitEthernet2/0/0
  Administative configurations:
```

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

```
      Mode: Synchronous
      ESMC TX: Enable
      ESMC RX: Enable
      QL TX: -
      QL RX: -
    Operational status:
      Port status: UP
      QL Receive: QL-DNU
      QL Transmit: QL-SEC
      QL rx overrided: QL-DNU
      ESMC Information rate: 1 packet/second
      ESMC Expiry: 5 second
Interface: GigabitEthernet3/0/0
  Administative configurations:
      Mode: Synchronous
      ESMC TX: Enable
      ESMC RX: Enable
      QL TX: -
      QL RX: -
    Operational status:
      Port status: UP
      QL Receive: QL-DNU
      QL Transmit: QL-SEC
      QL rx overrided: QL-DNU
      ESMC Information rate: 1 packet/second
      ESMC Expiry: 5 second
Interface: GigabitEthernet3/0/1
  Administative configurations:
      Mode: Synchronous
      ESMC TX: Enable
      ESMC RX: Enable
      QL TX: -
      QL RX: -
    Operational status:
      Port status: DOWN
      QL Receive: QL-DNU
      QL Transmit: -
      QL rx overrided: QL-DNU
      ESMC Information rate: 1 packet/second
      ESMC Expiry: 5 second
```

Use the show esmc detail command to display all the details of the ESMC parameters at the global and interface levels, as shown here:

```
Router#show esmc detail
Interface: GigabitEthernet2/0/0
  Administrative configurations:
      Mode: Synchronous
      ESMC TX: Enable
      ESMC RX: Enable
      QL TX: -
      QL RX: -
    Operational status:
      Port status: UP
      QL Receive: QL-DNU
      QL Transmit: QL-SEC
      QL rx overrided: QL-DNU
      ESMC Information rate: 1 packet/second
      ESMC Expiry: 5 second
      ESMC Tx Timer: Running
      ESMC Rx Timer: Running
      ESMC Tx interval count: 1
      ESMC INFO pkts in: 0
      ESMC INFO pkts out: 629451
      ESMC EVENT pkts in: 0
      ESMC EVENT pkts out: 0
Interface: GigabitEthernet2/0/1
  Administrative configurations:
      Mode: Synchronous
      ESMC TX: Enable
      ESMC RX: Enable
      QL TX: -
```

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

```
              QL RX: -
          Operational status:
            Port status: UP
            QL Receive: QL-DNU
            QL Transmit: QL-SEC
            QL rx overrided: QL-DNU
            ESMC Information rate: 1 packet/second
            ESMC Expiry: 5 second
            ESMC Tx Timer: Running
            ESMC Rx Timer: Running
            ESMC Tx interval count: 1
            ESMC INFO pkts in: 0
            ESMC INFO pkts out: 629451
            ESMC EVENT pkts in: 0
            ESMC EVENT pkts out: 0
        Interface: GigabitEthernet3/0/0
          Administrative configurations:
            Mode: Synchronous
            ESMC TX: Enable
            ESMC RX: Enable
            QL TX: -
            QL RX: -
          Operational status:
            Port status: UP
            QL Receive: QL-DNU
            QL Transmit: QL-SEC
            QL rx overrided: QL-DNU
            ESMC Information rate: 1 packet/second
            ESMC Expiry: 5 second
            ESMC Tx Timer: Running
            ESMC Rx Timer: Running
            ESMC Tx interval count: 1
            ESMC INFO pkts in: 0
            ESMC INFO pkts out: 624901
            ESMC EVENT pkts in: 0
            ESMC EVENT pkts out: 0
        Interface: GigabitEthernet3/0/1
          Administrative configurations:
            Mode: Synchronous
            ESMC TX: Enable
            ESMC RX: Enable
            QL TX: -
            QL RX: -
          Operational status:
            Port status: DOWN
            QL Receive: QL-DNU
            QL Transmit: -
            QL rx overrided: QL-DNU
            ESMC Information rate: 1 packet/second
            ESMC Expiry: 5 second
            ESMC Tx Timer: Running
            ESMC Rx Timer: Running
            ESMC Tx interval count: 0
            ESMC INFO pkts in: 0
            ESMC INFO pkts out: 0
            ESMC EVENT pkts in: 0
            ESMC EVENT pkts out: 0
```

Troubleshooting Synchronous Ethernet Configuration

The following debug commands are available for troubleshooting the Synchronous Ethernet configuration on a Cisco ASR 1000 Series Aggregation Services Router:

Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card

Configuring Synchronous Ethernet for a Cisco ASR 1000 Series Fixed Ethernet Line Card on a Cisco ASR 1000 Series Aggregation Services Router

Table 10: debug Commands for Troubleshooting

debug Command	Purpose

`debug platform network-clock`
 	
`Router# debug platform network-clock`
	Debugs issues related to the Synchronous Ethernet, such as alarms, Clock Out-of-Range (OOR), active-standby sources not selected correctly, and so on.

`debug esmc error`
 	
`debug esmc event`
 	
`debug esmc packet [interface <interface name>]`
 	
`debug esmc packet rx [interface <interface name>]`
 	
`debug esmc packet tx [interface <interface name>]`
 	
`Router# debug esmc event`
	Verifies whether the ESMC packets are transmitted and received with the correct quality-level values.

Troubleshooting Scenarios

Note   Before you troubleshoot, ensure that all the Synchronous Ethernet synchronization configurations are complete.

Table 11: Troubleshooting Scenarios Encountered While Configuring the Synchronous Ethernet, on page 59 provides the troubleshooting scenarios encountered while configuring the Synchronous Ethernet:

Table 11: Troubleshooting Scenarios Encountered While Configuring the Synchronous Ethernet

Problem	Solution
Clock is not getting selected	The following solutions may help you to troubleshoot this issue: • Verify that there are no alarms on the interfaces. Use the show network-clock synchronization detail command to check this. • Ensure that the nonrevertive configurations are in place. • Reproduce the issue and collate the logs using the debug network-clock errors, debug network-clock event, and debug network-clock sm commands. Contact the Cisco technical support if the issue persists.

Problem	Solution
Incorrect quality-level values	The following solutions may help you to troubleshoot this issue: • Ensure that there is no framing mismatch with the SSM option. • Verify the output of the show esmc detail and the show network -clock synchronization detail commands. • Reproduce the issue using the debug network-clock errors, debug network-clock event, and debug platform ssm commands. Also enable the debug hw-module subslot command.
Alarms are not getting triggered	• Reproduce the issue using the debug platform network-clock command enabled in the route processor. Alternatively, enable the debug network-clock event and debug network-clock errors commands.

Configuration Examples

This section includes the following configuration examples:

Basic Interface Configuration

The following example shows how to enter the 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 shows

how to configure interface port 1 on the Ethernet Line Card that is located in subslot 0 of the Ethernet Line Card that is installed in slot 0 of a Cisco ASR 1000 Series Aggregation Services 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 gigabitethernet 0/0/1
!
! 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
```

