Cisco IOS Wide-Area Networking Command Reference

Release 12.2

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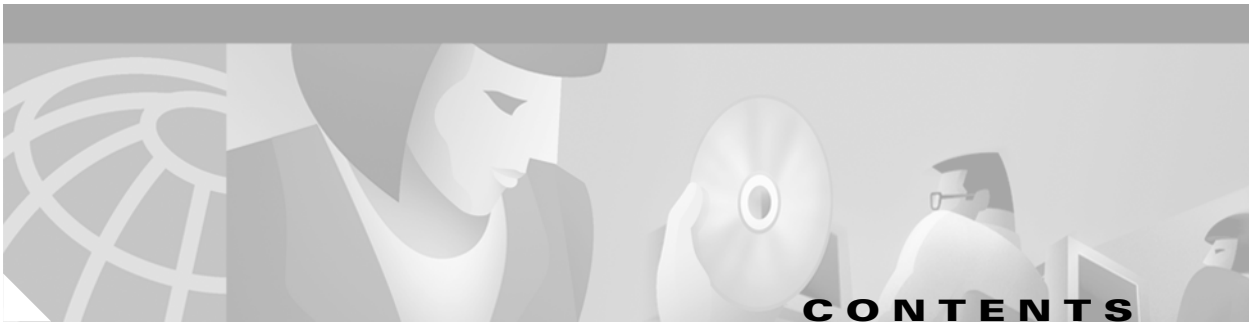

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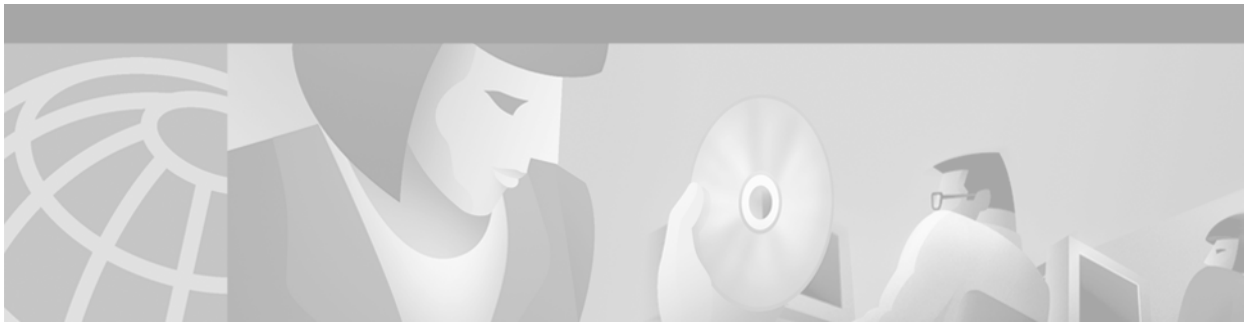


About Cisco IOS Software Documentation

This chapter discusses the objectives, audience, organization, and conventions of Cisco IOS software documentation. It also provides sources for obtaining documentation from Cisco Systems.

Documentation Objectives

Cisco IOS software documentation describes the tasks and commands necessary to configure and maintain Cisco networking devices.

Audience

The Cisco IOS software documentation set is intended primarily for users who configure and maintain Cisco networking devices (such as routers and switches) but who may not be familiar with the tasks, the relationship between tasks, or the Cisco IOS software commands necessary to perform particular tasks. The Cisco IOS software documentation set is also intended for those users experienced with Cisco IOS software who need to know about new features, new configuration options, and new software characteristics in the current Cisco IOS software release.

Documentation Organization

The Cisco IOS software documentation set consists of documentation modules and master indexes. In addition to the main documentation set, there are supporting documents and resources.

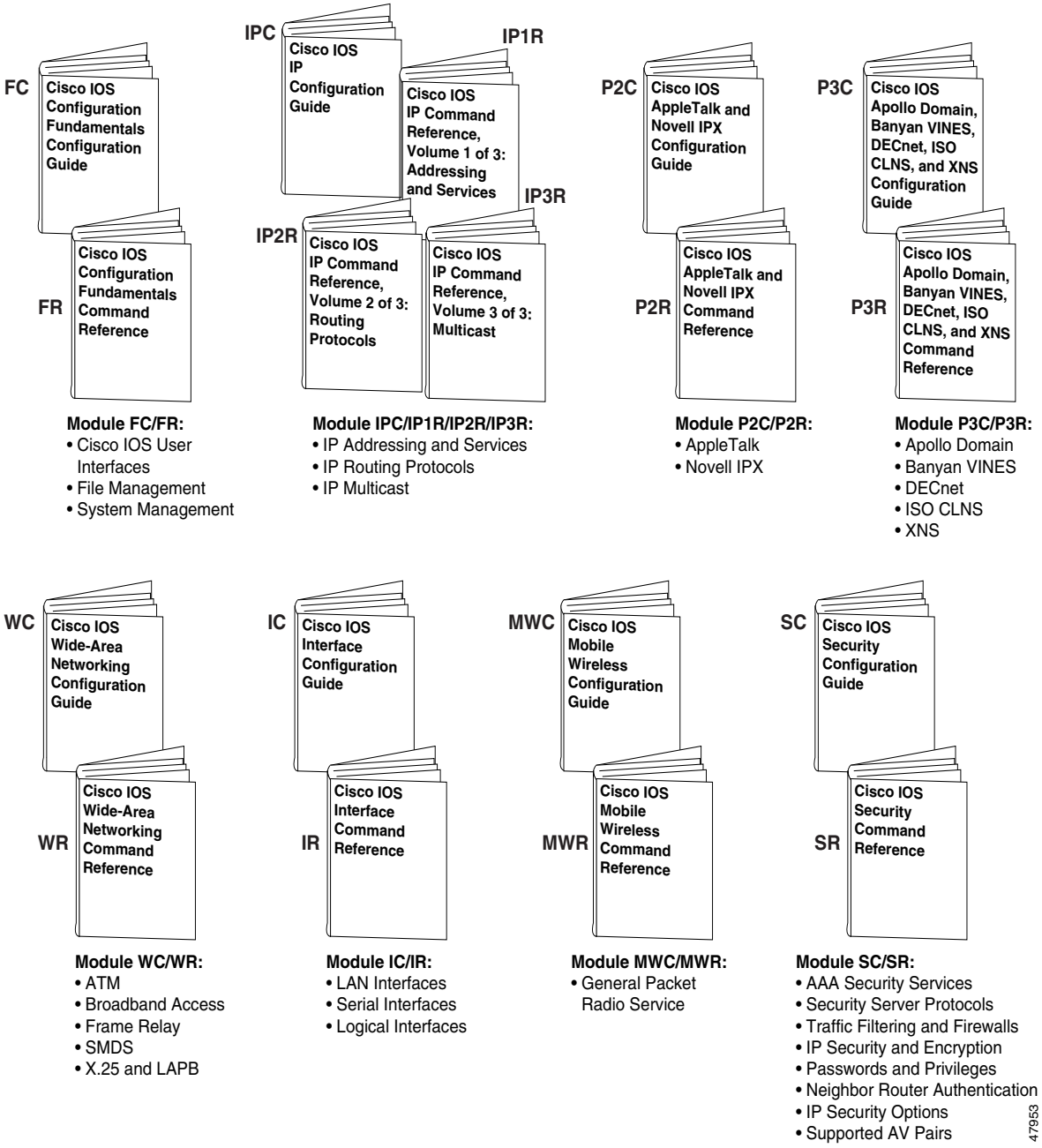
Documentation Modules

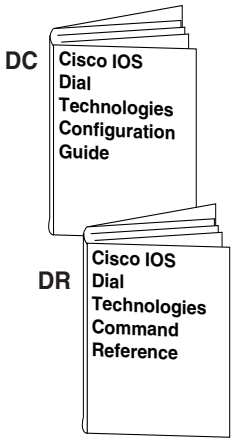
The Cisco IOS documentation modules consist of configuration guides and corresponding command reference publications. Chapters in a configuration guide describe protocols, configuration tasks, and Cisco IOS software functionality and contain comprehensive configuration examples. Chapters in a command reference publication provide complete Cisco IOS command syntax information. Use each configuration guide in conjunction with its corresponding command reference publication.

Figure 1 shows the Cisco IOS software documentation modules.

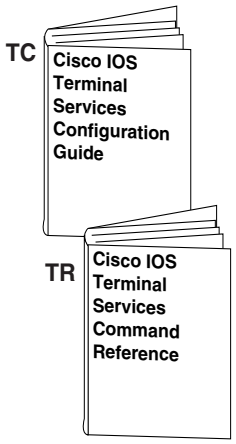
Note The abbreviations (for example, FC and FR) next to the book icons are page designators, which are defined in a key in the index of each document to help you with navigation. The bullets under each module list the major technology areas discussed in the corresponding books.

Figure 1 Cisco IOS Software Documentation Modules

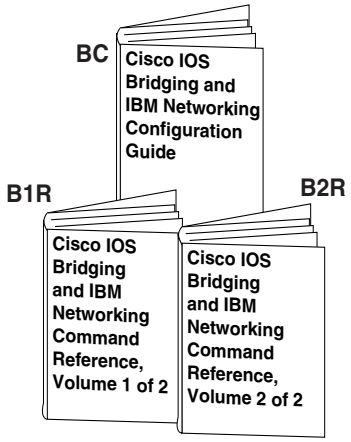




Module DC/DR:
- Preparing for Dial Access
- Modem and Dial Shelf Configuration and Management
- ISDN Configuration
- Signalling Configuration
- Dial-on-Demand Routing Configuration
- Dial-Backup Configuration
- Dial-Related Addressing Services
- Virtual Templates, Profiles, and Networks
- PPP Configuration
- Callback and Bandwidth Allocation Configuration
- Dial Access Specialized Features
- Dial Access Scenarios

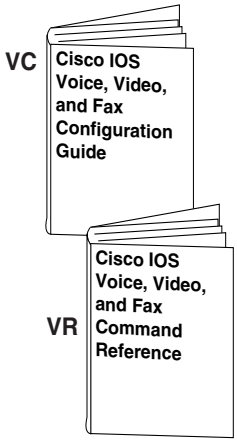


Module TC/TR:
- ARA
- LAT
- NASI
- Telnet
- TN3270
- XRemote
- X.28 PAD
- Protocol Translation

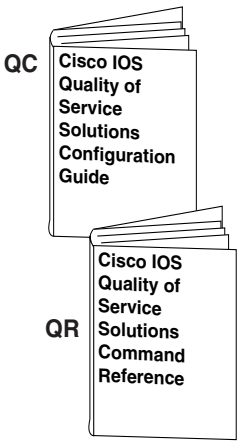


Module BC/B1R:
- Transparent Bridging
- SRB
- Token Ring Inter-Switch Link
- Token Ring Route Switch Module
- RSRB
- DLSw+
- Serial Tunnel and Block Serial Tunnel
- LLC2 and SDLC
- IBM Network Media Translation
- SNA Frame Relay Access
- NCIA Client/Server
- Airline Product Set

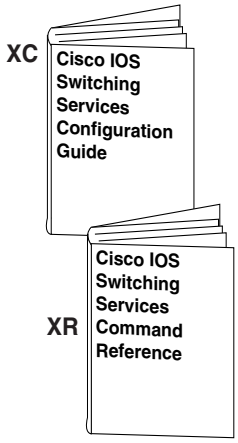
Module BC/B2R:
- DSPU and SNA Service Point
- SNA Switching Services
- Cisco Transaction Connection
- Cisco Mainframe Channel Connection
- CLAW and TCP/IP Offload
- CSNA, CMPC, and CMPC+
- TN3270 Server



Module VC/VR:
- Voice over IP
- Call Control Signalling
- Voice over Frame Relay
- Voice over ATM
- Telephony Applications
- Trunk Management
- Fax, Video, and Modem Support



Module QC/QR:
- Packet Classification
- Congestion Management
- Congestion Avoidance
- Policing and Shaping
- Signalling
- Link Efficiency Mechanisms



Module XC/XR:
- Cisco IOS Switching Paths
- NetFlow Switching
- Multiprotocol Label Switching
- Multilayer Switching
- Multicast Distributed Switching
- Virtual LANs
- LAN Emulation

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Master Indexes

Two master indexes provide indexing information for the Cisco IOS software documentation set: an index for the configuration guides and an index for the command references. Individual books also contain a book-specific index.

The master indexes provide a quick way for you to find a command when you know the command name but not which module contains the command. When you use the online master indexes, you can click the page number for an index entry and go to that page in the online document.

Supporting Documents and Resources

The following documents and resources support the Cisco IOS software documentation set:

- *Cisco IOS Command Summary* (two volumes)—This publication explains the function and syntax of the Cisco IOS software commands. For more information about defaults and usage guidelines, refer to the Cisco IOS command reference publications.
- *Cisco IOS System Error Messages*—This publication lists and describes Cisco IOS system error messages. Not all system error messages indicate problems with your system. Some are purely informational, and others may help diagnose problems with communications lines, internal hardware, or the system software.
- *Cisco IOS Debug Command Reference*—This publication contains an alphabetical listing of the **debug** commands and their descriptions. Documentation for each command includes a brief description of its use, command syntax, usage guidelines, and sample output.
- *Dictionary of Internetworking Terms and Acronyms*—This Cisco publication compiles and defines the terms and acronyms used in the internetworking industry.
- New feature documentation—The Cisco IOS software documentation set documents the mainline release of Cisco IOS software (for example, Cisco IOS Release 12.2). New software features are introduced in early deployment releases (for example, the Cisco IOS "T" release train for 12.2, 12.2(x)T). Documentation for these new features can be found in standalone documents called "feature modules." Feature module documentation describes new Cisco IOS software and hardware networking functionality and is available on Cisco.com and the Documentation CD-ROM.
- Release notes—This documentation describes system requirements, provides information about new and changed features, and includes other useful information about specific software releases. See the section "Using Software Release Notes" in the chapter "Using Cisco IOS Software" for more information.
- Caveats documentation—This documentation provides information about Cisco IOS software defects in specific software releases.
- RFCs—RFCs are standards documents maintained by the Internet Engineering Task Force (IETF). Cisco IOS software documentation references supported RFCs when applicable. The full text of referenced RFCs may be obtained on the World Wide Web at http://www.rfc-editor.org/.
- MIBs—MIBs are used for network monitoring. For lists of supported MIBs by platform and release, and to download MIB files, see the Cisco MIB website on Cisco.com at http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

New and Changed Information

Since the last release, the chapters "Broadband Access: PPP and Routed Bridge Encapsulation Commands" and "Frame Relay-ATM Interworking Commands" have been added to the *Cisco IOS Wide-Area Networking Command Reference*.

Document Conventions

Within Cisco IOS software documentation, 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.

The Cisco IOS documentation set uses the following conventions:

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

Command syntax descriptions use the following conventions:

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

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

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

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

Timesaver Means the *described action saves time*. You can save time by performing the action described in the paragraph.

Obtaining Documentation

The following sections provide sources for obtaining documentation from Cisco Systems.

World Wide Web

The most current Cisco documentation is available on the World Wide Web at the following website:

http://www.cisco.com

Translated documentation is available at the following website:

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

Documentation CD-ROM

Cisco documentation and additional literature are available in a CD-ROM package, which ships with your product. The Documentation CD-ROM is updated monthly and may be more current than printed documentation. The CD-ROM package is available as a single unit or through an annual subscription.

Ordering Documentation

Cisco documentation can be ordered in the following ways:

- Registered Cisco Direct Customers can order Cisco product documentation from the Networking Products MarketPlace:

  http://www.cisco.com/cgi-bin/order/order_root.pl

- Registered Cisco.com users can order the Documentation CD-ROM through the online Subscription Store:

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

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

Documentation Feedback

If you are reading Cisco product documentation on the World Wide Web, you can submit technical comments electronically. Click **Feedback** in the toolbar and select **Documentation**. After you complete the form, click **Submit** to send it to Cisco.

You can e-mail your comments to bug-doc@cisco.com.

To submit your comments by mail, use the response card behind the front cover of your document, or write to the following address:

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Document Resource Connection
170 West Tasman Drive
San Jose, CA 95134-9883

We appreciate your comments.

Obtaining Technical Assistance

Cisco provides Cisco.com as a starting point for all technical assistance. Customers and partners can obtain documentation, troubleshooting tips, and sample configurations from online tools. For Cisco.com registered users, additional troubleshooting tools are available from the TAC website.

Cisco.com

Cisco.com is the foundation of a suite of interactive, networked services that provides immediate, open access to Cisco information and resources at anytime, from anywhere in the world. This highly integrated Internet application is a powerful, easy-to-use tool for doing business with Cisco.

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Customers and partners can self-register on Cisco.com to obtain additional personalized information and services. Registered users can order products, check on the status of an order, access technical support, and view benefits specific to their relationships with Cisco.

To access Cisco.com, go to the following website:

http://www.cisco.com

Technical Assistance Center

The Cisco TAC website is available to all customers who need technical assistance with a Cisco product or technology that is under warranty or covered by a maintenance contract.

Contacting TAC by Using the Cisco TAC Website

If you have a priority level 3 (P3) or priority level 4 (P4) problem, contact TAC by going to the TAC website:

http://www.cisco.com/tac

P3 and P4 level problems are defined as follows:

- P3—Your network performance is degraded. Network functionality is noticeably impaired, but most business operations continue.
- P4—You need information or assistance on Cisco product capabilities, product installation, or basic product configuration.

In each of the above cases, use the Cisco TAC website to quickly find answers to your questions.