MAC Address Configuration

The following example shows how to change 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 gigabitethernet 0/0/1

!

! Modify the MAC address.

!

Router(config-if)# mac-address 1111.2222.3333
```

MAC Address Accounting Configuration

The following example shows how to enable MAC Address Accounting:

```
! Enter global configuration mode.

!

Router# configure terminal

! Enter configuration commands, one per line. End with CNTL/Z.

!

! Enable MAC address accounting

Router(config)# ip accounting mac-address {input | output}

Router(config-if)# ip accounting ?

access-violations Account for IP packets violating access lists on this interface

mac-address Account for MAC addresses seen on this interface

output-packets Account for IP packets output on this interface

precedence Count packets by IP precedence on this interface

<cr>
```

```
Router(config-if)# ip accounting mac-address ?

input Source MAC address on received packets

output Destination MAC address on transmitted packets

Router(config-if)# ip accounting mac-address input ?

<cr>

! Specify MAC address accounting for traffic entering the interface.

!

Router(config-if)# ip accounting mac-address input

! Specify MAC address accounting for traffic leaving the interface.

!

Router(config-if)# ip accounting mac-address output

Router(config-if)# end

! Verify the MAC Address on the interface.

!

Router# show interfaces GigabitEthernet 4/0/2 mac-accounting

GigabitEthernet4/0/2

Input (511 free)

000f.f7b0.5200(26): 124174 packets, 7450440 bytes, last: 1884ms ago

Total: 124174 packets, 7450440 bytes

Output (511 free)

000f.f7b0.5200(26): 135157 packets, 8109420 bytes, last: 1884ms ago

Total: 135157 packets, 8109420 bytes
```

MTU Configuration

The following example shows how to set the MTU interface to 9216 bytes:

```
! Enter global configuration mode.

!

Router# configure terminal

! Enter configuration commands, one per line. End with CNTL/Z.

!
```

```
! Specify the interface address

!

Router(config)# interface gigabitethernet 0/0/1

!

! Configure the interface MTU.

!

Router(config-if)# mtu 9216
```

VLAN Configuration

The following example shows how to create the subinterface number 268 on Ethernet Line Card interface port 2 (the third port), and configure the subinterface on the VLAN with the ID number 268, using IEEE 802.1Q 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 gigabitethernet 2/0/1.268

!

! Configure dot1q encapsulation and specify the VLAN ID.

!

Router(config-subif)# encapsulation dot1q 268
```

Troubleshooting the Cisco ASR 1000 Series Fixed Ethernet Line Card

This chapter describes techniques that you can use to troubleshoot the operation of your Cisco ASR 1000 Series Fixed Ethernet Line Cards, and includes the following sections:

The first section provides information about basic interface troubleshooting. If you are having a problem with your Ethernet Line Card, use the steps provided in the Performing Basic Interface Troubleshooting, on page 66 to begin your investigation of a possible interface configuration problem.

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

- General Troubleshooting Information, page 65
- Performing Basic Interface Troubleshooting, page 66

General Troubleshooting Information

This section describes general information for troubleshooting the Cisco ASR 1000 Series Fixed Ethernet Line Card, and includes the following subsections:

Using debug Commands

⚠️

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.

Along with the other **debug** commands supported on the Cisco ASR 1000 Series Aggregation Services Routers, you can obtain specific debug information for the Ethernet Line Cards on the using the **debug hw-module subslot** privileged EXEC command.

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

For information about other **debug** commands supported on the Cisco ASR 1000 Series Aggregation Services Routers, refer to the Cisco IOS Debug Command Reference and any related feature documents for the applicable Cisco IOS release.

Using show Commands

There are several **show** commands that you can use to monitor and troubleshoot the Cisco ASR 1000 Series Fixed Ethernet Line Card on the Cisco ASR 1000 Series Routers. This chapter describes using the **show interfaces** command to perform troubleshooting of your Ethernet Line Card.

For more information about **show** commands to verify and monitor Ethernet Line Cards, see Chapter 3, "Configuring the Cisco ASR 1000 Series Fixed Ethernet Line Card", and the Cisco IOS technology area command reference books.

Performing Basic Interface Troubleshooting

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

The following example shows an output of both the **show interfaces gigabitethernet** and **show interfaces tengigabitethernet** commands:

```
Router# show interfaces GigabitEthernet 3/0/0
GigabitEthernet3/0/0 is up, line protocol is up
Hardware is BUILT-IN-2T+20X1GE, address is badb.adbb.79c0 (bia badb.adbb.79c0)
MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 1000Mbps, link type is auto, media type is SX
output flow-control is off, input flow-control is off
ARP type: ARPA, ARP Timeout 04:00:00
Last input 2d14h, output 2d06h, output hang never
Last clearing of "show interfaces" counters 2d06h
Input queue: 0/375/0/0 (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
70388928 packets input, 24628646826 bytes, 0 no buffer
Received 0 broadcasts (0 IP multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 0 multicast, 0 pause input
70399206 packets output, 24905239826 bytes, 0 underruns
0 output errors, 0 collisions, 3 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 pause output
0 output buffer failures, 0 output buffers swapped out
Router# show interfaces TenGigabitEthernet 3/0/20
TenGigabitEthernet3/0/20 is up, line protocol is up
Hardware is BUILT-IN-2T+20X1GE, address is badb.adbb.79d4 (bia badb.adbb.79d4)
MTU 1500 bytes, BW 10000000 Kbit/sec, DLY 10 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive not supported
Full Duplex, 10000Mbps, link type is force-up, media type is 10GBase-LR
output flow-control is unsupported, input flow-control is unsupported
ARP type: ARPA, ARP Timeout 04:00:00
```

```
Last input 2d14h, output 2d06h, output hang never
Last clearing of "show interfaces" counters 2d06h
Input queue: 0/375/0/0 (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
702060742 packets input, 245584812270 bytes, 0 no buffer
Received 0 broadcasts (0 IP multicasts)
0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
0 watchdog, 0 multicast, 0 pause input
702060725 packets output, 248397436760 bytes, 0 underruns
0 output errors, 0 collisions, 3 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 pause output
0 output buffer failures, 0 output buffers swapped out
```

To verify that your interface is operating properly, complete the steps described in Table 3-1 :

Action	Example
From the global configuration mode, enter the **show interfaces gigabitethernet or the show interfaces tengigabitethernet** command.	Router# **show interfaces gigabitethernet 2/0/1** Router# **show interfaces tengigabitethernet 5/0/20**
Verify that the interface is up.	Router# **show interfaces gigabitethernet 2/0/1** **GigabitEthernet2/0/1 is up** , line protocol is up Router# **show interfaces tengigabitethernet 2/0/21** **TenGigabitEthernet2/0/21 is up,** line protocol is up (connected)
Verify that the line protocol is up.	Router# **show interfaces gigabitethernet 2/0/1** GigabitEthernet2/0/1 is up, **line protocol is up** Router# **show interfaces tengigabitethernet 2/0/21** TenGigabitEthernet2/0/21 is up, **line protocol is up (connected)**
Observe the Cyclic Redundancy Check (CRC) counter.	0 input errors, 0 CRC, 0 frame, 130043940 overrun, 0 ignored
Observe the carrier signal counters.	**0 lost carrier, 0 no carrier** , 0 pause output 0 output buffer failures, 0 output buffers swapped out

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

Verifying that the Interface is Up

In the output of the **show interfaces gigabitethernet or the show interfaces tengigabitethernet** 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 to confirm the failure. See the other troubleshooting sections in this chapter, and refer to the Cisco ASR 1000 Series Aggregation Services Router Hardware Installation Guide . If the hardware has failed, replace the Ethernet Line Card as necessary.

- Check the autonegotiation status.

Verifying if the Line Protocol is Up

In the output of the **show interfaces gigabitethernet or the show interfaces tengigabitethernet** command, verify that the line protocol is up. If the line protocol is down, then it means that 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 interfaces for misconfiguration.

- Verify that a hardware failure has not occurred. Observe the LEDs to confirm the failure. See the other troubleshooting sections in this chapter. If the hardware has failed, replace the Ethernet Line Card as necessary.

Verifying the CRC Counter

In the output of the **show interfaces gigabitethernet and the show interfaces tengigabitethernet** commands, 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 Ethernet Line Card interface.

Verifying the Carrier Signal

In the output of the **show interfaces gigabitethernet and the show interfaces tengigabitethernet** 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 the 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.

C H A P T E R 5

Upgrading Field-Programmable Devices

In general terms, field-programmable devices (FPDs) are hardware devices implemented on router cards that support separate upgrades. The term FPD has been introduced to collectively and generically describe any type of programmable hardware device on Ethernet Line Cards. FPDs were introduced on the Cisco ASR 1000 Series Aggregation Services Routers to support the Ethernet Line Cards.

This chapter describes the information that you need to verify the image versions and to perform Ethernet Line Card FPD upgrades.

This chapter includes the following sections:

Release History

Table 5-1 provides the release history for all FPD-related features on the Cisco ASR 1000 Series Aggregation Services Routers.

Table 12: FPD Release History

Release	Modification
Cisco IOS XE Release 3.10S	Initial release of the Ethernet Line Card FPD image for the ASR1000-2T+20X1GE Line Card.
Cisco IOS XE Release 3.11S	—
Cisco IOS XE Release 3.12S	Initial release of Ethernet Line Card FPD image for the ASR1000-6TGE Line Card.

FPD Upgrade

This section provides information to help you upgrade FPDs for Ethernet Line Cards.

✎

Note The instructions provided in this section are not always feasible for all the operating network environments.

This section contains the following topics:

Overview of FPD Images and Packages

The Cisco IOS image comes bundled with the FPD image in the Cisco ASR 1000 Series Aggregation Services Routers. In an Ethernet Line Card FPD incompatibility disables all the interfaces on that Ethernet Line Card until the incompatibility is addressed.