To register for Cisco.com, go to the following website:

http://www.cisco.com/register/

If you cannot resolve your technical issue by using the TAC online resources, Cisco.com registered users can open a case online by using the TAC Case Open tool at the following website:

http://www.cisco.com/tac/caseopen

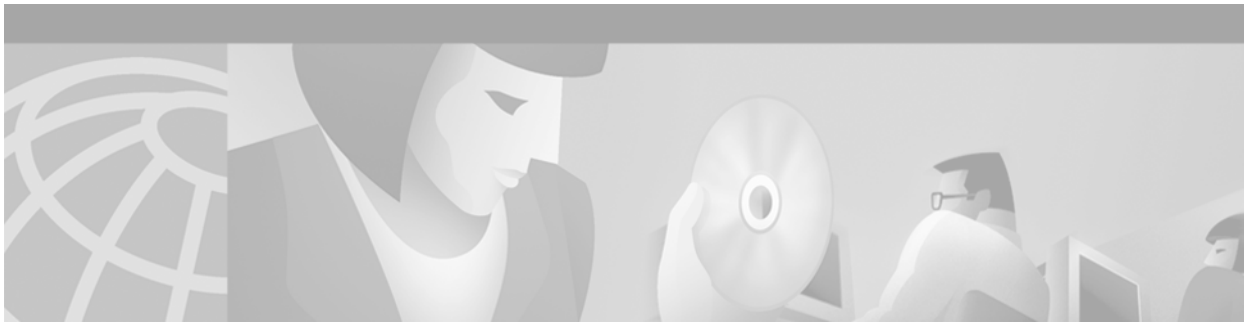
Contacting TAC by Telephone

If you have a priority level 1 (P1) or priority level 2 (P2) problem, contact TAC by telephone and immediately open a case. To obtain a directory of toll-free numbers for your country, go to the following website:

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

P1 and P2 level problems are defined as follows:

- P1—Your production network is down, causing a critical impact to business operations if service is not restored quickly. No workaround is available.
- P2—Your production network is severely degraded, affecting significant aspects of your business operations. No workaround is available.



Using Cisco IOS Software

This chapter provides helpful tips for understanding and configuring Cisco IOS software using the command-line interface (CLI). It contains the following sections:

- Understanding Command Modes
- Getting Help
- Using the no and default Forms of Commands
- Saving Configuration Changes
- Filtering Output from the show and more Commands
- Identifying Supported Platforms

For an overview of Cisco IOS software configuration, refer to the *Cisco IOS Configuration Fundamentals Configuration Guide*.

For information on the conventions used in the Cisco IOS software documentation set, see the chapter "About Cisco IOS Software Documentation" located at the beginning of this book.

Understanding Command Modes

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

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

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

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

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

Table 1 Accessing and Exiting Command Modes

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

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

Getting Help

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

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

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

Example: How to Find Command Options

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

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

Table 2 shows examples of how you can use the question mark (**?**) to assist you in entering commands. The table steps you through configuring an IP address on a serial interface on a Cisco 7206 router that is running Cisco IOS Release 12.0(3).

Table 2 How to Find Command Options

Command	Comment

`Router> enable`
`Password: <password>`
`Router#`
	Enter the **enable** command and password to access privileged EXEC commands. You are in privileged EXEC mode when the prompt changes to `Router#`.

`Router# configure terminal`
`Enter configuration commands, one per line. End with CNTL/Z.`
`Router(config)#`
	Enter the **configure terminal** privileged EXEC command to enter global configuration mode. You are in global configuration mode when the prompt changes to `Router(config)#`.

`Router(config)# interface serial ?`
`  <0-6>  Serial interface number`
`Router(config)# interface serial 4 ?`
`  /`
`Router(config)# interface serial 4/ ?`
`  <0-3>  Serial interface number`
`Router(config)# interface serial 4/0`
`Router(config-if)#`
	Enter interface configuration mode by specifying the serial interface that you want to configure using the **interface serial** global configuration command.
	Enter **?** to display what you must enter next on the command line. In this example, you must enter the serial interface slot number and port number, separated by a forward slash.
	You are in interface configuration mode when the prompt changes to `Router(config-if)#`.

Table 2 How to Find Command Options (continued)

Command	Comment

`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.

`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.
	Enter **?** to display what you must enter next on the command line. This example shows only some of the available interface IP configuration commands.

Table 2 How to Find Command Options (continued)

Command	Comment

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

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

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

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

Using the no and default Forms of Commands

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

Configuration commands also can have a **default** form, which returns the command settings to the default values. Most commands are disabled by default, so in such cases using the **default** form has the same result as using the **no** form of the command. However, some commands are enabled by default and

have variables set to certain default values. In these cases, the **default** form of the command enables the command and sets the variables to their default values. The Cisco IOS software command reference publications describe the effect of the **default** form of a command if the command functions differently than the **no** form.

Saving Configuration Changes

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

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

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

```
[OK]
Router#
```

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

Filtering Output from the show and more Commands

In Cisco IOS Release 12.0(1)T and later releases, you can search and filter the output of **show** and **more** commands. This functionality is useful if you need to sort through large amounts of output or if you want to exclude output that you need not see.

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

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

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

```
Router# show interface | include protocol

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

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

Identifying Supported Platforms

Cisco IOS software is packaged in feature sets consisting of software images that support specific platforms. The feature sets available for a specific platform depend on which Cisco IOS software images are included in a release. To identify the set of software images available in a specific release or to find out if a feature is available in a given Cisco IOS software image, see the following sections:

- Using Feature Navigator
- Using Software Release Notes

Using Feature Navigator

Feature Navigator is a web-based tool that enables you to quickly determine which Cisco IOS software images support a particular set of features and which features are supported in a particular Cisco IOS image.

Feature Navigator is available 24 hours a day, 7 days a week. To access Feature Navigator, you must have an account on Cisco.com. If you have forgotten or lost your account information, e-mail the Contact Database Administration group at cdbadmin@cisco.com. If you do not have an account on Cisco.com, go to http://www.cisco.com/register and follow the directions to establish an account.

To use Feature Navigator, you must have a JavaScript-enabled web browser such as Netscape 3.0 or later, or Internet Explorer 4.0 or later. Internet Explorer 4.0 always has JavaScript enabled. To enable JavaScript for Netscape 3.x or Netscape 4.x, follow the instructions provided with the web browser. For JavaScript support and enabling instructions for other browsers, check with the browser vendor.

Feature Navigator is updated when major Cisco IOS software releases and technology releases occur. You can access Feature Navigator at the following URL:

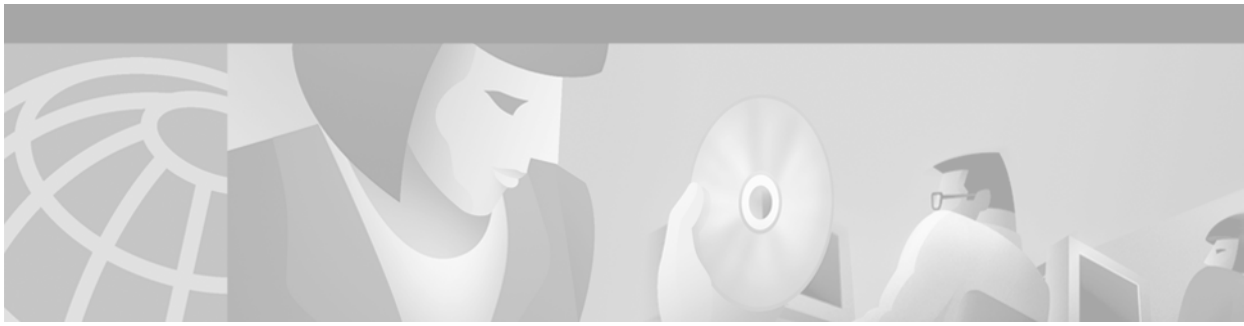
http://www.cisco.com/go/fn

Using Software Release Notes

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

- Platform support information
- Memory recommendations
- Microcode support information
- Feature set tables
- Feature descriptions
- Open and resolved severity 1 and 2 caveats for all platforms

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



ATM Commands

This chapter describes the commands available for configuring ATM interfaces on the following platforms:

- Cisco 2600 series routers
- Cisco 3600 series routers
- Cisco 4500 routers
- Cisco 4700 routers
- Cisco 7200 series routers
- Cisco 7500 series routers

This chapter also describes the commands available for configuring a serial interface for ATM access in other routers.

Note Beginning in Cisco IOS Release 11.3, all commands supported on the Cisco 7500 series routers are also supported on the Cisco 7000 series routers equipped with RSP7000.

For ATM configuration information and examples, refer to the chapter "Configuring ATM" in the *Cisco IOS Wide-Area Networking Configuration Guide*.

abr

To select available bit rate (ABR) quality of service (QoS) and configure the output peak cell rate and output minimum guaranteed cell rate for an ATM permanent virtual circuit (PVC) or virtual circuit (VC) class, use the **abr** command in the appropriate command mode. To remove the ABR parameters, use the **no** form of this command.

abr *output-pcr output-mcr*

no abr *output-pcr output-mcr*

Syntax Description

output-pcr	The output peak cell rate in kilobits per second.
output-mcr	The output minimum guaranteed cell rate in kilobits per second.

Defaults

ABR QoS at the maximum line rate of the physical interface

Command Modes

Interface-ATM-VC configuration (for an ATM PVC)

VC-class configuration (for a VC class)

PVC range configuration (for an ATM PVC range)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.1	This command was introduced.
12.1(5)T	This command was modified to be available in PVC range and PVC-in-range configuration modes.

Usage Guidelines

If the **abr** command is not explicitly configured on an ATM PVC, the VC inherits the following default configuration (listed in order of precedence):

- Configuration of any QoS command (**abr**, **ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC itself.
- Configuration of any QoS command (**abr**, **ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC's ATM subinterface.
- Configuration of any QoS command (**abr**, **ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC's ATM main interface.
- Global default value: ABR QoS at the maximum line rate of the PVC.

ABR is a quality of service class defined by the ATM Forum for ATM networks. ABR is used for connections that do not require timing relationships between source and destination. ABR provides no guarantees in terms of cell loss or delay, providing only best-effort service. Traffic sources adjust their transmission rate in response to information they receive describing the status of the network and its capability to successfully deliver data.

In ABR transmission, the peak cell rate (PCR) specifies the maximum value of the allowed cell rate (ACR), and minimum cell rate (MCR) specifies the minimum value for the ACR. ACR varies between the MCR and the PCR and is dynamically controlled using congestion control mechanisms.

Examples

The following example specifies the *output-pcr* argument to be 100,000 kbps and the *output-mcr* argument to be 3000 kbps for an ATM PVC:

```
pvc 1/32
 abr 100000 3000
```

Related Commands

Command	Description
ubr	Configures UBR QoS and specifies the output peak cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
ubr+	Configures UBR QoS and specifies the output peak cell rate and output minimum guaranteed cell rate for an ATM PVC, SVC, VC class or VC bundle member.
vbr-nrt	Configures the VBR-NRT QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size for an ATM PVC, SVC, or VC class.

atm aal aal3/4

To enable support for ATM adaptation layer 3/4 (AAL3/4) on an ATM interface, use the **atm aal aal3/4** interface configuration command. To disable support for ATM adaptation layer 3/4 (AAL3/4) on an ATM interface, use the **no** form of this command.

atm aal aal3/4

no atm aal aal3/4

Syntax Description

This command has no arguments or keywords.

Defaults

Support for AAL3/4 is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command is supported on Cisco 7500 series routers with AIP. This command is not supported on the ATM port adapter. Because Cisco 4500 and Cisco 4700 routers always support both AAL3/4 and AAL5, this command is not required on Cisco 4500 and Cisco 4700 routers.

Only one virtual circuit can exist on a subinterface that is being used for AAL3/4 processing, and that virtual circuit must be an AAL3/4 virtual circuit.

The AAL3/4 support feature requires static mapping of all protocols except IP.

Examples

The following example enables AAL3/4 on ATM interface 2/0:

```
interface atm2/0
 ip address 172.21.177.178 255.255.255.0
 atm aal aal3/4
```

Related Commands

Command	Description
atm mid-per-vc	Limits the number of MID numbers allowed on each VC.
atm multicast	Assigns an SMDS E.164 multicast address to the ATM subinterface that supports AAL3/4 and SMDS encapsulation.
atm smds-address	Assigns a unicast E.164 address to the ATM subinterface that supports AAL3/4 and SMDS encapsulation.
pvc	Creates or assigns a name to an ATM PVC, specifies the encapsulation type on an ATM PVC, or enters interface-ATM-VC configuration mode.

atm abr rate-factor

To configure the amount by which the cell transmission rate increases or decreases in response to flow control information from the network or destination for available bit rate (ABR) virtual circuits (VCs), use the **atm abr rate-factor** interface configuration command. To return to the default, use the **no** form of this command.

atm abr rate-factor [*rate-increase-factor*] [*rate-decrease-factor*]

no atm abr rate-factor [*rate-increase-factor*] [*rate-decrease-factor*]

Syntax Description

rate-increase-factor	(Optional) Factor by which to increase the data rate. The rate increase factor is specified in powers of 2 from 1 to 32768.
rate-decrease-factor	(Optional) Factor by which to decrease the data rate. The rate decrease factor is specified in powers of 2 from 1 to 32768.

Defaults

ABR rate increase and decrease factor is 16.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

To configure an ABR VC, use the **pvc** command with the **abr** keyword.

To verify the ABR rate factor, use the **show atm interface atm** EXEC command.

Examples

The following example sets the ABR rate factor to 32 for the next cell transferred on ATM interface 4/0:

```
interface atm 4/0
 atm abr rate-factor 32 32
```

Related Commands

Command	Description
pvc	Configures the PVC interface.
show atm interface atm	Displays ATM-specific information about an ATM interface.

atm address-registration

To enable the router to engage in address registration and callback functions with the Interim Local Management Interface (ILMI), use the **atm address-registration** interface configuration command. To disable ILMI address registration functions, use the **no** form of this command.

atm address-registration

no atm address-registration

Syntax Description

This command has no arguments or keywords.

Defaults

Enabled

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.

Usage Guidelines

This command enables a router to register its address with the ILMI for callback when specific events occur, such as incoming Simple Network Management Protocol (SNMP) traps or incoming new network prefixes.

Examples

The following example enables ATM interface I/O to register its address:

```
interface atm 1/0
 atm address-registration
```

Related Commands

Command	Description
atm ilmi-keepalive	Enables ILMI keepalives.

atm arp-server

To identify an ATM Address Resolution Protocol (ARP) server for the IP network or set time-to-live (TTL) values for entries in the ATM ARP table, use the **atm arp-server** interface configuration command. To remove the definition of an ATM ARP server, use the **no** form of this command.

atm arp-server [**self** [**time-out** *minutes*] | [**nsap** *nsap-address*]]

no atm arp-server [**self** [**time-out** *minutes*] | [**nsap** *nsap-address*]]

Syntax Description

self	(Optional) Specifies the current router as the ATM ARP server.
time-out *minutes*	(Optional) Number of minutes for which a destination entry listed in the ATM ARP server's ARP table will be kept before the server takes any action to verify or time out the entry.
nsap *nsap-address*	(Optional) Network service access point (NSAP) address of an ATM ARP server.

Defaults

The default timeout value is 20 minutes.

The ARP server process is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

If an NSAP address is specified, the ARP client on this interface uses the specified host as an ARP server. You can specify multiple ATM ARP servers by repeating the command. If **self** is specified, this interface acts as the ARP server for the logical IP network.

The ATM ARP server takes one of the following actions if a destination listed in the server's ARP table expires:

- If a virtual circuit still exists to that destination, the server sends an Inverse ARP request. If no response arrives, the entry times out.
- If a virtual circuit does not exist to the destination, the entry times out immediately.

This implementation follows RFC 1577, *Classical IP over ATM*.

To configure redundant ARP servers, you must first enable redundant ARP server support by entering the **atm classic-ip-extensions** command with the **BFI** keyword.

Examples

The following example configures ATM on an interface and configures the interface to function as the ATM ARP server for the IP subnetwork:

```
interface atm 0/0
 ip address 10.0.0.1.255.0.0.0
atm nsap-address ac.1533.66.020000.0000.0000.0000.0000.0000.0000.00
atm rate-queue 1 100
atm maxvc 1024
atm pvc 1 0 5 qsaal
atm arp-server self
```

Related Commands

Command	Description
atm classic-ip-extensions	Enables support for redundant ATM ARP servers on a single LIS.

atm classic-ip-extensions

To enable support for redundant ATM Address Resolution Protocol (ARP) servers on a single logical IP subnetwork (LIS), use the **atm classic-ip-extensions** command in interface configuration mode. To remove support for redundant ATM ARP servers, use the **no** form of this command.

atm classic-ip-extensions {**BFI** | **none**}

no atm classic-ip-extensions

Syntax Description

BFI	Enables simple redundant ARP server support. BFI as an acronym is undefined.
none	Enables standard RFC 1577 behavior (no redundant ARP server support).

Defaults

Redundant ATM ARP server support is not enabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Cisco's implementation of the ATM ARP server supports redundant ATM ARP servers on a single logical IP subnetwork (LIS). In order for redundant ATM ARP server support to work, all of the devices on the LIS must be Cisco devices and must have the **atm classic-ip-extensions BFI** command configured.

The **none** keyword enables behavior that complies with RFC 1577, *Classical IP over ATM*. RFC 1577 does not support redundant ARP servers.

Examples

The following example shows how to configure redundant ARP servers on an ATM interface:

```
Router(config)# interface atm 1/0
Router(config-if)# atm classic-ip-atm BFI
Router(config-if)# atm arp-server nsap 47.000580FFE1000000F21A3167.666666666666.00
Router(config-if)# atm arp-server nsap 47.000580FFE1000000F21A3167.555555555555.00
```

Related Commands

Command	Description
atm arp-server	Identifies an ATM Address Resolution Protocol (ARP) server for the IP network or sets TTL values for entries in the ATM ARP table.

atm clock internal

To cause the ATM interface to generate the transmit clock internally, use the **atm clock internal** interface configuration command. To restore the default value, use the **no** form of this command.

atm clock internal

no atm clock internal

Syntax Description

This command has no arguments or keywords.

Defaults

The ATM interface uses the transmit clock signal from the remote connection (the line). The switch provides the clocking.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is meaningless on a 4B/5B physical layer interface module (PLIM).

For SONET interfaces, use the **atm clock internal** command to configure an ATM port adapter to supply its internal clock to the line.

Examples

The following example causes the ATM interface to generate the transmit clock internally:

```
interface atm 4/0
 atm clock internal
```

atm compression

To specify the software compression mode on an interface, use the **atm compression** command in interface configuration mode. To remove the compression mode setting, use the **no** form of this command.

atm compression {**per-packet** | **per-interface** | **per-vc**}

no atm compression {**per-packet** | **per-interface** | **per-vc**}

Syntax Description

per-packet	Specifies packet-by-packet compression mode (no history). This is the default.
per-interface	Specifies one context per interface (with history).
per-vc	Specifies one context for every virtual circuit (with history).

Defaults

per-packet

Command Modes

Interface configuration

Command History

Release	Modification
11.3(1)MA	This command was introduced on the Cisco MC3810 multiservice concentrator.

Usage Guidelines

This command applies to ATM configuration on the Cisco MC3810 multiservice concentrator.

Examples

The following example configures per-packet ATM compression:

```
interface atm0
 atm compression per-packet
```

atm ds3-scramble

To enable scrambling of the ATM cell payload for the DS3 physical layer interface module (PLIM) on an ATM interface, use the **atm ds3-scramble** interface configuration command. To disable scrambling of the ATM cell payload for the DS3 PLIM, use the **no** form of this command.

atm ds3-scramble

no atm ds3-scramble

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.
11.1	Command syntax was changed from **ds3 scramble** to **atm ds3-scramble**.

Usage Guidelines

DS3 scrambling is used to assist clock recovery on the receiving end.

Examples

The following example disables DS3 scrambling on the interface:

```
interface atm 4/0
 no atm ds3-scramble
```

atm e164 auto-conversion

To enable ATM E164 autoconversion, use the **atm e164 auto-conversion** interface configuration command. To disable autoconversion, use the **no** form of this command.

atm e164 auto-conversion

no atm e164 auto-conversion

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

You must enable the ATM interface before using the **atm e164 auto-conversion** command.

When an interface is configured for E.164 auto conversion, ATM E.164 format addresses are converted to the corresponding native E.164 address for outgoing calls. For incoming calls, native E.164 addresses are converted to the corresponding ATM E.164 format.

Examples

The following example enables E.164 auto conversion on ATM interface 0/0/1:

```
interface atm 0/0/1
 atm e164 auto-conversion
```

atm e3-scramble

To enable scrambling of the ATM cell payload for the E3 physical layer interface module (PLIM) on an ATM interface, use the **atm e3-scramble** interface configuration command. To disable scrambling of the ATM cell payload for the E3 PLIM, use the **no** form of this command.

atm e3-scramble

no atm e3-scramble

Syntax Description

This command has no arguments or keywords.

Defaults

E3 scrambling is enabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

E3 scrambling is used to assist clock recovery on the receiving end.

Examples

The following example disables E3 scrambling on the interface:

```
interface atm 2/0
 no atm e3-scramble
```

atm esi-address

To enter the end station ID (ESI) and selector byte fields of the ATM network service access point (NSAP) address, use the **atm esi-address** interface configuration command. The NSAP address prefix is filled in via Integrated Local Management Interface (ILMI) from the ATM switch. To delete the end station address, use the **no** form of this command.

atm esi-address *esi***.***selector*

no atm esi-address *esi***.***selector*

Syntax Description

esi	End station ID field value in hexadecimal; 6 bytes long.
.*selector*	Selector field value in hexadecimal; 1 byte long.

Defaults

No ESI is defined.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

The **atm esi-address** command allows you to configure the ATM address by entering the ESI (12 hexadecimal characters) and the selector byte (2 hexadecimal characters). The ATM prefix (26 hexadecimal characters) will be provided by the ATM switch. To get the prefix from the ATM switch, the ILMI permanent virtual circuit (PVC) must be configured on the router and the ATM switch must be able to supply a prefix via ILMI. A period must be used to separate the *esi* from the *selector* arguments.

Note When ILMI is configured, use the **atm esi-address** command instead of the **atm nsap-address** command. The **atm esi-address** and **atm nsap-address** commands are mutually exclusive. Configuring the router with the **atm esi-address** command negates the **atm nsap-address** setting, and vice versa.

The ILMI PVC must be configured in order to get an NSAP address prefix from the switch.

Examples

The following example sets up the ILMI PVC and assigns the ESI and selector field values on the ATM interface 4/0:

```
interface atm 4/0
 atm pvc 2 0 16 ilmi
 atm esi-address 345678901234.12
```

Related Commands

Command	Description
atm nsap-address	Sets the NSAP address for an ATM interface using SVC mode.
ilmi manage	Enables ILMI management on an ATM PVC.
pvc	Configures the PVC interface.

atm exception-queue

To set the exception queue length, use the **atm exception-queue** interface configuration command. To restore the default value, use the **no** form of this command.

atm exception-queue *number*

no atm exception-queue

Syntax Description

number	Number of entries, in the range from 8 to 256.

Defaults

32 entries

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is supported on ATM interface processor (AIP) for Cisco 7500 series routers. This command is not supported on the ATM port adapter for Cisco 7200 and 7500 series routers, nor is it supported on Cisco 4500 and Cisco 4700 routers.

The exception queue is used for reporting ATM events, such as cycle redundancy check (CRC) errors.

Examples

The following example sets the exception queue to 50 entries:

```
atm exception-queue 50
```

atm framing (DS3)

To specify DS3 line framing on an ATM interface, use the **atm framing** interface configuration command. To return to the default C-bit with Physical Layer Convergence Protocol (PLCP) framing, use the **no** form of this command.

atm framing [**cbitadm** | **cbitplcp** | **m23adm** | **m23plcp**]

no atm framing [**cbitadm** | **cbitplcp** | **m23adm** | **m23plcp**]

Syntax Description

cbitadm	(Optional) Specifies C-bit with ATM direct mapping (ADM).
cbitplcp	(Optional) Specifies C-bit with PLCP framing.
m23adm	(Optional) Specifies M23 ATM direct mapping.
m23plcp	(Optional) Specifies M23 with PLCP framing.

Defaults

cbitplcp

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.
11.1	This command was modified to include the Cisco 7200 series routers with the ATM-CES port adapter.

Usage Guidelines

This command is available on Cisco 4500 and 4700 routers with DS3 access speeds, Cisco 7200 series routers, and Cisco 7500 series routers.

Framing on the interface must match that on the switch for this ATM link.

Examples

The following example specifies M23 ADM framing on a router that has been set up with DS3 access to an ATM network:

```
interface atm 4/0
 atm framing m32adm
```

atm framing (E3)

To specify E3 line framing, use the **atm framing** interface configuration command. To return to the default G.751 Physical Layer Convergence Protocol (PLCP) framing, use the **no** form of this command.

atm framing [**g751adm** | **g832adm** | **g751plcp**]

no atm framing [**g751adm** | **g832adm** | **g751plcp**]

Syntax Description

g751adm	(Optional) Specifies G.751 ATM Direct Mapping (ADM).
g832adm	(Optional) Specifies G.832 ATM Direct Mapping.
g751plcp	(Optional) Specifies G.751 PLCP encapsulation.

Defaults

g751plcp

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.
11.1	The **g751plcp** keyword was added, together with information on the Cisco 7200 series router with the ATM-CES port adapter.

Usage Guidelines

The default framing is described in the ITU-T Recommendation G.751.

Framing on the interface must match that on the switch for this ATM link.

Examples

The following example specifies G.832 ADM framing on a router that has been set up with E3 access to an ATM network:

```
interface atm 4/0
 atm framing g832adm
```

atm ilmi-keepalive

To enable Interim Local Management Interface (ILMI) keepalives, use the **atm ilmi-keepalive** interface configuration command. To disable ILMI keepalives, use the **no** form of this command.

atm ilmi-keepalive [*seconds*]

no atm ilmi-keepalive [*seconds*]

Syntax Description

seconds	(Optional) Number of seconds between keepalives. Values less than 3 seconds are rounded up to 3 seconds, and there is no upper limit.

Defaults

3 seconds

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.

Examples

The following example enables ILMI keepalives for the ATM interface 1/0:

```
interface atm 1/0
 atm address-registration
 atm ilmi-keepalive
```

Related Commands

Command	Description
atm address-registration	Enables the router to engage in address registration and callback functions with the ILMI.

atm ilmi-pvc-discovery

To enable ATM permanent virtual circuit (PVC) discovery, use the **atm ilmi-pvc-discovery** interface configuration command. To disable PVC Discovery, use the **no** form of this command.

atm ilmi-pvc-discovery [**subinterface**]

no atm ilmi-pvc-discovery [**subinterface**]

Syntax Description

subinterface	(Optional) Causes discovered PVCs to be assigned to the ATM subinterface whose number matches the discovered PVC's VPI number.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.3	This command was introduced.

Examples

The following example enables PVC Discovery on the ATM main interface 2/0. The **subinterface** keyword is used so that all discovered PVCs with a VPI value of 1 will be assigned to the subinterface 2/0.1:

```
interface atm 2/0
 pvc RouterA 0/16 ilmi
 exit
 atm ilmi-pvc-discovery subinterface
 exit

interface atm 2/0.1 multipoint
 ip address 172.21.51.5 255.255.255.0
```

atm lbo

To specify the cable length (line build-out) for the ATM interface, use the **atm lbo** interface configuration command. To return to the default, use the **no** form of this command.

atm lbo {**long** | **short**}

no atm lbo

Syntax Description

long	Specifies a cable length greater than 50 feet.
short	Specifies a cable length less than 50 feet.

Defaults

short

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Examples

The following example specifies that the ATM interface use a cable less than 50 feet:

```
interface atm 4/0
 atm lbo short
```

Related Commands

Command	Description
ces dsx1 lbo	Configures cable length for the CBR interface.

atm max-channels

To configure the number of transmit channels for the interface, use the **atm max-channels** interface configuration command. To return to the default, use the **no** form of this command.

atm max-channels *number*

no atm max-channels

Syntax Description

number	Maximum number of transmit channels for the interface. The range is 64 to 2048 channels. The default is 64 channels.

Defaults

64 channels

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

The **atm max-channels** command replaces the **atm tx-channels** command.

Transmit Descriptors

The **atm max-channels** command can be used to divide the available number (fixed) of transmit descriptors across the configured number of transmit channels. Typically, you think of a one-to-one association between a transmit channel and a VC; however, the ATM-CES port adapter supports other types of VCs than data VCs (for example CES VCs). Also, the ATM-CES port adapter can multiplex one or more VCs over a single virtual path (VP) that is shaped, and the VP only requires a single transmit channel. Therefore, the term *transmit channel* is used rather than *virtual circuit*.

Maximum Burst

The maximum burst of packets that are allowed per VC is limited by the number of transmit descriptors allocated per VC. Because the total number of transmit descriptors available is limited by the available SRAM space, configuration of the number of transmit channels for the interface determines the number of transmit descriptors for each transmit channel. Hence the burst size for each transmit channel is determined by the **atm max-channels** command. For example, for 64 (the default) transmit channels for the interface, 255 transmit descriptors are associated per channel, and for 512 transmit channels for the interface, 31 transmit descriptors are associated per channel.

To display information about the transmit descriptors, use the **show atm interface atm** command.

Examples

The following example sets the number of transmit descriptors for the interface to 120.

```
interface atm 2/0
 atm max-channels 120
```

Related Commands

Command	Description
show atm interface atm	Displays ATM-specific information about an ATM interface.

atm maxvc

To set the ceiling value of the virtual circuit descriptor (VCD) on the ATM interface, use the **atm maxvc** interface configuration command. To restore the default value, use the **no** form of this command.

atm maxvc *number*

no atm maxvc

Syntax Description

number	Maximum number of supported virtual circuits. Valid values are 256, 512, 1024, or 2048.

Defaults

2048 virtual circuits

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is supported on Cisco 7500 series routers; it is not supported on the Cisco 4500 and Cisco 4700 routers, which have a fixed maximum of 1024 VCs.

This command sets the maximum value supported for the *vcd* argument in the **atm pvc** command. It also determines the maximum number of virtual circuits on which the AIP allows segmentation and reassembly (SAR) to occur. However, if you set a **maxvc** limit and then enter the **atm pvc** command with a larger value for the *vcd* argument, the software does not generate an error message.

This command does not affect the virtual path identifier (VPI)-virtual channel identifier (VCI) pair of each virtual circuit.

Examples

The following example sets a ceiling VCD value of 1024 and restricts the AIP to supporting no more than 1024 virtual circuits:

```
atm maxvc 1024
```

Related Commands

Command	Description
pvc	Creates or assigns a name to an ATM PVC, specifies the encapsulation type on an ATM PVC, or enters interface-ATM-VC configuration mode.

atm mid-per-vc

To limit the number of message identifier (MID) numbers allowed on each virtual circuit, use the **atm mid-per-vc** interface configuration command.

atm mid-per-vc *maximum*

Syntax Description

maximum	Number of MIDs allowed per virtual circuit on this interface. The values allowed are 16, 32, 64, 128, 256, 512, and 1024.

Defaults

16 MIDs per virtual circuit.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command is supported on Cisco 7200 and 7500 series routers.

MID numbers are used by receiving devices to reassemble cells from multiple sources into packets.

This command limits the number of discrete messages allowed on the PVC at the same time. It does not limit the number of cells associated with each message.

The *maximum* set by the **atm mid-per-vc** command overrides the range between the *midhigh* and *midlow* values set by the **atm pvc** command. If you set a *maximum* of 16 but a *midlow* of 0 and a *midhigh* of 255, only 16 MIDs (not 256) are allowed on the virtual circuit.

Examples

The following example allows 64 MIDs per ATM virtual circuit:

```
atm mid-per-vc 64
```

Related Commands

Command	Description
pvc	Configures the PVC interface.

atm multicast

To assign a Switched Multimegabit Data Service (SMDS) E.164 multicast address to the ATM subinterface that supports ATM adaptation layer 3/4 (AAL3/4) and SMDS encapsulation, use the **atm multicast** interface configuration command.

atm multicast *address*

Syntax Description

address	Multicast E.164 address assigned to the subinterface.

Defaults

No multicast E.164 address is defined.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command is supported on Cisco 7500 series, Cisco 4500, and Cisco 4700 routers. This command is not supported on the ATM port adapter.

Each AAL3/4 subinterface is allowed only one multicast E.164 address. This multicast address is used for all protocol broadcast operations.

Examples

The following example assigns a multicast E.164 address to the ATM subinterface that is being configured:

```
atm multicast e180.0999.000
```

Related Commands

Command	Description
abr	Selects ABR QoS and configures output peak cell rate and output minimum guaranteed cell rate for an ATM PVC or VC class.
atm smds-address	Assigns a unicast E.164 address to the ATM subinterface that supports AAL3/4 and SMDS encapsulation.
pvc	Configures the PVC interface.

atm multipoint-interval

To specify how often new destinations can be added to multipoint calls to an ATM switch in the network, use the **atm multipoint-interval** interface configuration command. To return to the default interval, use the **no** form of this command.

atm multipoint-interval *interval*

no atm multipoint-interval *interval*

Syntax Description

interval	Interval length in seconds, in the range from 0 to 4294967.

Defaults

30 seconds

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.

Usage Guidelines

This command applies to switched virtual circuits (SVCs) only, not to permanent virtual circuits (PVCs).

This command has no effect unless ATM multipoint signalling is enabled on the interface.

Examples

The following example enables point-to-multipoint signalling on the ATM interface 2/0. It also specifies that new destinations can be added to multipoint calls every 60 seconds:

```
interface atm 2/0
 atm multipoint-signalling
 atm multipoint-interval 60
```

Related Commands

Command	Description
atm multipoint-signalling	Enables point-to-multipoint signalling to the ATM switch.

atm multipoint-signalling

To enable point-to-multipoint signalling to the ATM switch, use the **atm multipoint-signalling** interface configuration command. To disable point-to-multipoint signalling to the ATM switch, use the **no** form of this command.

atm multipoint-signalling

no atm multipoint-signalling

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.
11.1	Functionality was changed to allow this command on all subinterfaces, not just the main interface.

Usage Guidelines

If multipoint signalling is enabled, the router uses existing static map entries that have the **broadcast** keyword set to establish multipoint calls. One call is established for each logical subnet of each protocol.

All destinations are added to the call. One multicast packet is sent to the ATM switch for each multipoint call. The ATM switch replicates the packet to all destinations.

The **atm multipoint-interval** command determines how often new destinations can be added to a multipoint call.

Note Prior to Release 11.1, when this command was used on the main interface, it also affected all subinterfaces. For Release 11.1 and later, explicit configuration on each subinterface is required to obtain the same functionality.

Examples

The following example enables point-to-multipoint signalling on the ATM interface 2/0:

```
interface atm 2/0
 atm multipoint-signalling
```

Related Commands

Command	Description
atm multipoint-interval	Specifies how often new destinations can be added to multipoint calls to an ATM switch in the network.

atm nsap-address

To set the network service access point (NSAP) address for an ATM interface using switched virtual circuit (SVC) mode, use the **atm nsap-address** interface configuration command. To remove any configured address for the interface, use the **no** form of this command.

atm nsap-address *nsap-address*

no atm nsap-address

Syntax Description

nsap-address	The 40-digit hexadecimal NSAP address of this interface (the source address).

Defaults

No NSAP address is defined for this interface.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

When configuring an SVC, you must use the **atm nsap-address** command to define the source NSAP address. It identifies a particular port on the ATM network and must be unique across the network.

Note When the Integrated Local Management Interface (ILMI) is configured, use the **atm esi-address** command instead of the **atm nsap-address** command. The **atm esi-address** and **atm nsap-address** commands are mutually exclusive. Configuring the router with the **atm esi-address** command negates the **atm nsap-address** setting, and vice versa.

Configuring a new address on the interface overwrites the previous address. The router considers the address as a string of bytes and will not prefix or suffix the address with any other strings or digits. The complete NSAP address must be specified, because this value is used in the Calling Party Address Information Element in the SETUP message to establish a virtual circuit.

ATM NSAP addresses have a fixed length of 40 hexadecimal digits. You must configure the complete address in the following dotted format:

```
xx.xxxx.xx.xxxxxx.xxxx.xxxx.xxxx.xxxx.xxxx.xxxx.xx
```

Note All ATM NSAP addresses should be entered in the dotted hexadecimal format shown above, which conforms to the User-Network Interface (UNI) specification.The dotted method provides some validation that the address is a legal value. If you know your address format is correct, the dots may be omitted.

Examples

In the following example, the source NSAP address for the interface is AB.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12:

```
atm nsap-address AB.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12
```

atm oam flush

To drop all current and future Operation, Administration, and Maintenance (OAM) cells received on an ATM interface, use the **atm oam flush** interface configuration command. To receive OAM cells on an ATM interface, use the **no** form of this command.

atm oam flush

no atm oam flush

Syntax Description

This command has no arguments or keywords.

Defaults

Dropping of OAM cells is disabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.3	This command was introduced.

Examples

The following example drops all current and future OAM cells received on the ATM main interface with slot 0 and port 0:

```
interface atm 0/0
 atm oam flush
```

atm oversubscribe

To manage bandwidth for service categories other than constant bit rate (CBR), use the **atm overscribe** global configuration command on a per-ATM-interface basis. To disable bandwidth management, use the **no** form of the command.

atm oversubscribe

no atm oversubscribe

Syntax Description

This command has no arguments or keywords.

Defaults

The default is to allow as much bandwidth as possible with no upper limits. The **no** form of the **atm overscribe** command enables bandwidth management on any ATM interface you specify.

Command Modes

Global configuration

Command History

Release	Modification
12.0(3)T	This command was introduced.

Usage Guidelines

When you type the enabling command (the **no** version), a check determines if the ATM link is already oversubscribed. If so, the command is rejected. Otherwise, the total bandwidth available on the link is recorded and all future connection setup requests are monitored to ensure that the link is not oversubscribed.

The bandwidth allocated for each service category is displayed in the output of the **show atm interface atm** command.

The ATM bandwidth manager keeps track of bandwidth used by VCs on a per-interface basis. Because many services require guaranteed bandwidth (for variable bit rate-real time (VBR-RT), available bit rate (ABR), CBR, for instance), bandwidth management is required. The purpose of the bandwidth manager is to reserve resources for connections that require guaranteed services. Bandwidth management for CBR is turned on automatically for all interfaces supporting CBR. Bandwidth management for other service categories must be turned on by the user. All service categories outside CBR is monitored only if specifically requested.

Note Because unspecified bit rate (UBR) does not provide any guarantees, bandwidth specified for a UBR connection is not used in any calculations.

In all cases, bandwidth check for a PVC is done when the PVC is configured. Bandwidth check for a SVC is done when a signalling call is placed or received.

When you specify the **atm pvp** command, the system checks if the specified bandwidth is available on the interface. If the bandwidth available is greater than or equal to the peak rate specified for the Permanent Virtual Path (PVP), the command is accepted, otherwise the command is rejected.

Within the VC mode the steps taken to check for bandwidth available are to ascertain if the bandwidth is already used by the VC to fulfill the request. If the VC being configured is a PVC and belongs to a PVP, the bandwidth available on the PVP is used for the check; otherwise the bandwidth available on the interface is used for the check.

When configuring services within a VC class, the steps taken are to check if the new bandwidth requirement can be fulfilled for all VCs using the class (on a per-interface basis), by comparing with the bandwidth available on the corresponding interface.

Bandwidth checking for an SVC occurs before a SETUP message is sent for an outbound call. If the bandwidth check fails, the SETUP message is not sent. If the bandwidth check passes, the traffic class from which the service category is inherited, is updated with the requirements for the new SVC.

When an SVC setup is requested for remotely initiated calls, a bandwidth check occurs as soon as the SETUP message is received. This bandwidth check has two components:

- Match the bandwidth requested by the remote end with the bandwidth configured locally.
- Check if bandwidth configured locally can be satisfied currentl.

If the bandwidth check fails, a RELEASE message is sent out and the call is rejected. If the bandwidth check passes, resources are reserved for the VC and the call is accepted.

Examples

The following example displays the available bandwidth after you enter VC mode. Notice that the bandwidth is specified in kbps.

```
Router# show atm interface atm 2/0
 Interface ATM2/0:
 AAL enabled: AAL5, Maximum VCs:1024, Current VCCs:5

 Maximum Transmit Channels:64
 Max. Datagram Size:4496
 PLIM Type:SONET - 155Mbps, TX clocking:LINE
 Cell-payload scrambling:OFF
 sts-stream scrambling:ON
 877 input, 120843834 output, 0 IN fast, 20 OUT fast
 ABR parameters, rif:16 rdf:16, 0 out drop
 Bandwidth distribution :CBR :16000  Avail bw = 139000
 Config. is ACTIVE
```

Notice that the bandwidth is specified as (139000) kbps.

atm pvp

To create a permanent virtual path (PVP) used to multiplex (or bundle) one or more virtual circuits (VCs), use the **atm pvp** interface configuration command. To remove a PVP, use the **no** form of this command.

atm pvp *vpi* [*peak-rate*]

no atm pvp *vpi*

Syntax Description

vpi	ATM network virtual path identifier (VPI) of the VC to multiplex on the permanent virtual path. The range is 0 to 255. The VPI is an 8-bit field in the header of the ATM cell. The VPI value is unique only on a single link, not throughout the ATM network because it has local significance only. The VPI value must match that of the switch. The number specified for the *vpi* must not already exist. If the number specified for the *vpi* is already being used by an existing VC, this command is rejected.
peak-rate	(Optional) Maximum rate in kbps at which the PVP can transmit data. The range is 84 kbps to line rate. The default is the line rate.

Defaults

PVP is not configured.

The default *peak-rate* is the line rate.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

This command is commonly used to create a PVP that is used multiplex circuit emulation service (CES) and data VCs.

The ATM-CES port adapter supports multiplexing of one or more VCs over a virtual path that is shaped at a constant bandwidth. For example, you can buy a virtual path service from an ATM service provider and multiplex both the CES and data traffic over the virtual path.

All subsequently created VCs with a *vpi* argument matching the *vpi* specified with the **atm pvp** command are multiplexed onto this PVP. This PVP connection is an ATM connection where switching is performed on the VPI field of the cell only. A PVP is created and left up indefinitely. All VCs that are multiplexed over a PVP share and are controlled by the traffic parameters associated with the PVP.

Changing the *peak-rate* argument causes the ATM-CES port adapter to go down and then back up.

When you create a PVP, two VC are created (VCI 3 and 4) by default. These VCs are created for VP end-to-end loopback and segment loopback OAM support.

To verify the configuration of a PVP, use the **show atm vp** EXEC command.

Examples

The following example creates a permanent virtual path with a peak rate of 2000 kbps. The subsequent VC created are multiplexed onto this virtual path.

```
interface atm 6/0
 atm pvp 1 2000
 atm pvc 13 1 13 aal5snap
 exit
interface cbr 6/1
 ces circuit 0
 ces pvc 9 interface atm6/0 vpi 1 vci 100
 exit
```

Related Commands

Command	Description
show atm vp	Displays the statistics for all VPs on an interface or for a specific VP.

atm rate-queue

To create a permanent rate queue or specify a rate queue tolerance, use the **atm rate-queue** interface configuration command. To remove a rate queue or rate queue tolerance, use the **no** form of this command.

atm rate-queue {*queue-number speed* | **tolerance svc** [**pvc**] *tolerance-value* [**strict**]}

no atm rate-queue {*queue-number speed* | **tolerance svc** [**pvc**] *tolerance-value* [**strict**]}

Syntax Description

queue-number	Queue number in the range 0 through 7 on the ATM Interface Processor (AIP) for Cisco 7500 series routers, and in the range 0 through 3 on the network processing module (NPM) for Cisco 4500 and Cisco 4700 routers. On the AIP, queues 0 through 3 are in the high-priority bank, and queues 4 through 7 are in the low-priority bank. Queues in the same priority bank have the same priority; for example, queues 0 and 3 have the same priority. On the NPM, all 4 queues have the same priority.
speed	Speed in megabits per second (Mbps) in the range from 1 through 155. The maximum speed is determined by the detected physical layer inteface module (PLIM) type on the AIP or NPM: • 34 Mbps for E3 • 45 Mbps for DS-3 • 100 Mbps for Transparent Asynchronous Transmitter/Receiver Interface (TAXI) • 155 Mbps for Synchronous Optical Network (SONET)
tolerance	Specifies that you want to use a rate queue tolerance value.
svc	Specifies that the *tolerance-value* will be applied to SVCs.
pvc	(Optional) If specified, the *tolerance-value* will be applied to PVCs.
tolerance-value	A tolerance level expressed as a percentage used for assigning rate queues for each virtual circuit (VC) with a requested peak rate. This value is applied to switched virtual circuits (SVCs), discovered VCs, and permanent virtual circuits (PVCs) (when the **pvc** keyword is used). This value can be 0 or 5 through 99. For SVCs and discovered VCs, the default value is 10. For PVCs, the default value is 0.
strict	(Optional) Indicates whether SVC traffic-shaping parameters are altered beyond the SVC tolerance or rejects the incoming call.

Defaults

No rate queue is defined. The default rate-queue tolerance for SVCs and discovered VCs is 10. For PVCs, it is 0.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3	The following keywords were added: • **tolerance** • **svc**

Usage Guidelines

If a PVC or SVC is created, and its rate queue does not match a permanent rate queue that was created using the **atm-rate queue** *queue-number speed* command, one of the following will occur:

- The PVC or SVC will use an existing rate queue if the PVC's or SVC's rate queue falls within the *tolerance-value* specified.
- The software will dynamically create a new and unique rate queue if the PVC or SVC does not fall within a previously configured rate-queue tolerance.

If you do not create permanent rate queues or if you create PVCs with peak or average rates that are not matched by the rate queues you configure, the software dynamically creates rate queues as necessary to satisfy the requests of the **atm pvc** commands.

You can create multiple rate queues. A warning message appears if all rate queues are deconfigured or if the combined rate queues exceed the PLIM rate.

Examples

The following example configures a permanent rate queue with a *queue-number* of 1 and a *speed* of 100 Mbps:

```
atm rate-queue 1 100
```

The following example configures a rate queue with a *tolerance-value* of 20 which will apply to SVCs, discovered VCs, and PVCs.

```
interface atm 2/0
 atm rate-queue tolerance svc pvc 20
```

Related Commands

Command	Description
pvc	Configures the PVC interface.
svc	Creates an ATM SVC and specifies the destination NSAP address on a main interface or subinterface.

atm rawq-size

To define the ATM Interface Processor (AIP) raw-queue size, use the **atm rawq-size** interface configuration command. To restore the default value, use the **no** form of this command.

atm rawq-size *number*

no atm rawq-size

Syntax Description

number	Maximum number of cells in the raw queue simultaneously, in the range from 8 through 256.

Defaults

32 cells

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is supported on the Cisco 7200 and 7500 series routers, but not on the Cisco 4500 and Cisco 4700 routers.

The raw queue is used for raw ATM cells, which include Operation, Administration, and Maintenance (OAM) (F4 and F5) and Interim Local Management Interface (ILMI) cells.

Examples

The following example allows a maximum of 48 cells in the raw queue:

```
atm rawq-size 48
```

atm rxbuff

To set the maximum number of receive buffers for simultaneous packet reassembly, use the **atm rxbuff** interface configuration command. To restore the default value, use the **no** form of this command.

atm rxbuff *number*

no atm rxbuff

Syntax Description

number	Maximum number of packet reassemblies that the ATM Interface Processor (AIP) can perform simultaneously, from 0 to 512.

Defaults

256 packet reassemblies

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is supported on AIP for Cisco 7500 series routers. This command is not supported on the ATM port adapter for Cisco 7200 and 7500 series routers, nor is it supported on Cisco 4500 and Cisco 4700 routers.

Examples

The following example allows the AIP to perform a maximum of 300 packet reassemblies simultaneously:

```
atm rxbuff 300
```

atmsig close atm

To disconnect a switched virtual circuit (SVC), use the **atmsig close atm** EXEC command.

AIP on Cisco 7500 series; ATM, ATM-CES, enhanced ATM port adapter on Cisco 7200 series; 1-port ATM-25 network module on Cisco 2600 and 3600 series

atmsig close atm *slot*/*port vcd*

ATM and enhanced ATM port adapter on Cisco 7500 series

atmsig close atm *slot*/*port-adapter*/*port vcd*

NPM on Cisco 4500 and Cisco 4700

atmsig close atm *number vcd*

Syntax Description

slot	ATM slot number. Use this format for the following platform configurations: • AIP on Cisco 7500 series routers. • ATM port adapter, ATM-CES port adapter, or enhanced ATM port adapter on Cisco 7200 series routers. • 1-port ATM-25 network module on Cisco 2600 and 3600 series routers.
/port	ATM port number. Because the AIP and all ATM port adapters have a single ATM interface, the port number is always 0.
vcd	Virtual circuit descriptor of the signalling SVC to close.
slot/port-adapter	ATM slot number and port adapter number. Use this format for the ATM port adapter or ATM-CES port adapter on Cisco 7500 series routers.
number	ATM network processor module number for the NPM on Cisco 4500 and Cisco 4700 routers.

Command Modes

EXEC

Command History

Release	Modification
10.3	This command was introduced.
11.1	The *number* argument was added.

Usage Guidelines

Execute this command if you want to close a particular SVC. Because virtual circuits are numbered per interface, you must specify the ATM interface by its slot number.

Examples

The following example closes SVC 2 on ATM interface 4/0:

```
atmsig close atm4/0 2
```

atm sig-traffic-shaping strict

To specify that a switched virtual circuit (SVC) should be established on an ATM interface only if shaping can be done per the signaled traffic parameters, use the **atm sig-traffic-shaping strict** interface configuration command. To disable strict traffic shaping, use the **no** form of this command.

atm sig-traffic-shaping strict

no atm sig-traffic-shaping strict

Syntax Description

This command has no arguments or keywords.

Defaults

The default value is lenient (not strict) traffic shaping for SVCs.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command is supported on the Cisco 7500 series routers, Cisco 4500 routers, and Cisco 4700 routers. This command is not supported on the ATM port adapter.

If strict traffic shaping is configured on the router ATM interface, then an SVC is established only if traffic shaping can be provided for the transmit cell flow per the signaled traffic parameters. If such shaping cannot be provided, the SVC is released.

If strict traffic shaping is not configured on the router ATM interface, an attempt is made to establish an SVC with traffic shaping for the transmit cell flow per the signaled traffic parameters. If such shaping cannot be provided, the SVC is installed with default shaping parameters (it behaves as though a PVC were created without specifying traffic parameters).

The signalling SETUP message carries the forward and backward traffic parameters. For connections initiated by the source router, traffic is shaped to the SETUP message forward parameters. For connections initiated by another router or host, traffic is shaped to the backward parameters.

Examples

The following example allows an SVC to be established on an ATM interface using only signaled traffic parameters:

```
atm sig-traffic-shaping strict
```

atm smds-address

To assign a unicast E.164 address to the ATM subinterface that supports ATM adaptation layer 3/4 (AAL3/4) and Switched Multimegabit Data Service (SMDS) encapsulation, use the **atm smds-address** interface configuration command.

atm smds-address *address*

Syntax Description

address	Unicast E.164 address assigned to the subinterface.

Defaults

No E.164 address is assigned.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command is supported on Cisco 7500 series routers, Cisco 4500 routers, and Cisco 4700 routers. This command is not supported on the ATM port adapter.

Each AAL3/4 subinterface is allowed only one unicast E.164 address.

Examples

The following example assigns a unicast E.164 address to the ATM subinterface that is being configured:

```
atm smds-address c141.555.1212
```

Related Commands

Command	Description
abr	Selects ABR QoS and configures output peak cell rate and output minimum guaranteed cell rate for an ATM PVC or VC class.
atm aal aal3/4	Enables support for ATM adaptation layer 3/4 (AAL3/4) on an ATM interface.
atm multicast	Assigns an SMDS E.164 multicast address to the ATM subinterface that supports AAL3/4 and SMDS encapsulation.
pvc	Configures the PVC interface.

atm sonet stm-1

To set the mode of operation and thus control type of ATM cell used for cell-rate decoupling on the SONET physical layer interface module (PLIM), use the **atm sonet stm-1** interface configuration command. To restore the default Synchronous Transport Signal level 3, concatenated (STS-3c) operation, use the **no** form of this command.

atm sonet stm-1

no atm sonet stm-1

Syntax Description

This command has no arguments or keywords.

Defaults

STS-3c

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Use STM-1 in applications where the ATM switch requires “idle cells” for rate adaptation. An idle cell contains 31 zeros followed by a one. STM-1 is defined as a Synchronous Digital Hierarchy/Synchronous Transport Signal level 1 (SDH/STM-1) operation (ITU-T specification).

Use the default (STS-3c) in applications where the ATM switch requires “unassigned cells” for rate adaptation. An unassigned cell contains 32 zeros.

Examples

The following example specifies ATM SONET STM-1:

```
atm sonet stm-1
```

atm txbuff

To set the maximum number of transmit buffers for simultaneous packet fragmentation, use the **atm txbuff** interface configuration command. To restore the default value, use the **no** form of this command.

atm txbuff *number*

no atm txbuff

Syntax Description

number	Maximum number of packet fragmentations that the ATM Interface Processor (AIP) can perform simultaneously, from 0 to 512.

Defaults

256

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is supported on the AIP for Cisco 7500 series routers. This command is not supported on the ATM port adapter for Cisco 7200 and 7500 series routers, nor is it supported on Cisco 4500 and Cisco 4700 routers.

Examples

The following example configures the AIP to perform up to 300 packet fragmentations simultaneously:

```
atm txbuff 300
```

atm uni-version

To specify the User-Network Interface (UNI) version (3.0 or 3.1) the router should use when Interim Local Management Interface (ILMI) link autodetermination is unsuccessful or ILMI is disabled, use the **atm uni-version** interface configuration command. To restore the default value to 3.0, use the **no** form of this command.

atm uni-version *version-number*

no atm uni-version *version-number*

Syntax Description

version-number	UNI version selected on an interface. Valid values are 3.0 and 3.1.

Defaults

Version 3.0

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Normally, when the ILMI link autodetermination is enabled on the interface and is successful, the router accepts the UNI version returned by ILMI. If the ILMI link autodetermination is unsuccessful or ILMI is disabled, the UNI version defaults to 3.0. You can override the default UNI version by using this command to enable UNI 3.1 signalling support. The **no** form of the command sets the UNI version to one returned by ILMI if ILMI is enabled and the link autodetermination process is successful. Otherwise, the UNI version reverts to 3.0.

Examples

The following example specifies UNI version 3.1 signalling port on the ATM interface 2/0:

```
interface atm 2/0
 atm uni-version 3.1
```

atm vc-per-vp

To set the maximum number of virtual channel identifier (VCIs) to support per virtual path identifier (VPI), use the **atm vc-per-vp** interface configuration command. To restore the default value, use the **no** form of this command.

atm vc-per-vp *number*

no atm vc-per-vp

Syntax Description

number	Maximum number of VCIs to support per VPI. See the following list for valid values: • **AIP for Cisco 7500 series**—Valid values are 16, 32, 64, 128, 256, 512, and 1024. • **ATM port adapter for Cisco 7200 series and 7500 series**—Valid values are 16, 32, 64, 128, 256, 512, 1024, and 2048. • **NPM for Cisco 4500 and Cisco 4700 routers**—Valid values are 32, 64, 128, 256, 512, 1024, 2048, 4096, and 8192. • **Network module with IMA for the Cisco 2600 series and 3600 series**—Valid values are 256, 512, and 1024.

Defaults

1024

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command controls the memory allocation in the ATM Interface Processor (AIP), ATM port adapter, ATM network module, or network processor module (NPM) to deal with the VCI table.

An invalid VCI causes a warning message to be displayed.

Cisco 2600 and 3600 series with IMA

Note For Cisco 2600 and 3600 series with IMA, changing the value of the **atm vc-per-vp** command on one interface affects all of the interfaces on that network module.

Table 3 lists the possible VCI ranges and corresponding VPI ranges for the Cisco 2600 and 3600 series with IMA.

Table 3 VCI and VPI Ranges for Cisco 2600 and 3600 Series with IMA

VCI Range	VPI Range
0–255	0–15, 64–79, 128–143, and 192–207
0–511	0–15, 64–79
0–1023	0–15

Examples

The following example sets the maximum number of VCIs per VPI to 512:

```
atm vc-per-vp 512
```

Related Commands

Command	Description
pvc	Configures the PVC interface.

atm vp-filter

To set the ATM Interface Processor (AIP) filter register, use the **atm vp-filter** interface configuration command. To restore the default value, use the **no** form of this command.

atm vp-filter *hexvalue*

no atm vp-filter

Syntax Description

hexvalue	Value in hexadecimal format.

Defaults

0x7B

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is supported on Cisco 7500 series routers, but not on Cisco 4500 and Cisco 4700 routers. This command is not supported on ATM port adapters.

This command allows you to specify a virtual path identifier (VPI) or range of VPIs to be used for ATM adaptation layer 3/4 (AAL3/4) processing. All other VPIs map to AAL5 processing. If only AAL5 processing is required, you can either let the virtual path filter default or set it to an arbitrary VPI so that AAL5 processing is performed on all VPIs.

This command configures the hexadecimal value used in the virtual path filter register in the reassembly operation. The virtual path filter comprises 16 bits. The virtual path filter register uses the most significant bits (bits 15 through 8, the left half of the filter) as mask bits, and uses bits 7 through 0 (the right half of the filter) as compare bits.

When a cell is received, the right half of the filter is exclusively NORed with the binary value of the incoming VPI. The result is then ORed with the left half of the filter (the mask). If the result is all 1s, then reassembly is done using the VCI/message identifier (MID) table (AAL3/4 processing). Otherwise, reassembly is done using the VPI-VCI pair table (AAL5 processing).

Examples

In the following example, all incoming cells are reassembled using AAL3/4 processing:

```
atm vp-filter ff00
```

In the following example, all incoming cells with the virtual path equal to 0 are reassembled using AAL3/4 processing; all other cells are reassembled using AAL5 processing:

```
atm vp-filter 0
```

In the following example, all incoming cells with the most significant bit of the virtual path set are reassembled using AAL3/4 processing; all other cells are reassembled using AAL5 processing:

```
atm vp-filter 7f80
```

broadcast

To configure broadcast packet duplication and transmission for an ATM virtual circuit (VC) class, permanent virtual circuit (PVC), switched virtual circuit (SVC), or VC bundle, use the **broadcast** command in the appropriate command mode. To disable transmission of broadcast packets for your ATM VC class, PVC, SVC, or VC bundle, use the **no** form of this command. To restore the default behavior according to the description in the following "Usage Guidelines" section, use the **default** form of this command.

broadcast

no broadcast

default broadcast

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled. For classical IP SVCs, broadcast is enabled.

Command Modes

Interface-ATM-VC configuration (for ATM PVCs and SVCs)

VC-class configuration (for a VC-class)

Bundle configuration (for a VC bundle)

PVC range configuration (for an ATM PVC range)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3 T	This command was introduced.
12.0(3)T	Enhancements were added for configuration of broadcast packet duplication and transmission for an ATM VC bundle.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.

Usage Guidelines

If broadcasting and multipoint signalling are enabled on an SVC, a multipoint SVC will be created to handle the SVC.

Note If you use the **broadcast** command to configure broadcasting for an ATM PVC or SVC, VC-class, or VC bundle, this configuration takes precedence over any previous configuration using the **broadcast** command.

If the **broadcast** command is not explicitly configured on an ATM PVC, SVC, or VC bundle, the VC inherits the following default configuration (listed in order of precedence):

- Configuration of the **broadcast** command in a VC class assigned to the PVC, SVC, or VC bundle itself.
- Configuration of the **broadcast** command in a VC class assigned to the PVC's, SVC's, or VC bundle's ATM subinterface.
- Configuration of the **broadcast** command in a VC class assigned to the PVC's, SVC's, or VC bundle's ATM main interface.

Note When a VC is a member of a VC bundle, configuration using the **broadcast** command in VC-class configuration mode no longer applies to the VC. Bundle configuration takes precedence.

To use the **broadcast** command in bundle configuration mode, enter the **bundle** command to enact bundle configuration mode for the bundle for which you want to enable broadcast forwarding.

Examples

The following example enables the transmission of broadcast packets on an ATM PVC named router5:

```
pvc router5 1/32
 broadcast
```

The following example enables the transmission of broadcast packets on an ATM PVC bundle named chicago:

```
bundle chicago
 broadcast
```

Related Commands

Command	Description
class-int	Assigns a VC class to an ATM main interface or subinterface.
class-vc	Assigns a VC class to an ATM PVC, SVC, or VC bundle member.
encapsulation	Sets the encapsulation method used by the interface.
inarp	Configures the Inverse ARP time period for an ATM PVC, VC class, or VC bundle.
oam-bundle	Enables end-to-end F5 OAM loopback cell generation and OAM management for a virtual circuit class that can be applied to a virtual circuit bundle.
oam retry	Configures parameters related to OAM management for an ATM PVC, SVC, VC class, or VC bundle.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle. Enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).
ubr	Configures UBR QoS and specifies the output peak cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
ubr+	Configures UBR QoS and specifies the output peak cell rate and output minimum guaranteed cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
vbr-nrt	Configures the VBR-NRT QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size for an ATM PVC, SVC, VC class, or VC bundle member.

cbr

To configure the constant bit rate (CBR) for the ATM circuit emulation service (CES) for an ATM permanent virtual circuit (PVC) on the Cisco MC3810, use the **cbr** command in the appropriate configuration mode. To restore the default, use the **no** form of this command.

cbr *rate*

no cbr *rate*

Syntax Description

rate	Constant bit bate (also known as the average cell rate) for ATM CES. The valid range for this command is from 56 to 10,000 kbps.

Defaults

The CBR is not configured.

Command Modes

Interface-ATM-VC configuration (for ATM PVCs and SVCs)

PVC range configuration (for an ATM PVC range)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
12.0	This command was introduced.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.

Usage Guidelines

This command applies to ATM configuration on the Cisco MC3810.

Examples

The following example configures the constant bit rate on ATM PVC 20 on the Cisco MC3810:

```
pvc 20
 cbr 56
```

Related Commands

Command	Description
ces cell-loss-integration-period	Sets the CES cell-loss integration period on the Cisco MC3810 multiservice concentrator.
ces clockmode synchronous	Configures the ATM CES synchronous clock mode on the Cisco MC3810 multiservice concentrator.
ces connect	Maps the CES service to an ATM PVC on the Cisco MC3810 multiservice concentrator.
ces initial-delay	Configures the size of the receive buffer of a CES circuit on the Cisco MC3810 multiservice concentrator.

Command	Description
ces max-buf-size	Configures the send buffer of a CES circuit on the Cisco MC3810 multiservice concentrator.
ces partial-fill	Configures the number of user octets per cell for the ATM CES on the Cisco MC3810 multiservice concentrator.
ces service	Configures the ATM CES type on the Cisco MC3810 multiservice concentrator.
encapsulation atm-ces	Enables CES ATM encapsulation on the Cisco MC3810 multiservice concentrator.

ces

To configure Circuit Emulation Service (CES) on a router port and enter CES configuration mode, use the **ces** global configuration command.

ces *slot/port*

Syntax Description

slot/port	Backplane slot number and port number on the interface. The port value is always 0 as the interface configuration applies to all ports in the slot.

Defaults

No CES interface is configured.

Command Modes

Global configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

This command is used on Cisco 2600 series and 3600 series routers that have OC-3/STM-1 ATM CES network modules.

The **ces** command enters CES configuration mode. Use CES configuration mode to configure CES parameters such as the CES clock.

Examples

The following example configures the CES interface in slot 2:

```
ces 2/0
```

Related Commands

Command	Description
clock-select	Allows the selection of clock sources and priority.

ces aal1 clock

To configure the ATM adaptation layer 1 (AAL1) timing recovery clock for the constant bit rate (CBR) interface, use the **ces aal1 clock** interface configuration command. To return the clock to the default, use the **no** form of this command.

ces aal1 clock {**adaptive** | **srts** | **synchronous**}

no ces aal1 clock

Syntax Description

adaptive	Adjusts output clock on a received AAL1 on FIFO basis. Use in unstructured mode.
srts	Sets the clocking mode to synchronous residual time stamp.
synchronous	Configures the timing recovery to synchronous for structured mode.

Defaults

synchronous

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

The clock mode must be **synchronous** for structured mode. In unstructured mode, use the **adaptive** keyword when a network-derived clock is not available.

Use the **srts** keyword when a network-derived clock is available but devices attached to the CES port use a different clock reference. The **srts** keyword samples the incoming clock, subtracts from the network clock, and sends the remainder in an AAL1 header. The clock is reconstructed during output by adding the residual to the network reference.

Use the **synchronous** keyword for all other modes.

Examples

The following command sets the AAL1 timing recovery clock to adaptive mode:

```
interface cbr 4/0
 ces aal1 clock adaptive
```

Related Commands

Command	Description
ces aal1 service	Configures the type of CES used on the CBR interface.
ces dsx1 clock source	Configures a transmit clock source for the CBR interface.
network-clock-select (ATM)	Establishes the sources and priorities of the requisite clocking signals for an ATM-CES port adapter.

ces aal1 service

To configure the type of circuit emulation service used on the constant bit rate (CBR) interface, use the **ces aal1 service** interface configuration command. To return the type of service to unstructured, use the **no** form of this command.

ces aal1 service {**structured** | **unstructured**}

no ces aal1 service

Syntax Description

structured	Sets the type of service to structured (cross-connect).
unstructured	Sets the type of service to unstructured (clear-channel).

Defaults

unstructured

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

The **structured** keyword means that each time slot is an independent entity grouped into circuits, where each circuit has an independent permanent virtual circuit (PVC).

The **unstructured** keyword reduces the incoming serial data on the receiving end of the ATM network. The keyword also sets the service to single circuit, single PVC, where all time slots are carried.

Examples

The following example changes the mode for the **ces aal1 service** command to structured:

```
interface cbr 4/0
 ces aal1 service structured
```

Related Commands

Command	Description
ces aal1 clock	Configures the AAL1 timing recovery clock for the CBR interface.
ces circuit	Configures the connection attributes for the CBR interface.
ces dsx1 clock source	Configures a transmit clock source for the CBR interface.
ces dsx1 framing	Selects the frame type for the data line on the CBR interface.
ces dsx1 lbo	Configures cable length for the CBR interface.
ces dsx1 linecode	Selects the line code type for the CBR interface.
ces dsx1 loopback	Enables a loopback for the CBR interface.
ces dsx1 signalmode robbedbit	Enables the signal mode as robbed bit on a CBR interface.

Command	Description
ces pvc	Configures the destination port for the circuit on the CBR interface.
show ces circuit	Displays detailed circuit information for the CBR interface.
show ces interface cbr	Displays detailed CBR port information.
show ces status	Displays the status of the ports on the ATM-CES port adapter.
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

ces-cdv

To set the cell delay variation, use the **ces-cdv** interface-ATM-VC configuration command.

ces-cdv *time*

Syntax Description

time	Maximum tolerable cell arrival jitter with a range of 1 to 65535 microseconds.

Defaults

5000 microseconds

Command Modes

Interface-ATM-VC configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

This command is used on Cisco 2600 series and 3600 series routers that have OC-3/STM-1 ATM CES network modules.

Examples

The following example configures the maximum tolerable cell arrival jitter at 7500 microseconds:

```
interface atm1/0
 pvc 0 0/41 ces
  ces-cdv 7500
```

Related Commands

Command	Description
interface atm	Configures the ATM interface.
svc	Configures the SVC.

ces circuit

To configure the connection attributes for the constant bit rate (CBR) interface, use the **ces circuit** interface configuration command. To return the connection attributes to the default or to enable the circuit, use the **no** form of this command.

ces circuit *circuit-number* [**cas**] [**cdv** *range*] [**circuit-name** *name*] [**on-hook-detection** *hex-number*] [**partial-fill** *range*] [**shutdown**] [**timeslots** *range*]

no ces circuit *circuit-number* [**cas**] [**cdv** *range*] [**circuit-name** *name*] [**on-hook-detection** *hex-number*] [**partial-fill** *range*] [**shutdown**] [**timeslots** *range*]

Syntax Description

circuit-number	Selects the circuit identification. For unstructured service, use 0. For T1 structured service, the range is 1 through 24. For E1 structure service, the range is 1 through 31.
cas	(Optional) Enables channel-associated signalling for structured service only. The default is **no cas**.
cdv *range*	(Optional) Enables the peak-to-peak cell delay variation requirement. The range for CDV is 1 through 65535 milliseconds. The default is 2000 milliseconds.
circuit-name *name*	(Optional) Sets the ASCII name for the circuit emulation service internetworking function CES-IWF circuit. The string for the circuit name is 0 through 255. The default is CBRx/x:0.
on-hook-detection *hex-number*	(Optional) Enables detection of whether the circuit is on-hook. Hex values are 0 through F to indicate a 2- or 4-bit AB[CD] pattern to detect on-hook. The AB[CD] bits are determined by the manufacturer of the voice/video telephony device that is generating the CBR traffic.
partial-fill *range*	(Optional) Enables the partial AAL1 cell fill service for structured service only. The range is 0 through 47. The default is 47.
shutdown	(Optional) Marks the CES-IWF circuit administratively down. The default is **no shutdown**.
timeslots *range*	(Optional) Configures the time slots for the CES-IWF circuit for structured service only. The range is 1 through 24 for T1. The range is 1 through 31 for E1.

Defaults

No circuit is configured.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

Channel-associated signalling (CAS) provides information about the time slot (on or off the hook) and is updated once per multiframe.

With both the CAS and on-hook detection features enabled, these features work together to enable an ingress node in an ATM network to monitor on-hook and off-hook conditions for a specified 1 x 64 structured CES circuit. As implied by the notation "1 x 64," the on-hook detection (or bandwidth-release) feature is supported only in a structured CES circuit that involves a single time slot at each end of the connection.

The time slot configured for the structured CES circuit at the ingress node (time slot 2) can be different from the DS0 time slot configured at the egress node (time slot 4). Only one such time slot can be configured at each end of the circuit when the on-hook detection feature is used.

When you invoke the on-hook feature, the ingress ATM-CES port adapter monitors the ABCD bits in the incoming CBR bit stream to detect on-hook and off-hook conditions in the circuit. In an "off-hook" condition, all the bandwidth provisioned for the specified CES circuit is used for transporting ATM AAL1 cells across the network from the ingress node to the egress node.

In an on-hook condition, the network periodically sends dummy ATM cells from the ingress node to the egress node to maintain the connection. However, these dummy cells consume only a fraction of the circuit's reserved bandwidth, leaving the rest of the bandwidth available for use by other network traffic. This bandwidth-release feature enables the network to make more efficient use of its resources.

When the CAS feature is enabled for a CES circuit, the bandwidth of the DS0 channel is limited to 56 kbps for user data, because CAS functions consume 8 kbps of channel bandwidth for transporting the ABCD signalling bits. These signalling bits are passed transparently from the ingress node to the egress node as part of the ATM AAL1 cell stream.

In summary, when the optional CAS and on-hook detection features are enabled, the following conditions apply:

- The permanent virtual connection (PVC) provisioned for the CES circuit always exists.
- The bandwidth for the CES circuit is always reserved.
- During an on-hook state, most of the bandwidth reserved for the CES circuit is not in use. (Dummy cells are sent from the ingress node to the egress node to maintain the connection.) Therefore, this bandwidth becomes available for use by other network traffic, such as available bit rate (ABR) traffic.
- During an off-hook state, all the bandwidth reserved for the CES circuit is dedicated to that circuit.

Examples

The following example sets the structured service CDV range to 5000 milliseconds and enables the interface:

```
interface cbr 4/0
 ces circuit 3 cdv 5000
 ces circuit 3 no shutdown
```

Related Commands

Command	Description
ces aal1 service	Configures the type of CES used on the CBR interface.
show ces circuit	Displays detailed circuit information for the CBR interface.
show ces interface cbr	Displays detailed CBR port information.

Command	Description
show ces status	Displays the status of the ports on the ATM-CES port adapter.
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

ces dsx1 clock source

To configure a transmit clock source for the constant bit rate (CBR) interface, use the **ces dsx1 clock source** interface configuration command. To return the clock source to the default, use the **no** form of this command.

ces dsx1 clock source {**loop-timed** | **network-derived**}

no ces dsx1 clock source

Syntax Description

loop-timed	Configures the transmit clock to loop (RX-clock to TX-clock).
network-derived	Configures the transmit clock to be derived from the network.

Defaults

network-derived

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Examples

The following example sets the clock source to loop-timed:

```
interface cbr 4/0
 ces dsx1 clock source loop-timed
```

Related Commands

Command	Description
ces aal1 clock	Configures the AAL1 timing recovery clock for the CBR interface.
ces aal1 service	Configures the type of CES used on the CBR interface.
network-clock-select (ATM)	Establishes the sources and priorities of the requisite clocking signals for an ATM-CES port adapter.
show ces circuit	Displays detailed circuit information for the CBR interface.
show ces interface cbr	Displays detailed CBR port information.
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

ces dsx1 framing

To select the frame type for the data line on the constant bit rate (CBR) interface, use the **ces dsx1 framing** interface configuration command. To return the frame type to the default, use the **no** form of this command.

T1

ces dsx1 framing {**esf** | **sf**}

no ces dsx1 framing

E1

ces dsx1 framing {**e1_crc_mfCASlt** | **e1_crc_mf_lt** | **e1_lt** | **e1_mfCAS_lt**}

no ces dsx1 framing

Syntax Description

esf	Configures the line type to extended super frame for T1.
sf	Configures the line type to super frame for T1.
e1_crc_mfCASlt	Configures the line type to E1 CRC with channel-associated signalling (CAS) enabled.
e1_crc_mf_lt	Configures the line type to E1 CRC with CAS disabled.
e1_lt	Configures the line type to E1 with CAS disabled.
e1_mfCAS_lt	Configures the line type to E1 with CAS enabled.

Defaults

esf (for T1)

e1_lt (for E1)

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

Use this command in configurations where the router communicates with the data line. The service provider determines which framing type is required for your circuit.

Examples

The following example sets the data line type to super frame:

```
interface cbr 4/0
 ces dsx1 framing sf
```

Related Commands

Command	Description
ces aal1 service	Configures the type of CES used on the CBR interface.
show ces circuit	Displays detailed circuit information for the CBR interface.
show ces interface cbr	Displays detailed CBR port information.
show ces status	Displays the status of the ports on the ATM-CES port adapter.
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

ces dsx1 lbo

To configure cable length for the constant bit rate (CBR) interface, use the **ces dsx1 lbo** interface configuration command. To return the cable length to the default, use the **no** form of this command.

ces dsx1 lbo *length*

no ces dsx1 lbo

Syntax Description

length	Sets the cable length. Values (in feet) are **0_110**, **110_200**, **220_330**, **330_440**, **440_550**, **550_660**, **660_above**, and **square_pulse**. Values represent a range in feet.

Defaults

0_110 feet

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

Set the cable length to the desired number of feet on your system.

Examples

The following example sets the cable length to 440 feet:

```
interface cbr 4/0
 ces dsx1 lbo 440_550
```

Related Commands

Command	Description
atm lbo	Specifies the cable length (line build-out) for the ATM interface.
ces aal1 service	Configures the type of CES used on the CBR interface.
show ces circuit	Displays detailed circuit information for the CBR interface.
show ces interface cbr	Displays detailed CBR port information.
show ces status	Displays the status of the ports on the ATM-CES port adapter.
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

ces dsx1 linecode

To select the line code type for the constant bit rate (CBR) interface, use the **ces dsx1 linecode** interface configuration command. To return the line code to the default, use the **no** form of this command.

T1

ces dsx1 linecode {**ami** | **b8zs**}

no ces dsx1 linecode

E1

ces dsx1 linecode {**ami** | **hdb3**}

no ces dsx1 linecode

Syntax Description

ami	Specifies the alternate mark inversion (AMI) as the line code type. Valid for T1 and E1 interfaces.
b8zs	Specifies B8ZS as the line code type. Valid for T1 interfaces. This is the default for T1.
hdb3	Specifies HDB3 as the line code type. Valid for E1 interfaces. This is the default for E1.

Defaults

b8zs (for T1)

hdb3 (for E1)

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

Use this command in configurations where the switch communicates with the data line. The service provider determines which line code type is required for your circuit.

Examples

The following example specifies B8ZS as the line code type:

```
interface cbr 4/0
 ces dsx1 linecode b8zs
```

Related Commands

Command	Description
ces aal1 service	Configures the type of CES used on the CBR interface.
show ces circuit	Displays detailed circuit information for the CBR interface.

Command	Description
show ces interface cbr	Displays detailed CBR port information.
show ces status	Displays the status of the ports on the ATM-CES port adapter.
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

ces dsx1 loopback

To enable a loopback for the constant bit rate (CBR) interface, use the **ces dsx1 loopback** interface configuration command. To disable the loopback, use the **no** form of this command.

ces dsx1 loopback {**line** | **noloop** | **payload**}

no ces dsx1 loopback {**line** | **noloop** | **payload**}

Syntax Description

line	Sets the received signal to be looped at the line (does not penetrate the line).
noloop	Sets the interface to no loop.
payload	Sets the received signal to be looped through the device and returned.

Defaults

No loopback

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

This command is useful for testing the circuit emulation port adapter module.

Examples

The following example sets a payload loopback:

```
interface cbr 4/0
 ces dsx1 loopback payload
```

Related Commands

Command	Description
ces aal1 service	Configures the type of CES used on the CBR interface.
loopback	Configures the ATM interface into loopback mode.
show ces circuit	Displays detailed circuit information for the CBR interface.
show ces interface cbr	Displays detailed CBR port information.
show ces status	Displays the status of the ports on the ATM-CES port adapter.
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

ces dsx1 signalmode robbedbit

To enable the signal mode as robbed bit on a constant bit rate (CBR) interface, use the **ces dsx1 signalmode robbedbit** interface configuration command. To return the signal mode to the default, use the **no** form of this command.

ces dsx1 signalmode robbedbit

no ces dsx1 signalmode robbedbit

Syntax Description

This command has no arguments or keywords.

Defaults

No signal mode is enabled.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

A T1 frame consists of 24 time slots (DS0) that send at a rate of 64 kbps. T1 defines the ability to send signalling in-band on individual time slots by removing the low bit of each byte for signalling in robbedbit mode. This procedure allows 8 kbps for signalling and leaves 56 kbps for data.

In structured mode, you can send the T1 signalling information across the network. Structured mode means that after you enable **robbedbit** signalling mode on the port, and enable CAS on individual circuits that need this type of service, you are robbing bits from the DS0. The system then puts the bits in the specified format to be sent across the network and reinserts them at the passive side on the CES-IWF connection.

Examples

The following example enables channel-associated signalling and robbed bit signalling:

```
interface cbr 4/0
 ces circuit 1 cas
 ces dsx1 signalmode robbedbit
```

Related Commands

Command	Description
ces aal1 service	Configures the type of CES used on the CBR interface.
ces circuit	Configures the connection attributes for the CBR interface.
show ces circuit	Displays detailed circuit information for the CBR interface.
show ces interface cbr	Displays detailed CBR port information.

Command	Description
show ces status	Displays the status of the ports on the ATM-CES port adapter.
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

ces partial-fill

To configure the number of user octets per cell for the ATM circuit emulation service (CES), use the **ces partial-fill** command in interface configuration mode. To delete the CES partial-fill value, use the **no** form of this command.

ces partial-fill *octets*

no ces partial-fill *octets*

Syntax Description

octets	Number of user octets per cell for the CES. Possible values of octet range from 0 to 47. Setting this number to zero disables partial cell fill and causes all cells to be completely filled before they are sent.

Defaults

47 octets

Command Modes

Interface configuration

Command History

Release	Modification
11.3 MA	This command was introduced.

Usage Guidelines

This command applies to ATM configuration on the Cisco MC3810.

Setting the value of the **ces partial-fill** command to zero disables partial cell fill and causes all cells to be completely filled before they are sent. This command is supported on serial ports 0 and 1 when the **encapsulation atm-ces** command is enabled.

Examples

The following example sets the CES partial cell fill to 20 octets per cell for serial port 0:

```
interface serial 0
 ces partial-fill 20
```

Related Commands

Command	Description
ces cell-loss-integration-period	Sets the CES cell-loss integration period on the Cisco MC3810 multiservice concentrator.
ces clockmode synchronous	Configures the ATM CES synchronous clock mode on the Cisco MC3810 multiservice concentrator.
ces connect	Maps the CES service to an ATM PVC on the Cisco MC3810 multiservice concentrator.
ces initial-delay	Configures the size of the receive buffer of a CES circuit on the Cisco MC3810 multiservice concentrator.

Command	Description
ces max-buf-size	Configures the send buffer of a CES circuit on the Cisco MC3810 multiservice concentrator.
ces service	Configures the ATM CES type on the Cisco MC3810 multiservice concentrator.

ces pvc

To configure the destination port for the circuit on the constant bit rate (CBR) interface, use the **ces pvc** interface configuration command. To remove the destination port on the circuit, use the **no** form of this command.

ces pvc *circuit-number* **interface atm** *slot/port* **vpi** *number* **vci** *number*

no ces pvc *circuit-number* **interface atm** *slot/port* **vpi** *number* **vci** *number*

Syntax Description

circuit-number	Selects the circuit identification. The range is 0 to 24. For unstructured service, use 0. For T1 structure service, the range is 1 through 24. For E1 structure service, the range is 1 through 31.
interface atm *slot/port*	Slot and port number of the ATM interface. Used to create a hard permanent virtual circuit (PVC). Only a hard PVC can be configured for the CBR interfaces on the ATM-CES port adapter.
vpi *number*	Virtual path identifier of the destination PVC. Range is 0 through 255.
vci *number*	Virtual channel identifier of the destination PVC. Range is 1 through 16383.

Defaults

No destination port is configured.

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

Use the **interface** option to create a hard PVC. Use the **dest-atm-addr** option to create a soft PVC. Soft PVCs are not supported on Cisco 7200 series routers.

You must configure both sides of the CES circuits because at the source (the active side in CES-IWF), the time slots are not recognized at the destination (the passive side).

Each CES circuit has an ATM address. When configuring the source PVC, you need the destination ATM address.

Examples

The following example shows setting a hard PVC. In this example, the destination of ATM port 0 in slot 1 is assigned to circuit 31 on CBR port 0 in slot 1.

```
interface cbr 1/0
 ces pvc 31 interface atm 1/0 vpi 0 vci 512
```

Related Commands

Command	Description
ces aal1 service	Configures the type of CES used on the CBR interface.
show ces circuit	Displays detailed circuit information for the CBR interface.
show ces interface cbr	Displays detailed CBR port information.
show ces status	Displays the status of the ports on the ATM-CES port adapter.
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

class-int

To assign a virtual circuit (VC) class to an ATM main interface or subinterface, use the **class-int** command in interface configuration mode. To remove a VC class, use the **no** form of this command.

class-int *vc-class-name*

no class-int *vc-class-name*

Syntax Description

vc-class-name	Name of the VC class you are assigning to your ATM main interface or subinterface.

Defaults

No VC class is assigned to an ATM main interface or subinterface.

Command Modes

Interface configuration

Command History

Release	Modification
11.3(4)T	This command was introduced, replacing the **class** command for assigning VC classes to ATM main interfaces or subinterfaces.

Usage Guidelines

Use this command to assign a previously defined set of parameters (defined in a VC class) to an ATM main interface or subinterface. To create a VC class that defines these parameters, use the **vc-class atm** command. Refer to the section "Configuring VC Classes" in the "Configuring ATM" chapter of the *Cisco IOS Wide-Area Networking Configuration Guide* for more information.

To use this command for assigning a VC class to an ATM main interface or subinterface, you must first enter the **interface atm** command to enter interface configuration mode.

When you create a VC class for an ATM main interface or subinterface, you can use the following commands to define your parameters: **abr**, **broadcast**, **bump**, **encapsulation**, **idle-timeout**, **ilmi manage**, **inarp**, **oam-bundle**, **oam-pvc**, **oam retry**, **oam-svc**, **protocol**, **ubr**, **ubr+**, and **vbr-nrt**.

Parameters applied to an individual VC supersede interface- and subinterface-level parameters. Parameters that are configured for a VC through discrete commands entered in interface-ATM-VC configuration mode supersede VC class parameters assigned to an ATM main interface or subinterface by the **class-int** command.

Examples

In the following example, a class called classA is first created and then applied to an ATM main interface 2/0:

```
! The following commands create the class classA:
vc-class atm classA
 ubr 10000
 encapsulation aal5mux ip

! The following commands apply classA to ATM main interface 2/0:
interface atm 2/0
 class-vc classA
```

Related Commands

Command	Description
abr	Selects ABR QoS and configures output peak cell rate and output minimum guaranteed cell rate for an ATM PVC or VC class.
broadcast	Configures broadcast packet duplication and transmission for an ATM VC class, PVC, SVC, or VC bundle.
encapsulation aal5	Configures the AAL and encapsulation type for an ATM PVC, SVC, or VC class.
idle-timeout	Configures the idle timeout parameter for tearing down an ATM SVC connection.
ilmi manage	Enables ILMI management on an ATM PVC.
inarp	Configures the Inverse ARP time period for an ATM PVC, VC class, or VC bundle.
oam-pvc	Enables end-to-end F5 OAM loopback cell generation and OAM management for an ATM PVC or VC class.
oam retry	Configures parameters related to OAM management for an ATM PVC, SVC, VC class, or VC bundle.
oam-svc	Enables end-to-end F5 OAM loopback cell generation and OAM management for an ATM SVC or VC class.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle. Enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).
show atm map	Displays the list of all configured ATM static maps to remote hosts on an ATM network.
ubr	Configures UBR QoS and specifies the output peak cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
ubr+	Configures UBR QoS and specifies the output peak cell rate and output minimum guaranteed cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
vbr-nrt	Configures the VBR-NRT QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size for an ATM PVC, SVC, VC class, or VC bundle member.
vc-class atm	Configures a VC class for an ATM VC or interface.

class-vc

To assign a virtual circuit (VC) class to an ATM permanent virtual circuit (PVC), switched virtual circuit (SVC), or VC bundle member, use the **class-vc** command in the appropriate configuration mode. To remove a VC class, use the **no** form of this command.

class-vc *vc-class-name*

no class-vc *vc-class-name*

Syntax Description

vc-class-name	Name of the VC class you are assigning to your ATM PVC, SVC, or VC bundle member.

Defaults

No VC class is assigned to an ATM PVC, SVC, or VC bundle member.

Command Modes

Interface-ATM-VC configuration (for ATM PVCs and SVCs)

Bundle-vc configuration (for VC bundle members)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3(4)T	This command was introduced, replacing the **class** command for assigning VC classes to ATM PVCs and SVCs.
12.0(3)T	This command was modified to support application of a VC class to an ATM VC bundle and an ATM VC bundle member.
12.1(5)T	This command was made available in PVC-in-range configuration mode.

Usage Guidelines

Use this command to assign a previously defined set of parameters (defined in a VC class) to an ATM PVC, SVC, or VC bundle member. To create a VC class that defines these parameters, use the **vc-class atm** command. Refer to the section "Configuring VC Classes" in the "Configuring ATM" chapter of the *Cisco IOS Wide-Area Networking Configuration Guide* for more information.

ATM PVCs and SVCs

To use this command for assigning a VC class to an ATM PVC or SVC, you must first enter the **interface atm** command in global configuration mode and then the **pvc** or **svc** command in interface configuration mode.

When you create a VC class for an ATM PVC or SVC, you can use the following commands to define your parameters: **abr**, **broadcast**, **bump**, **encapsulation**, **idle-timeout**, **ilmi manage**, **inarp**, **oam-bundle**, **oam-pvc**, **oam retry**, **oam-svc**, **protocol**, **ubr**, **ubr+**, and **vbr-nrt**.

Parameters that are configured for a PVC or SVC through discrete commands entered in interface-ATM-VC configuration mode supersede VC class parameters assigned to an ATM PVC or SVC by the **class-vc** command.

ATM VC Bundle Members

To use this command for assigning a VC class to a VC bundle member, you must first enter the **pvc-bundle** command to enter bundle-vc configuration mode.

When you create a VC class for a VC bundle member, you can use the following commands to define your parameters: **bump**, **precedence**, **protect**, **ubr**, **ubr+**, and **vbr-nrt**. You cannot use the following commands in vc-class configuration mode to configure a VC bundle member: **encapsulation**, **protocol**, **inarp**, and **broadcast**. These commands are useful only at the bundle level, not the bundle member level.

Parameters applied to an individual VC supersede bundle-level parameters. Parameters that are directly configured for a VC through discrete commands entered in bundle-vc configuration mode supersede VC class parameters assigned to a VC bundle member by the **class-vc** command.

Examples

The following sections show examples for applying the **class-vc** command to ATM PVC, SVC, and VC bundle members.

In the following example, a class called classA is first created and then applied to an ATM PVC:

```
! The following commands create the class classA:
vc-class atm classA
 ubr 10000
 encapsulation aal5mux ip

! The following commands apply classA to an ATM PVC:
interface atm 2/0
 pvc router5 1/32
 class-vc classA
```

In the following example, a class called classA is first created and then applied to the bundle member called vcmember, a member of bundle1:

```
! The following commands create the class classA:
vc-class atm classA
 precedence 6-5
 no bump traffic
 protect group
 bump explicitly 7
 vbr-nrt 20000 10000 32