Upgrading Your Cisco IOS Release and FPD Image

To upgrade your Cisco IOS release and FPD image, perform the following steps:

SUMMARY STEPS

1. Download the Ethernet Line Card package for the Cisco IOS release that you are upgrading to. The package contains both the Cisco IOS image and the FPD image.
2. Boot the new version of Cisco IOS.
3. When the new version of Cisco IOS boots, search for the bundled FPD image. The FPD images will be updated automatically as part of the Cisco IOS boot process.
4. After the router has booted, verify that the upgrade was successful by entering the show hw-module all fpd command.

DETAILED STEPS

Step 1 Download the Ethernet Line Card package for the Cisco IOS release that you are upgrading to. The package contains both the Cisco IOS image and the FPD image.

Step 2 Boot the new version of Cisco IOS.

Step 3 When the new version of Cisco IOS boots, search for the bundled FPD image. The FPD images will be updated automatically as part of the Cisco IOS boot process.

Step 4 After the router has booted, verify that the upgrade was successful by entering the show hw-module all fpd command.

Upgrading Only Your Cisco IOS Release and Retaining Your Current FPD Image

You can choose to upgrade your Cisco IOS release with or without retaining your current FPD image. Alternatively, you can choose to upgrade your Cisco IOS image and retain your current FPD image, although this is not recommended.

SUMMARY STEPS

1. Use the no upgrade fpd auto command to disable the bundled FPD image. This disables the Auto Upgrade feature.
2. Save the configuration.
3. Load the new image.

DETAILED STEPS

Step 1	Use the no upgrade fpd auto command to disable the bundled FPD image. This disables the Auto Upgrade feature.
Step 2	Save the configuration.
Step 3	Load the new image. **Note** If your current FPD image is not compatible with the new image, the Ethernet Line Cards do not come online.

Upgrading FPD Images in a Production System

Adding an Ethernet Line Card to a production system presents the possibility that the Ethernet Line Card may contain versions of FPD images that are incompatible with the Cisco IOS release currently running on the router. In addition, the FPD upgrade operation can be 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, type of Ethernet Line Card, and the type of service configured.

For these reasons, we recommend that one of the following alternatives be used to perform the FPD upgrade on a production system if possible:

Using a Nonproduction System to Upgrade the Cisco ASR 1000 Series Aggregation Services Routers Ethernet Line Card FPD Image

Before beginning the upgrade, ensure that:

- 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).

Perform the following procedure to carry out an upgrade on the spare system:

SUMMARY STEPS

1. Insert the Ethernet Line Card into the spare system.
2. Verify that the upgrade was successful by entering the **show hw-module all fpd** command.
3. Remove the Ethernet Line Card from the spare system after the upgrade.
4. Insert the Ethernet Line Card into the target production system.

DETAILED STEPS

Step 1 Insert the Ethernet Line Card into the spare system.
If an upgrade is required, the system will perform the necessary FPD image updates so that when this Ethernet Line Card is inserted to the target production system it will not trigger an FPD upgrade operation there.

Step 2 Verify that the upgrade was successful by entering the **show hw-module all fpd** command.

Step 3 Remove the Ethernet Line Card from the spare system after the upgrade.

Step 4 Insert the Ethernet Line Card into the target production system.

Verifying System Compatibility

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 Ethernet Line Card. (The Automatic Upgrade feature is enabled by default. It can be disabled by using the **no upgrade fpd auto** command.)

If the FPD images on the Ethernet Line Card are compatible with the system, you will only need to re-enable the Automatic Upgrade feature using the **upgrade fpd auto** command.

Perform the following procedure to check the FPD images on the Ethernet Line Card for system compatibility:

SUMMARY STEPS

1. Disable the Automatic Upgrade feature using the **no upgrade fpd auto** global configuration command.
2. Insert the Ethernet Line Card into the system.
3. Re-enable the Automatic Upgrade feature using the **upgrade fpd auto** command in the global configuration mode.

DETAILED STEPS

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

Step 2 Insert the Ethernet Line Card into the system.
If the FPD images are compatible, the Ethernet Line Card will operate successfully after bootup.

If the FPD images are not compatible, the Ethernet Line Card is disabled. At this point, we recommend that you wait for a scheduled maintenance during which the system will be offline, to manually perform the FPD upgrade, as described in the .

Step 3   Re-enable the Automatic Upgrade feature using the **upgrade fpd auto** command in the global configuration mode.

Optional FPD Procedures

This section provides information about 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 Ethernet Line Card FPD Images

To manually upgrade the current FPD version on an Ethernet Line Card, use the following command:

```
Router# upgrade hw-module subslot
[slot-number/subslot-number] fpd bundle [reload]
```
In this example, *slot-number* is the slot where the Ethernet Line Card is installed, *subslot-number* is the subslot number where the Ethernet Line Card is located, **fpd** indicates the type of upgrade required, **bundle** selects the bundled FPD package, and **reload** specifies that the Ethernet Line Card is automatically reloaded after the upgrade. Note that **subslot** *slot-number/subslot-number* is used to specify an Ethernet Line Card FPD upgrade.

⚠
Caution   The Ethernet Line Card will automatically be reloaded to complete the FPD upgrade.

⚠
Caution   An image upgrade may take a long time to be completed depending on the Ethernet Line Card.

Upgrading Multiple FPD Images

A single piece of hardware can contain multiple FPD images. The router can upgrade up to three FPD images simultaneously. However, only one FPD upgrade per router slot can occur at a time.

Users should note that some FPD images require the Ethernet Line Card to reload to be completed. Since the FPD upgrade process will perform this step automatically, users do not have to intervene. However, the other FPDs in the hardware of the specified slot will have to wait for this reload to be completed before their upgrade process begins.

With a manual upgrade, you must include the **reload** option to cause the Ethernet Line Card to reload automatically. See the description provided for the **upgrade hw-module subslot command earlier in this section.**

During an automatic upgrade, the router will upgrade as many FPDs as possible at a time. No user intervention is possible or necessary. The upgrade process will not stop until all the FPD images have been updated.

During manual upgrades, it is important to note that users can only specify upgrades for a single piece of hardware each time the **upgrade hw-module subslot** [*slot-number/subslot-number*] command is entered. The

maximum of three simultaneous upgrades applies to manual upgrades as well. If you individually specify multiple manual FPD upgrades, only three FPDs can be upgraded simultaneously and that can only occur when the hardware is in different router slots. The FPD upgrade process will stop when all the FPDs for the specified hardware have been upgraded.

Displaying Current and Minimum Required FPD Image Versions

To display the current version of FPD images on the Ethernet Line Cards installed on your router, use the **show hw-module** *slot-number*/*subslot-number* | **all**] **fpd** command, where *slot-number* is the slot number where the Ethernet Line Card is installed, and *subslot-number* is the number of the Ethernet Line Card subslot where a target Ethernet Line Card is located. Entering the **all** keyword shows information pertaining to the hardware in all the router slots.

The following examples show the output when the **show** command is used.

The following sample shows that FPD versions on the Ethernet Line Cards in the system meet the minimum requirements.

For ASR1000-2T+20X1GE:

```
Router# show hw-module subslot all fpd
==== ====================== ====== ===========================================
                            H/W    Field Programmable    Current    Min. Required
Slot Card Type              Ver.   Device: "ID-Name"     Version    Version
==== ====================== ====== ===========================================
3/0  BUILT-IN-2T+20X1GE     1.0    22-DB FPGA                1.13       1.13
==== ====================== ====== ===========================================
```

For ASR1000-6TGE:

```
Router# show hw-module subslot all fpd
==== ====================== ====== ===========================================
                            H/W    Field Programmable    Current    Min. Required
Slot Card Type              Ver.   Device: "ID-Name"     Version    Version
==== ====================== ====== ===========================================
3/0  BUILT-IN-6TGE     0.3    22-DB FPGA                1.9       1.8
==== ====================== ====== ===========================================
```

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

```
Router# show hw-module subslot 1/0 fpd
==== ====================== ====== ===========================================
                            H/W    Field Programmable    Current    Min. Required
Slot Card Type              Ver.   Device: "ID-Name"     Version    Version
==== ====================== ====== ===========================================
1/0  BUILT-IN-2T+20X1GE     1.0    22-DB FPGA                1.13       1.13
==== ====================== ====== ===========================================
```

The output display in this example shows that the Shared Port Adapter in subslot 0/1 is disabled because one of the programmable devices does not meet the minimum version requirements:

```
Router# show hw-module all fpd
==== ====================== ====== ===========================================
                            H/W    Field Programmable    Current    Min. Required
Slot Card Type              Ver.   Device: "ID-Name"     Version    Version
==== ====================== ====== ===========================================
 0/0 SPA-4XOC3-POS          1.0    1-I/O FPGA               3.4       3.4
---- ---------------------- ------ ------------------ ----------- --------------
 0/1 SPA-2XT3/E3 <DISABLED> 1.0    1-ROMMON                 2.12      2.12
                                   2-I/O FPGA               0.6       1.0     *
                                   3-E3 FPGA                1.0       1.4     *
                                   4-T3 FPGA                1.0       1.4     *
---- ---------------------- ------ ------------------ ----------- --------------
```

```
 0/2 SPA-1X10GE-L-V2          1.0   1-10GE I/O FPGA       1.9          1.9
---- ---------------------- ------ ----------------- ----------- --------------
 0/3 SPA-1X10GE-L-V2          1.0   1-10GE I/O FPGA       1.9          1.9
==== ====================== ====== ================================================
 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:
        asr1000-fpd-bundle.pkg
==== ====================== ====== ================================================
```

Displaying Information About the Default FPD Image Package

Use the **show upgrade fpd package default** command to find out which SPAs and Ethernet Line Cards are supported with your current Cisco IOS release, and which FPD image package you need for an upgrade.

```
Router#
show upgrade fpd package default
***************************************************************************
This Cisco IOS software image requires the following default FPD Image
Package for the automatic upgrade of FPD images (the package is available
from Cisco.com and is accessible from the Cisco Software Center page where
this IOS software image can be downloaded):
***************************************************************************
Version: 12.2(XN)
Package Filename: asr1000-fpd-bundle.pkg
      List of card type supported in this package:
                                                         Minimal
                  No. Card Type                          HW Ver.
                  ---- ------------------------------------- -------
      1) 4xT SERIAL SPA                        0.0
                    2) 4xT SERIAL SPA                        2.0
                    3) 1xCHSTM1 SPA                          0.0
                    4) SPA-1XCHOC12/DS0                      0.0
                    5) SPA-1XCHOC12/DS0                      0.0
                    6) 1xCHOC48STM16 SPA                     2.0
                    7) 2xCT3 SPA                             0.100
                    8) 2xCT3 SPA                             0.200
                    9) 4xCT3 SPA                             0.100
                   10) 4xCT3 SPA                             0.200
                   11) WMA SPA                               0.165
                   12) 2x10GE & 20x1GE eLC                   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:

```
Router# show upgrade fpd progress

FPD Image Upgrade Progress Table:

==== ================== ================================================
                                                 Approx.
                          Field Programmable   Time      Elapsed
 Slot Card Type          Device : "ID-Name"   Needed      Time     State
==== ================== ================== ========== ========== ===========
 3/0 BUILT-IN-2T+20X1GE 22-DB FPGA           00:01:00   00:00:23  Updating...
---- ------------------ ------------------ ----------- -------- -----------
 0/2 SPA-2XT3/E3        4-T3 FPGA            --:--:--   --:--:--  Waiting...
==== ================== ================== ========== ========== ===========
```

FPD Image Upgrade Examples

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

Automatic FPD Image Upgrade Example

The following example shows the output displayed when a SPA in slot 0 subslot 1 requires an FPD image upgrade and the **upgrade fpd auto** command is *enabled* . The required FPD image is automatically upgraded.

> **Note** Note that the FPD image of an Ethernet Line Card is also upgraded similarly.