! The following commands create bundle1, add vcmember to bundle1, and then applies classA
! to vcmember:
bundle bundle1
 pvc-bundle vcmember
  class-vc classA
```

Taking into account hierarchy precedence rules, the VC bundle member vcmember will be characterized by these parameters:

- It carries traffic whose IP Precedence level is 6 and 5.
- It does not allow other traffic to be bumped onto it. When the VC goes down, its bumped traffic will be redirected to a VC whose IP Precedence level is 7.
- It is a member of the protected group of the bundle. When all members of a protected group go down, the bundle goes down.
- It has Variable Bit Rate-Non Real Time (VBR-NRT) quality of service traffic parameters.

Related Commands

Command	Description
abr	Selects ABR QoS and configures output peak cell rate and output minimum guaranteed cell rate for an ATM PVC or VC class.
broadcast	Configures broadcast packet duplication and transmission for an ATM VC class, PVC, SVC, or VC bundle.
bump	Configures the bumping rules for a VC class that can be assigned to a VC bundle.
bundle	Creates a bundle or modifies an existing bundle to enter bundle configuration mode.
class-bundle	Configures a VC bundle with the bundle-level commands contained in the specified VC class.
encapsulation aal5	Configures the AAL and encapsulation type for an ATM PVC, SVC, or VC class.
idle-timeout	Configures the idle timeout parameter for tearing down an ATM SVC connection.
ilmi manage	Enables ILMI management on an ATM PVC.
inarp	Configures the Inverse ARP time period for an ATM PVC, VC class, or VC bundle.
oam-pvc	Enables end-to-end F5 OAM loopback cell generation and OAM management for an ATM PVC or VC class.
oam retry	Configures parameters related to OAM management for an ATM PVC, SVC, VC class, or VC bundle.
oam-svc	Enables end-to-end F5 OAM loopback cell generation and OAM management for an ATM SVC or VC class.
precedence (VC bundle)	Configures precedence levels for a VC member of a bundle, or for a VC class that can be assigned to a VC bundle.
protect	Configures a VC class with protected group or protected VC status for application to a VC bundle member.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle. Enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).
pvc-bundle	Adds a PVC to a bundle as a member of the bundle and enters bundle-vc configuration mode in order to configure that PVC bundle member.
show atm bundle	Displays the bundle attributes assigned to each bundle VC member and the current working status of the VC members.
show atm bundle statistics	Displays statistics on the specified bundle.
show atm map	Displays the list of all configured ATM static maps to remote hosts on an ATM network.
ubr	Configures UBR QoS and specifies the output peak cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
ubr+	Configures UBR QoS and specifies the output peak cell rate and output minimum guaranteed cell rate for an ATM PVC, SVC, VC class, or VC bundle member.

Command	Description
vbr-nrt	Configures the VBR-NRT QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size for an ATM PVC, SVC, VC class, or VC bundle member.
vc-class atm	Configures a VC class for an ATM VC or interface.

clear atm arp

To clear Address Resolution Protocol (ARP) entries for an ATM interface that is configured as an ARP server, use the **clear atm arp** command in EXEC mode.

clear atm arp *atm-interface* {*ip-address* | *****}

Syntax Description

atm-interface	ATM interface number (for example, 3/0).
ip-address	Clears the ARP entry for the specified IP address.
*	Clears all ARP entries on the interface.

Defaults

No default behavior or values.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Use this command to clear ARP entries for an ATM interface. Use the asterisk (*) to delete all of the ARP entries for the interface, or specify the IP address of a particular entry to be deleted.

If an ARP entry for an existing virtual circuit (VC) is deleted, the ARP server will immediately try to get another entry for that VC.

Examples

The following example shows how to delete the ARP entry for 172.20.173.28:

```
Router# clear atm arp 3/0 172.20.173.28
```

dxi map

To map a protocol address to a given virtual path identifier (VPI) and virtual channel identifier (VCI), use the **dxi map** interface configuration command. To remove the mapping for that protocol and protocol address, use the **no** form of this command.

dxi map *protocol protocol-address vpi vci* [**broadcast**]

no dxi map *protocol protocol-address*

Syntax Description

protocol	One of the following bridging or protocol keywords: **apollo**, **appletalk**, **bridge**, **clns**, **decnet**, **ip**, **novell**, **vines**, or **xns**.
protocol-address	Protocol-specific address.
vpi	Virtual path identifier in the range 0 to 15.
vci	Virtual circuit identifier in the range 0 to 63.
broadcast	(Optional) Address to which broadcasts should be forwarded.

Defaults

No map definition is established.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command is used in configurations where the router is intended to communicate with an ATM network through an ATM data service unit (ADSU). Given the circuit identifier parameters (VPI and VCI) for the ATM permanent virtual circuit (PVC), the router computes and uses the DXI frame address (DFA) that is used for communication between the router and the ADSU.

The **dxi map** command can be used only on a serial interface or HSSI configured for ATM-DXI encapsulation.

Examples

The following example converts all IP packets intended for the host with IP address 172.21.170.49 into ATM cells identified with a VPI of 2 (binary 0000 0010) and a VCI of 46 (binary 0000 0000 0010 1110) by the ADSU:

```
interface serial 0
 dxi map ip 172.21.170.49 2 46 broadcast
```

Using the mapping defined in Annex A of the ATM DXI Specification, the router uses the VPI and VCI information in this example to compute a DFA of 558 (binary 1000101110). The ADSU will use the DFA of the incoming frame to extract the VPI and VCI information when formulating ATM cells.

Related Commands

Command	Description
dxi pvc	Configures multiprotocol or single protocol ATM-DXI encapsulation.
encapsulation atm-dxi	Enables ATM-DXI encapsulation.

dxi pvc

To configure multiprotocol or single protocol ATM-Data Exchange Interface (DXI) encapsulation, use the **dxi pvc** interface configuration command. To disable multiprotocol ATM-DXI encapsulation, use the **no** form of this command.

dxi pvc *vpi vci* [**snap** | **nlpid** | **mux**]

no dxi pvc *vpi vci* [**snap** | **nlpid** | **mux**]

Syntax Description

vpi	ATM network virtual path identifier (VPI) of this PVC, in the range from 0 through 15. The VPI is a 4-bit field in the header of the ATM DXI frame. The VPI value is unique only on a single interface, not throughout the ATM network, because it has local significance only. Both *vpi* and *vci* cannot be specified as 0; if one is 0, the other cannot be 0.
vci	ATM network virtual channel identifier (VCI) of this PVC, in the range from 0 to 63. The VCI is a 6-bit field in the header of the ATM DXI frame. The VCI value is unique only on a single interface, not throughout the ATM network, because it has local significance only. Both vpi and vci cannot be specified as 0; if one is 0, the other cannot be 0
snap	(Optional) LLC/SNAP encapsulation based on the protocol used in the packet. This keyword defines a PVC that can carry multiple network protocols. This is the default.
nlpid	(Optional) RFC 1294/1490 encapsulation. This option is provided for backward compatibility with the default encapsulation in earlier versions of the Cisco IOS software.
mux	(Optional) MUX encapsulation; the carried protocol is defined by the **dxi map** command when the PVC is set up. This keyword defines a PVC that carries only one network protocol.

Defaults

LLC/SNAP encapsulation

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command can be used only on a serial interface or HSSI that is configured with ATM-DXI encapsulation.

Select the **nlpid** option if you are using the default encapsulation for software releases earlier than Cisco IOS Release 10.3.

Examples

The following example configures ATM-DXI MUX encapsulation on serial interface 1. The PVC identified by a VPI of 10 and a VCI of 10 can carry a single protocol. Then the protocol to be carried on this PVC is defined by the **dxi map** command.

```
interface serial 1
 dxi pvc 10 10 mux
 dxi map ip 172.21.176.45 10 10 broadcast
```

The following example configures ATM-DXI NLPID encapsulation on serial interface 1. The PVC identified by a VPI of 11 and a VCI of 12 can carry multiprotocol traffic that is encapsulated with a header described in RFC 1294/1490.

```
interface serial 1
 dxi pvc 11 12 nlpid
```

Related Commands

Command	Description
class-int	Maps a protocol address to a given VPI and VCI.
encapsulation atm-dxi	Enables ATM-DXI encapsulation.
show dxi pvc	Displays the PVC statistics for a serial interface.

encapsulation aal5

To configure the ATM adaptation layer (AAL) and encapsulation type for an ATM permanent virtual circuit (PVC), switched virtual circuit (SVC), virtual circuit (VC) class, or VC bundle, use the **encapsulation aal5** command in the appropriate command mode. To remove an encapsulation from a PVC, SVC, VC class, or VC bundle, use the **no** form of this command.

encapsulation aal5*encap* [**virtual-template** *number*]

no encapsulation aal5*encap* [**virtual-template** *number*]

Note To configure Integrated Local Management Interface (ILMI), QSAAL, or Switched Multimegabit Data Service (SMDS) encapsulations for an ATM PVC, use the **pvc** command.

Syntax Description

encap	AAL and encapsulation type. When **mux** is specified, a protocol is required. Possible options for the *encap* argument are as follows: **auto**—For PPP over ATM SVCs only. The **auto** keyword enables an ATM SVC to use either aal5snap or aal5mux encapsulation. **ciscoppp**—For Cisco Point-to-Point Protocol (PPP) over ATM. Supported on ATM PVCs only. **mux apollo**—For a multiplex (MUX)-type VC using the Apollo protocol. **mux appletalk**—For a MUX-type VC using the AppleTalk protocol. **mux decnet**—For a MUX-type VC using the DECnet protocol. **mux frame-relay**—For a MUX-type virtual circuit for Frame Relay-ATM Network Interworking (FRF.5) on the Cisco MC3810. **mux fr-atm-srv**—For a MUX-type virtual circuit for Frame Relay-ATM Service Interworking (FRF.8) on the Cisco MC3810. **mux ip**—For a MUX-type VC using the IP protocol. **mux ipx**—For a MUX-type VC using the IPX protocol. **mux ppp**—For a MUX-type virtual circuit running IETF-compliant PPP over ATM. You must use the **virtual-template** *number* argument to identify the virtual template. (If you need to establish a virtual template, use the **interface virtual-template** command.) The **mux ppp** keyword applies to ATM PVCs only.

Syntax Description

	mux vines—For a MUX-type VC using the VINES protocol. **mux voice**—For a MUX-type VC for Voice over ATM on the Cisco MC3810 router. **mux xns**—For a MUX-type VC using the XNS protocol. **nlpid**—Allows ATM interfaces to interoperate with High-Speed Serial Interfaces (HSSIs) that are using an ATM data service unit (ADSU) and running ATM-Data Exchange Interface (DXI). Supported on ATM PVCs only. **snap**—The only encapsulation supported for Inverse ARP. Logical Link Control/Subnetwork Access Protocol (LLC/SNAP) precedes the protocol datagram.
virtual-template *number*	(Optional) (This argument is required for **ciscoppp** encapsulation only.) Specifies the number used to identify the virtual template.

Defaults

The global default encapsulation is **snap**. See the "Usage Guidelines" section for other default characteristics.

Command Modes

Interface-ATM-VC configuration (for an ATM PVC or SVC)

VC-class configuration (for a VC class)

Bundle configuration (for a VC bundle)

PVC range configuration (for an ATM PVC range)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3 T	This command was introduced.
12.0(3)T	• This command was enhanced to provide encapsulation configuration for ATM VC bundles. • The **mux frame** and **mux voice** options were added for the Cisco MC3810 series router.
12.0(7)T	• The **mux fr-atm-srv** option was added for the Cisco MC3810 series router. • The **mux frame** option was changed to **mux frame-relay**.
12.1(3)T	The **auto** option was added to provide encapsulation configuration for PPP over ATM SVCs.
12.1(5)T	The **ciscoppp**, **mux**, and **snap** options were made available in PVC range and PVC-in-range configuration modes.

Usage Guidelines

A VC bundle can have only one encapsulation configured for it: either **snap** or **mux.**

Use one of the **mux** encapsulation options to dedicate the specified PVC to a single protocol; use the **snap** encapsulation option to multiplex two or more protocols over the same PVC. Whether you select **mux** or **snap** encapsulation might depend on practical considerations, such as the type of network and the pricing offered by the network. If the pricing of the network depends on the number of PVCs set up, **snap** might be the appropriate choice. If pricing depends on the number of bytes transmitted, **mux** might be the appropriate choice because it has slightly less overhead.

To use this command to configure a VC bundle, first enter the **bundle** subinterface configuration command to create a new bundle or modify an existing one and to enter bundle configuration mode.

Note When a VC is a member of a VC bundle, configuration using the **encapsulation aal5** command in VC class mode no longer applies to the VC. Bundle configuration takes precedence.

When configuring Cisco PPP over ATM, specify the **ciscoppp** encapsulation for the *encap* argument and specify the virtual template number.

It is possible to implicitly create a virtual template when configuring Cisco PPP over ATM. In other words, if the parameters of the virtual template are not explicitly defined before you configure the ATM PVC, the PPP interface will be brought up using default values from the virtual template identified. However, some parameters (such as an IP address) take effect only if they are specified before the PPP interface comes up. Therefore, we recommend that you explicitly create and configure the virtual template before configuring the ATM PVC to ensure such parameters take effect.

If you specify virtual template parameters after the ATM PVC is configured, you should enter a **shutdown** command followed by a **no shutdown** command on the ATM subinterface to restart the interface, causing the newly configured parameters (such as an IP address) to take effect.

If the **encapsulation aal5** command is not explicitly configured on an ATM PVC, SVC, or VC bundle, the VC inherits the following default configuration (listed in order of precedence from lowest to highest):

- Configuration of the **encapsulation aal5** command in a VC class assigned to the PVC, PVC bundle, or SVC itself
- Configuration of the **encapsulation aal5** command in a VC class assigned to the PVC's, SVC's, or VC bundle's ATM subinterface
- Configuration of the **encapsulation aal5** command in a VC class assigned to the PVC's, SVC's, or VC bundle's ATM main interface
- Global default: *encap* = **snap**

When configuring a PVC range or an individual PVC within a PVC range, the following options are available:

- **encapsulation aal5ciscoppp**
- **encapsulation aal5mux**
- **encapsulation aal5snap**

Examples

The following example configures an ATM SVC called "chicago" with encapsulation auto. Encapsulation auto enables the SVC to use PPP and either aal5snap or aal5mux encapsulation.

```
svc chicago
  encapsulation aal5auto
```

The following example configures an ATM PVC with VPI 0 and VCI 33 for a MUX-type encapsulation using IP:

```
pvc 0/33
 encapsulation aal5mux ip
```

The following example configures a bundle called chicago for aal5snap encapsulation:

```
bundle chicago
 encapsulation aal5snap
```

Related Commands

Command	Description
broadcast	Configures broadcast packet duplication and transmission for an ATM VC class, PVC, SVC, or VC bundle.
class-int	Assigns a VC class to an ATM main interface or subinterface.
class-vc	Assigns a VC class to an ATM PVC, SVC, or VC bundle member.
inarp	Configures the Inverse ARP time period for an ATM PVC, VC class, or VC bundle.
oam-bundle	Enables end-to-end F5 OAM loopback cell generation and OAM management for a virtual circuit class that can be applied to a virtual circuit bundle.
oam retry	Configures parameters related to OAM management for an ATM PVC, SVC, VC class, or VC bundle.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle. Enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).

encapsulation atm-dxi

To enable ATM-Data Exchange Interface (DXI) encapsulation, use the **encapsulation atm-dxi** interface configuration command. To disable ATM-DXI, use the **no** form of this command.

encapsulation atm-dxi

no encapsulation atm-dxi

Syntax Description

This command has no arguments or keywords.

Defaults

When ATM-DXI encapsulation is not configured, HDLC is the default encapsulation.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example configures ATM-DXI encapsulation on serial interface 1:

```
interface serial 1
 encapsulation atm-dxi
```

Related Commands

Command	Description
class-int	Maps a protocol address to a given VPI and VCI.

idle-timeout

To configure the idle timeout parameter for tearing down an ATM switched virtual circuit (SVC) connection, use the **idle-timeout** command in the appropriate command mode. To disable the timeout parameter, use the **no** form of this command.

idle-timeout *seconds* [*minimum-rate*]

no idle-timeout *seconds* [*minimum-rate*]

Syntax Description

seconds	Number of seconds that the SVC is idle, after which the ATM SVC is disconnected.
minimum-rate	(Optional) Minimum traffic rate, in kilobits per second (kbps), required on an ATM SVC to maintain the SVC connection.

Defaults

The default idle timeout is 300 seconds.

The default *minimum-rate* is 0 kbps.

Command Modes

Interface-ATM-VC configuration (for ATM permanent virtual circuits [PVCs] or SVCs)

VC-class configuration (for virtual circuit [VC] classes)

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

If within the idle timeout period, both the input and output traffic rates are below the *minimum-rate*, the SVC connection is torn down. The input and output traffic rates are set using the **ubr**, **ubr+**, or **vbr-nrt** command.

If the **idle-timeout** command is not explicitly configured on an ATM SVC, the SVC inherits the following default configuration (listed in order of next highest precedence):

- Configuration of the **idle-timeout** command in a VC class assigned to the SVC itself.
- Configuration of the **idle-timeout** command in a VC class assigned to the SVC's ATM subinterface.
- Configuration of the **idle-timeout** command in a VC class assigned to the SVC's ATM main interface.
- Global default—The global idle timeout default is the value set using the **idle-timeout** interface configuration command. If the **idle-timeout** command is not configured, the default idle timeout is 300 seconds, and the *minimum-rate* is 0 kbps.

Examples

The following example configures an ATM SVC connection inactive after an idle period of 300 seconds. The SVC connection is also configured so that it is considered inactive if the traffic rate is less than 5 kbps.