```
*Nov 28 13:14:22.782: %FPD_MGMT-3-INCOMP_IMG_VER: Incompatible I/O FPGA (FPD ID=2) image
version detected for SPA-2XT3/E3 card in subslot 0/1. Detected version = 0.6, minimum
required version = 1.0. Current HW version = 1.0.
*Nov 28 13:14:22.783: %FPD_MGMT-5-UPGRADE_ATTEMPT: Attempting to automatically upgrade the
 FPD image(s) for SPA-2XT3/E3 card in subslot 0/1. Use 'show upgrade fpd progress' command
 to view the upgrade progress ...
*Nov 28 13:14:22.841: %FPD_MGMT-6-BUNDLE_DOWNLOAD: Downloading FPD image bundle for
SPA-2XT3/E3 card in subslot 0/1 ...
*Nov 28 13:14:22.981: %FPD_MGMT-6-UPGRADE_TIME: Estimated total FPD image upgrade time for
 SPA-2XT3/E3 card in subslot 0/1 = 00:01:00.
*Nov 28 13:14:22.983: %FPD_MGMT-6-UPGRADE_START: I/O FPGA (FPD ID=2) image upgrade in
progress for SPA-2XT3/E3 card in subslot 0/1. Updating to version 1.1. PLEASE DO NOT INTERRUPT
 DURING THE UPGRADE PROCESS (estimated upgrade completion time = 00:01:00) ...
*Nov 28 13:14:43.267: %FPD_MGMT-6-UPGRADE_PASSED: I/O FPGA (FPD ID=2) image in the SPA-2XT3/E3
 card in subslot 0/1 has been successfully updated from version 0.6 to version 1.0. Upgrading
 time = 00:00:20.285
*Nov 28 13:14:43.267: %FPD_MGMT-6-OVERALL_UPGRADE: All the attempts to upgrade the required
 FPD images have been completed for SPA-2XT3/E3 card in subslot 0/1. Number of
successful/failure upgrade(s): 1/0.
*Nov 28 13:14:43.268: %FPD_MGMT-5-CARD_POWER_CYCLE: SPA-2XT3/E3 card in subslot 0/1 is being
 power cycled for the FPD image upgrade to take effect.
```

Manual FPD Image Upgrade Example

In the following example, FPD for the BUILT-IN-2T+20X1GE in subslot 3/0 is upgraded manually from the bundled FPD image package file. The command excludes the optional keyword **reload to ensure** that the line card does not get automatically reloaded.

```
Router#upgrade hw-module subslot 0/3 fpd bundled
% The following FPD will be upgraded for BUILT-IN-2T+20X1GE (H/W ver = 1.1) in slot 3/0:
================== =========== =========== ============
Field Programmable   Current     Upgrade     Estimated
Device: "ID-Name"    Version     Version     Upgrade Time
================== =========== =========== ============
22-DB FPGA           1.0         1.1         00:01:00
================== =========== =========== ============
% 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]: yes
% Initiating the upgrade operation on the target card ...
  (Use "show upgrade fpd progress" command to see upgrade progress)
```

```
Router#
*Mar  4 16:13:17.230: %FPD_MGMT-6-UPGRADE_TIME: Estimated total FPD image upgrade time for
 BUILT-IN-2T+20X1GE card in slot 3/0 = 00:01:00.
*Mar  4 16:13:17.232: %FPD_MGMT-6-UPGRADE_START: I/O FPGA (FPD ID=2) image upgrade in
progress for BUILT-IN-2T+20X1GE card in slot 3/0. Updating to version 1.1. PLEASE DO NOT
INTERRUPT DURING THE UPGRADE PROCESS (estimated upgrade completion time = 00:01:00) ...
*Mar  4 16:13:42.909: %FPD_MGMT-6-UPGRADE_PASSED: I/O FPGA (FPD ID=2) image in the
BUILT-IN-2T+20X1GE card in slot 3/0 has been successfully updated from version 1.0 to version
 1.1. Upgrading time = 00:00:25.676
*Mar  4 16:13:42.909: %FPD_MGMT-6-OVERALL_UPGRADE: All the attempts to upgrade the required
 FPD images have been completed for BUILT-IN-2T+20X1GE card in subslot 3/0. Number of
successful/failure upgrade(s): 1/0.
```

In the following example, FPD for the 2-port T3/E3 SPA in subslot 0/3 is upgraded manually from the bundled FPD image package file. Since the command includes the optional keyword **reload**, the SPA automatically reloads and the new FPD image takes effect immediately. Note that the FPD image of an Ethernet Line Card is also upgraded similarly.

```
Router#upgrade hw-module subslot 0/3 fpd bundled reload
% The following FPD will be upgraded for SPA-2XT3/E3 (H/W ver = 1.1) in subslot 0/3:
        ================== =========== =========== ============
        Field Programmable   Current     Upgrade     Estimated
        Device: "ID-Name"    Version     Version     Upgrade Time
        ================== =========== =========== ============
        2-I/O FPGA             1.0         1.1         00:01:00
        ================== =========== =========== ============
% NOTES:
  - Use 'show upgrade fpd progress' command to view the progress of the FPD
    upgrade.
  - The target card will be automatically reloaded after the upgrade
    operation. This reload will interrupt normal operation of the card. If
    necessary, ensure that appropriate actions have been taken to redirect
    card traffic before starting the FPD upgrade.
% Are you sure that you want to perform this operation? [no]: yes
% Initiating the upgrade operation on the target card ...
  (Use "show upgrade fpd progress" command to see upgrade progress)
Router#
*Mar  4 16:15:22.862: %FPD_MGMT-6-UPGRADE_TIME: Estimated total FPD image upgrade time for
 SPA-2XT3/E3 card in subslot 0/3 = 00:01:00.
*Mar  4 16:15:22.864: %FPD_MGMT-6-UPGRADE_START: I/O FPGA (FPD ID=2) image upgrade in
progress for SPA-2XT3/E3 card in subslot 0/3. Updating to version 1.1. PLEASE DO NOT INTERRUPT
 DURING THE UPGRADE PROCESS (estimated upgrade completion time = 00:01:00) ...
*Mar  4 16:15:47.795: %FPD_MGMT-6-UPGRADE_PASSED: I/O FPGA (FPD ID=2) image in the SPA-2XT3/E3
 card in subslot 0/3 has been successfully updated from version 1.0 to version 1.1. Upgrading
 time = 00:00:24.931
*Mar  4 16:15:47.795: %FPD_MGMT-6-OVERALL_UPGRADE: All the attempts to upgrade the required
 FPD images have been completed for SPA-2XT3/E3 card in subslot 0/3. Number of
successful/failure upgrade(s): 1/0.
*Mar  4 16:15:47.796: %FPD_MGMT-5-CARD_POWER_CYCLE: SPA-2XT3/E3 card in subslot 0/3 is being
 power cycled for the FPD image upgrade to take effect.
```

Troubleshooting Problems with FPD Image Upgrades

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

It contains the following topics:

Power Failure or Removal of an Ethernet Line Card During an FPD Image Upgrade

These instructions should only be used if a previous upgrade attempt has failed due to an external reason such as a power failure or removal of an Ethernet Line Card or a SPA.

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

Note   To find more information about FPD-related messages, see the system error messages guide pertaining to your Cisco IOS XE software release.

```
Nov.28 11:30:36:%SPA_OIR-3-RECOVERY_RELOAD:subslot 0/1:Attempting
recovery by reloading SPA
Nov.28 11:30:51:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 0/1
Nov.28 11:30:56:%SPA_OIR-3-RECOVERY_RELOAD:subslot 0/1:Attempting
recovery by reloading SPA
Nov.28 11:31:11:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 0/1
Nov.28 11:31:16:%SPA_OIR-3-RECOVERY_RELOAD:subslot 0/1:Attempting
recovery by reloading SPA
Nov.28 11:31:31:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 0/1
Nov.28 11:31:31:%SPA_OIR-3-SPA_POWERED_OFF:subslot 0/1:SPA 4xOC3 POS
SPA powered off after 5 failures within 600 seconds
```

The **show hw-module all fpd** command can be used to verify that a SPA or an Ethernet Line Card is using a corrupted FPD image. In this example, the SPA in slot 0/1 is corrupted.

```
Router# show hw-module all fpd
==== ====================== ====== =============================================
                            H/W    Field Programmable   Current    Min. Required
Slot Card Type              Ver.   Device: "ID-Name"    Version      Version
==== ====================== ====== ================== =========== ==============
 0/2 SPA-8XOC12-POS          1.0   1-I/O FPGA             1.1         1.1
---- ---------------------- ------ ------------------ ----------- --------------
 0/3 SPA-2X1GE-SYNCE         1.50  1-2xGE SYNCE I/O F    1.12        1.12
                                   2-2xGE SYNCE SPAMO    1.0         1.0
---- ---------------------- ------ ------------------ ----------- --------------
 1/0 BUILT-IN-2T+20X1GE      1.1   22-DB FPGA            1.14        1.13
---- ---------------------- ------ ------------------ ----------- --------------
 3/0 SPA-5X1GE-V2            1.2   1-GE I/O FPGA         1.10        1.10
---- ---------------------- ------ ------------------ ----------- --------------
 3/3 SPA-4XOC3-POS-V2        1.0   1-I/O FPGA            1.1         1.1
---- ---------------------- ------ ------------------ ----------- --------------
 4/0 SPA-1X10GE-L-V2         1.2   1-10GE I/O FPGA       1.9         1.9
---- ---------------------- ------ ------------------ ----------- --------------
 4/1 SPA-1X10GE-L-V2         1.2   1-10GE I/O FPGA       1.9         1.9
---- ---------------------- ------ ------------------ ----------- --------------
 5/0 BUILT-IN-6TGE           0.3   22-DB FPGA            1.9         1.8
==== ====================== ====== =============================================
```

Performing an FPD Recovery Upgrade

The recovery upgrade procedure can only be performed on an Ethernet Line Card or a SPA that has been powered off by the system after it has failed all of the retries attempted to initialize the Ethernet Line Card or 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 subslot 0/1.

Note   Because a recovery upgrade is done at a more conservative speed, it may take more than the estimated upgrade time.

Note When the system asks Do you want to perform the recovery upgrade operation? Answer **y** to this question only if you have attempted an FPD upgrade that has failed due to a power failure or an Ethernet Line Card removal.Contact Cisco Technical Support, if you have not had a failed upgrade attempt due to a power failure or an Ethernet Line Card removal.

```
Nov.28 11:29:55:%SPA_OIR-3-RECOVERY_RELOAD:subslot 0/1:Attempting
recovery by reloading SPA
Nov.28 11:30:10:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 0/1
Nov.28 11:30:15:%SPA_OIR-3-RECOVERY_RELOAD:subslot 0/1:Attempting
recovery by reloading SPA
Nov.28 11:30:31:%SPA_OIR-3-HW_INIT_TIMEOUT:subslot 0/1
Router# upgrade hw-module subslot 0/1 fpd bundled
% Cannot 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.
% The following FPD(s) will be upgraded for SPA-4XOC3-POS (H/W ver =
1.0) in subslot 0/1:
    ================== =========== =========== ============
    Field Programmable   Current     Upgrade     Estimated
    Device:"ID-Name"     Version     Version   Upgrade Time
    ================== =========== =========== ============
    22-DB1-I/O FPGA             ?.?         3.4       00:00:50
    ================== =========== =========== ============
% Do you want to perform the recovery upgrade operation? [no]:y
% Cannot perform recovery upgrade operation because the target card is
not in a failed state. Please try again later.
```
When the following error message is displayed, you can perform the recovery upgrade:

```
Nov.28 11:31:31:%SPA_OIR-3-SPA_POWERED_OFF:subslot 0/1:SPA 4xOC3 POS SPA powered off after
 5 failures within 600 seconds
```

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

Perform the manual FPD image upgrade method using the **upgrade hw-module subslot** command to recover from a corrupted image after the Ethernet Line Card has been powered off by the system. In this command, *slot-number* is the slot where the Ethernet Line Card is installed; *subslot-number* is always 0.

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

```
Router# upgrade hw-module subslot 0/1 fpd bundled
% Cannot get FPD version information from SPA-4XOC3-POS in subslot 0/1.
  If a previous upgrade attempt on the target card was interrupted, then the
  corruption of FPD image might have prevented the card from coming online.
  If this is the case, then a recovery upgrade would be required to fix the
  failure.
(Hit ENTER to proceed with recovery upgrade operation) [confirm]
% The following FPD will be upgraded for SPA-4XOC3-POS (H/W ver = 1.0) in subslot 0/1:
    ================== =========== =========== ============
          Minimum Compatible
    Field  Programmable  Current    Required  Version Found
    Device:"ID-Name"     Version    Version   In The File
    ================== =========== =========== ============
    22-DB   FPGA         1.13        1.13       1.13
    ================== =========== =========== ============
% NOTES:
 - Use 'show upgrade fpd progress' command to view the progress of the FPD
    upgrade.
 - Upgrade or downgrade operation can only be performed with FPD images that have compatible
 version with the one defined for this IOS image. That is to have the same major version
number and with minor version number no lower than the one defined for Minimum Required
Version.
 - Since the target card is currently in disabled state, it will be
    automatically reloaded after the upgrade operation for the changes to
```

```
      take effect.
% Do you want to perform the recovery upgrade operation? [no]: y
% Starting recovery upgrade operation in the background ...
  (Use "show upgrade fpd progress" command to see upgrade progress)
Router#
*Nov 28 17:46:10.191:%FPD_MGMT-6-UPGRADE_TIME: Estimated total FPD image upgrade time for
SPA-4XOC3-POS card in subslot 0/1 = 00:00:50.
*Nov 28 17:46:10.233:%FPD_MGMT-6-UPGRADE_START: I/O FPGA (FPD ID=1) image upgrade in progress
 for SPA-4XOC3-POS card in subslot 0/1. Updating to version 3.4. PLEASE DO NOT INTERRUPT
DURING THE UPGRADE PROCESS (estimated upgrade completion time = 00:00:50) ...
*Nov 28 17:46:55.948:%FPD_MGMT-6-UPGRADE_PASSED: I/O FPGA (FPD ID=1) image in the
SPA-4XOC3-POS card in subslot 0/1 has been successfully updated from version ?.? to version
 3.4. Upgrading time = 00:00:45.715
*Nov 28 17:46:55.948:%FPD_MGMT-6-OVERALL_UPGRADE: All the attempts to upgrade the required
 FPD images have been completed for SPA-4XOC3-POS card in subslot 0/1. Number of
successful/failure upgrade(s): 1/0.
*Nov 28 17:46:55.949:%FPD_MGMT-5-CARD_POWER_CYCLE: SPA-4XOC3-POS card in subslot 0/1 is
being power cycled for the FPD image upgrade to take effect.
```

Verifying a Successful Upgrade

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

```
Router# show hw-module subslot all fpd
==== ===================== ====== ===============================================
                           H/W    Field Programmable  Current   Min. Required
Slot Card Type             Ver.   Device: "ID-Name"   Version   Version
==== ===================== ====== ================== =========== ==============
 0/2 SPA-8XOC12-POS        1.0    1-I/O FPGA             1.1         1.1
---- --------------------- ------ ------------------ ----------- --------------
 0/3 SPA-2X1GE-SYNCE       1.50   1-2xGE SYNCE I/O F    1.12        1.12
                                  2-2xGE SYNCE SPAMO    1.0         1.0
---- --------------------- ------ ------------------ ----------- --------------
 1/0 BUILT-IN-2T+20X1GE    1.1    22-DB FPGA            1.14        1.14
---- --------------------- ------ ------------------ ----------- --------------
 3/0 SPA-5X1GE-V2          1.2    1-GE I/O FPGA         1.10        1.10
---- --------------------- ------ ------------------ ----------- --------------
 3/3 SPA-4XOC3-POS-V2      1.0    1-I/O FPGA            1.1         1.1
---- --------------------- ------ ------------------ ----------- --------------
 4/0 SPA-1X10GE-L-V2       1.2    1-10GE I/O FPGA       1.9         1.9
---- --------------------- ------ ------------------ ----------- --------------
 4/1 SPA-1X10GE-L-V2       1.2    1-10GE I/O FPGA       1.9         1.9
---- --------------------- ------ ------------------ ----------- --------------
 5/0 BUILT-IN-6TGE         0.3    22-DB FPGA            1.9         1.9
==== ===================== ====== ===============================================
```

I N D E X