```
idle-timeout 300 5
```

Related Commands

Command	Description
ubr	Selects UBR QoS and configures the output peak cell rate for an ATM PVC, SVC, or VC class.
ubr+	Selects UBR QoS and configures the output peak cell rate and output minimum guaranteed cell rate for an ATM PVC, SVC, or VC class.
vbr-nrt	Configures the VBR-NRT QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size for an ATM PVC, SVC, or VC class.

ilmi manage

To enable Integrated Local Management Interface (ILMI) management on an ATM permanent virtual circuit (PVC), use the **ilmi manage** command in the appropriate command mode. To disable ILMI management, use the **no** form of this command.

ilmi manage

no ilmi manage

Syntax Description

This command has no arguments or keywords.

Defaults

ILMI management is disabled.

Command Modes

Interface-ATM-VC configuration (for an ATM PVC)

VC-class configuration (for a virtual circuit [VC] class)

PVC range configuration (for an ATM PVC range)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3 T	This command was introduced.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.

Usage Guidelines

If the **ilmi manage** command is not explicitly configured on an ATM PVC, the PVC inherits the following default configuration (listed in order of precedence):

- Configuration of the **ilmi manage** command in a VC class assigned to the PVC itself.
- Configuration of the **ilmi manage** command in a VC class assigned to the PVC's ATM subinterface.
- Configuration of the **ilmi manage** command in a VC class assigned to the PVC's ATM main interface.
- Global default: ILMI management is disabled.

Examples

The following example enables ILMI management on the ATM PVC with VPI 0 and VCI 60. The ILMI PVC is assigned the name routerA and the VPI and VCI are 0 and 16, respectively.

```
interface atm 0/0
 pvc routerA 0/16 ilmi
 exit
interface atm 0/0.1 multipoint
 pvc 0/60
 ilmi manage
```

ima active-links-minimum

To set the minimum number of links that must be operating in order for an ATM inverse multiplexing over ATM (IMA) group to remain in service, use the **ima active-links-minimum** interface configuration command. To remove the current configuration and set the value to the default, use the **no** form of this command.

ima active-links-minimum *number*

no ima active-links-minimum *number*

Syntax Description

number	Number of links; a value from 1 to 8.

Defaults

The default is one link.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)XK	This command was introduced on Cisco 2600 and 3600 series routers.
12.0(5)T	This command was integrated into Cisco IOS Release 12.0(5)T.
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100, 7200, and 7500 series routers was integrated into Cisco IOS Release 12.1(5)T.

Usage Guidelines

The minimum number of links that should be active for continued group operation depends upon the applications you are using and the speeds they require. ATM frame size and the number of links in a group affect the overhead required by ATM.

Examples

The following example specifies that two links in IMA group 2 must be operational in order for the group to remain in service:

```
interface atm 0/ima2
 ima active-links-minimum 2
```

Related Commands

Command	Description
interface atm ima	Configures an ATM IMA group.

ima clock-mode

To set the transmit clock mode for an ATM inverse multiplexing over ATM (IMA) group, use the **ima clock-mode** interface configuration command. To remove the current configuration, use the **no** form of this command.

ima clock-mode {**common** *port* | **independent**}

no ima clock-mode

Syntax Description

common	The transmit clocks for all the links in the group are derived from the same source.
port	When you choose a common clock source, also specify the link that will provide clocking for the IMA group, which is called the common link. If the common link fails, the system automatically chooses one of the remaining active links to provide clocking.
independent	The transmit clock source for at least one link in the IMA group is different from the clock source used by the other links.

Defaults

The default value is **common**. If no port is specified, the system automatically chooses an active link to provide clocking.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)XK	This command was introduced on Cisco 2600 and 3600 series routers.
12.0(5)T	This command was integrated into Cisco IOS Release 12.0(5)T
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100, 7200, and 7500 series routers was integrated into Cisco IOS Release 12.1(5)T.

Usage Guidelines

This command controls the clock for the IMA group as a whole. If all the links in the group share a clock source, use the **common** keyword. If all the links use different clock sources, use the **independent** clock source keyword.

When the **common** keyword is set, the **clock source** ATM interface configuration command for the common link determines clocking for all the links in the group.When the **independent** keyword is set, the **clock source** ATM interface configuration command is used under each interface to determine clocking individually.

Because the system automatically chooses a replacement for the common link when it fails, any link in an IMA group potentially can provide the recovered transmit clock. For this reason, even when the common keyword is set with a specific link stipulated by the port value, you should use the ATM interface configuration **clock source** command to make sure that the clock source is configured correctly on each interface in the IMA group.

Examples

The following example specifies that the links in IMA group 2 use a common clock source on link 0:

```
interface atm0/ima2
 ima clock-mode common 0
```

Related Commands

Command	Description
clock source	Configures the clock source of a DS1 link.
interface atm ima	Configures an ATM IMA group.
show ima interface atm	Provides information about all configured IMA groups or a specific IMA group.

ima differential-delay-maximum

To specify the maximum differential delay among the active links in an inverse multiplexing over ATM (IMA) group, use the **ima differential-delay-maximum** interface configuration command. To restore the default setting, use the **no** form of this command.

ima differential-delay-maximum *msec*

no ima differential-delay-maximum *msec*

Syntax Description

msec	Specifies the differential delay in milliseconds (ms). The range of values depends on the type of card used. PA-A3-8T1IMA—25 to 250 milliseconds PA-A3-8E1IMA—25 to 190 milliseconds NM-8T1-IMA—25 to 200 milliseconds

Defaults

25 milliseconds

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)XK	This command was introduced on Cisco 2600 and 3600 series routers.
12.0(5)T	This command was integrated into Cisco IOS Release 12.0(5)T.
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100, 7200, and 7500 series routers was integrated into Cisco IOS Release 12.1(5)T.

Usage Guidelines

This command helps control latency in ATM-layer traffic by setting a limit on how much latency the slowest link in the group is allowed to introduce (a slower link has a longer propagation delay—for example, due to a longer path through the network or less accurate physical layer clocking—than other links). Setting a high value allows a slow link to continue operating as part of the group, although such a setting means there is added delay to links across the group. A low setting may result in less latency for traffic across the group than a high setting, but it can mean that the system takes a slow link out of operation, reducing total bandwidth.

When a link has been removed from service, it is automatically placed back in service when it meets the delay differential standard. If a link delay exceeds the specified maximum, the link is dropped; otherwise, the IMA feature adjusts for differences in delays so that all links in a group are aligned and carry ATM-layer traffic.

Examples

The following example specifies that the links in IMA group 2 have a maximum differential delay of 50 ms:

```
interface atm0/ima2
 ima differential-delay-maximum 50
```

Related Commands

Command	Description
show ima interface atm	Provides information about all configured IMA groups or a specific IMA group.

ima frame-length

To specify the number of cells in IMA frames, use the **ima frame-length** interface configuration command. IMA frames are numbered sequentially and each contains an IMA Control Protocol (ICP) cell at a specific position. To remove the current setting and restore the default value, use the **no** form of this command.

ima frame-length {**32** | **64** | **128** | **256**}

no ima frame-length {**32** | **64** | **128** | **256**}

Syntax Description

32	Specifies a value of 32 cells.
64	Specifies a value of 64 cells.
128	Specifies a value of 128 cells.
256	Specifies a value of 256 cells.

Defaults

The default value is 128 cells in a frame.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)XE	This command was introduced.
12.0(7)XE1	Support for Cisco 7100 series routers added.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.

Usage Guidelines

Frame length can affect performance, because the greater the total number of frames required to communicate a given number of cells, the greater the overhead for header and other control cells. In addition, shorter frame lengths might diminish performance when translated ATM-Frame Relay interworking occurs.

Examples

On Cisco 7100 and 7200 series routers, the following example specifies that the links in IMA group 2 have a frame length of 64 cells:

```
interface atm 1/ima2
 ima frame-length 64
```

ima-group

To define physical links as inverse multiplexing over ATM (IMA) group members, use the **ima-group** interface configuration command for each group member. To remove the port from the group, use the **no** form of this command.

ima-group *group-number*

no ima-group *group-number*

Syntax Description

group-number	Specifies an IMA group number from 0 to 3. IMA groups can span multiple ports on a port adapter but cannot span port adapters.

Defaults

Physical links are not included in IMA groups.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)XK	This command was introduced on Cisco 2600 and 3600 series routers.
12.0(5)T	This command was integrated into Cisco IOS 12.0(5)T.
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100, 7200, and 7500 series routers was integrated into Cisco IOS Release 12.1(5)T.

Usage Guidelines

When the configuration is first performed or when the group number is changed, the interface is automatically disabled, moved to the new group, and then enabled.

Examples

The following example makes interface 1 on the ATM module in slot 0 a member of IMA group 2:

```
interface atm0/1
 ima-group 2
```

Related Commands

Command	Description
interface atm	Configures an ATM interface.
interface atm ima	Configures an ATM IMA group.
show ima interface atm	Provides information about all configured IMA groups or a specific IMA group.
shutdown (interface)	Disables an interface.

ima test

To specify an interface and test pattern for verifying connectivity of all links in an IMA group, use the **ima test** interface configuration command. To stop the test, use the **no** form of this command.

ima test [**link** *port*] [**pattern** *pattern-id*]

no ima test [**link** *port*] [**pattern** *pattern-id*]

Syntax Description

link *port*	(Optional) The identifier for the interface wherethe physical link is located.
pattern *pattern-id*	(Optional) A value from 0 to 254, set in hexadecimal or decimal numbers, identifying a pattern to be sent to the far end of the link.

Defaults

There is no default for the *port* value. The default value for *pattern-id* is 106 (0x6A).

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)XK	This command was introduced on Cisco 2600 and 3600 series routers.
12.0(5)T	This command was integrated into Cisco IOS 12.0(5)T.
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.

Usage Guidelines

To verify link and group connectivity, the pattern is sent from the specified link and looped back from the receiving end across all links belonging to the group as defined at the remote end. Verifying link and group connectivity can help troubleshoot physical link connectivity or configuration problems at the remote end. The local end verifies that the pattern is returned on all links belonging to the group at the local end, and testing is continuous. An IMA control protocol (ICP) cell in each frame identifies the pattern.

When a link is not transmitting or receiving a pattern correctly, the command reports the link number where the problem exists.

Examples

The following example configures link 4 to send test pattern 56:

```
interface atm 0/ima 2
 ima test link 2 pattern 56
```

Related Commands

Command	Description
show ima interface atm	Provides information about all configured IMA groups or a specific IMA group.

inarp

To configure the Inverse Address Resolution Protocol (ARP) time period for an ATM permanent virtual circuit (PVC), virtual circuit (VC) class, or VC bundle, use the **inarp** command in the appropriate command mode. To restore the default Inverse ARP time period behavior, use the **no** form of this command.

inarp *minutes*

no inarp *minutes*

Syntax Description

minutes	Number of minutes for the Inverse ARP time period.

Defaults

When Inverse ARP is enabled, *minutes* = 15 minutes.

Command Modes

Interface-ATM-VC configuration (for an ATM PVC)

VC-class configuration (for a VC class)

Bundle configuration (for a VC bundle)

PVC range configuration (for an ATM PVC range)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3 T	This command was introduced.
12.0(3)T	This command was enhanced to provide support to configure the Inverse ARP time period for an ATM VC bundle.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.

Usage Guidelines

This command is supported for **aal5snap** encapsulation only when Inverse ARP is enabled. Refer to the **encapsulation** command for configuring **aal5snap** encapsulation and the **protocol** command for enabling Inverse ARP.

If the **inarp** command is not explicitly configured on an ATM PVC, the PVC inherits the following default configuration (listed in order of precedence):

- Configuration of the **inarp** command in a VC class assigned to the PVC itself.
- Configuration of the **inarp** command in a VC class assigned to the PVC's ATM subinterface.
- Configuration of the **inarp** command in a VC class assigned to the PVC's ATM main interface.
- Global default for the *minutes* argument is 15 minutes; this default assumes that Inverse ARP is enabled.

Note As the inheritance rules imply, when a VC is a member of a VC bundle, configuration using the **inarp** command in VC class configuration mode no longer applies to that VC. Bundle configuration takes precedence.

For ATM VC bundle management, the Inverse ARP parameter can only be enabled at the bundle level and applied to all VC members of the bundle—that is, it cannot be enabled in bundle-vc configuration mode for individual VC bundle members. To use this command in bundle configuration mode, first enter the **bundle** command to create the bundle and enter bundle configuration mode.

Examples

The following example sets the Inverse ARP time period to 10 minutes:

```
inarp 10
```

Related Commands

Command	Description
bundle	Creates a bundle or modifies an existing bundle to enter bundle configuration mode.
broadcast	Configures broadcast packet duplication and transmission for an ATM VC class, PVC, SVC, or VC bundle.
class-int	Assigns a VC class to an ATM main interface or subinterface.
class-vc	Assigns a VC class to an ATM PVC, SVC, or VC bundle member.
encapsulation aal5	Configures the AAL and encapsulation type for an ATM PVC, SVC, or VC class.
oam-bundle	Enables end-to-end F5 OAM loopback cell generation and OAM management for a virtual circuit class that can be applied to a virtual circuit bundle.
oam retry	Configures parameters related to OAM management for an ATM PVC, SVC, VC class, or VC bundle.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle. Enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).

interface atm

To configure an ATM interface type and enter interface configuration mode, use the **interface atm** global configuration command.

Cisco 7500 series with AIP; Cisco 7200 series with ATM, ATM-CES, and enhanced ATM port adapters; Cisco 2600 and 3600 series with 1-port ATM-25 network module

interface atm *slot*/**0**

Cisco 7500 series with ATM and enhanced ATM port adapter

interface atm *slot*/*port-adapter*/**0**

Cisco 4500 and 4700 series with NPM

interface atm *number*

Cisco 2600 and 3600 series

interface atm *slot*/*port*

To configure an ATM subinterface, use the **interface atm** global configuration command.

Cisco 7500 series with AIP; Cisco 7200 series with ATM, ATM-CES, and enhanced ATM port adapters; Cisco 2600 and 3600 series with 1-port ATM-25 network module

interface atm *slot*/**0.** *subinterface-number* {**multipoint** | **point-to-point**}

Cisco 7500 series with ATM and enhanced ATM port adapter

interface atm *slot*/*port-adapter*/**0.***subinterface-number* {**multipoint** | **point-to-point**}

Cisco 4500 and 4700 series with NPM

interface atm *number*.*subinterface-number* {**multipoint** | **point-to-point**}

Cisco 2600 and 3600 series

interface atm *slot*/*port*.*subinterface-number* {**multipoint** | **point-to-point**}

Syntax Description

slot	Specifies the backplane slot number on your router. The value ranges from 0 to 4, depending on what router you are configuring. Refer to your router hardware documentation.
/0	ATM port number. Because the ATM Interface Processor (AIP) and all ATM port adapters have a single ATM interface, the port number is always 0.
port-adapter	ATM port adapter number for the ATM port adapter or enhanced ATM port adapter on Cisco 7500 series routers. The value can be 0 or 1.

number	On Cisco 4500 and Cisco 4700 routers, specifies the network processing module (NPM) number. The numbers are assigned at the factory at the time of installation or when added to a system, and can be displayed with the **show interfaces** command.
port	ATM port number on a Cisco 2600 or 3600 series router, indicating the T1 or E1 link that you are configuring. Enter a value from 0 to 3 or from 0 to 7, depending on whether the network module has four ports or eight ports.
.*subinterface-number*	Subinterface number in the range 1 to 4294967293.
multipoint | **point-to-point**	Specifies a multipoint or point-to-point subinterface.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example assigns an IP network address and network mask to the ATM interface in slot 1 on port 0 of a Cisco 7500 series router:

```
interface atm 1/0
 ip address 10.1.1.1.255.255.255.0
```

Related Commands

Command	Description
show interfaces atm	Displays information about the ATM interface.

interface atm ima

To configure an inverse multiplexing over ATM (IMA) group, use the **interface atm ima** global configuration command.

interface atm *slot*/**ima***group-number*

Syntax Description

slot/	Specifies the slot location of the ATM IMA network module. The values range from 0 to 5 depending on the router.
group-number	Enter an IMA group number from 0 to 3. You can create up to four groups. Do not include a space before the group number.

Defaults

By default there are no IMA groups, only individual ATM links.

Command Modes

Global configuration

Command History

Release	Modification
12.0(5)XK	This command was introduced on Cisco 2600 and 3600 series routers.
12.0(5)T	This command was integrated into Cisco IOS 12.0(5)T.
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100, 7200, and 7500 series routers was integrated into Cisco IOS Release 12.1(5)T.

Usage Guidelines

If the group does not exist when the command is issued, the command automatically creates the group.

When a port is configured for IMA functionality, it no longer operates as an individual ATM link.

Specifying ATM links as members of a group by using the **ima group** interface command does not enable the group. You must use the **interface atm ima** command to create the group.

Examples

The following example configures IMA group 0 on the module in slot 1:

```
interface atm 1/ima0
  ip address 10.18.16.121 255.255.255.192
```

Related Commands

Command	Description
ima-group	Defines IMA group members.
interface atm	Configures an ATM interface.
show ima interface atm	Provides information about all configured IMA groups or a specific IMA group.
shutdown (interface)	Disables an interface.

interface cbr

To specify the T1 or E1 constant bit rate interface on an ATM-CES port adapter, and to enter interface configuration mode, use the **interface cbr** global configuration command.

interface cbr *slot/port*

Syntax Description

slot/	Backplane slot number.
port	Interface port number.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

The ATM-CES port adapter has four T1 (1.544 Mbps) or four E1 (2.048 Mbps) ports (75- or 120-ohm) that can support both structured (N x 64 kbps) and unstructured ATM Forum-compliant circuit emulation services (CES), and one port that supports an OC-3 (155 Mbps) single-mode intermediate reach interface or a T3 (45 Mbps) or E3 (34 Mbps) standards-based ATM interface.

Examples

The following example specifies the first T1 or E1 port on the ATM-CES port adapter in slot 1:

```
interface cbr 1/0
```

Related Commands

Command	Description
show ces interface cbr	Displays detailed CBR port information.
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

loopback

To loop packets back to the interface for testing, use the **loopback** interface configuration command with or without an optional keyword. To remove the loopback, use the **no** form of this command.

Cisco 2600 and 3600 Series

loopback [**line** | **local** | **payload** | **remote**]

no loopback [**line** | **local** | **payload** | **remote**]

Cisco 7100, 7200, and 7500 Series

loopback {**diagnostic** | **local** {**payload** | **line**} | **remote** {**iboc** | **esf** {**payload** | **line**}}}
(for T1 lines)

loopback {**diagnostic** | **local** {**payload** | **line**}}
(for E1 lines)

no loopback

Syntax Description

line	Places the interface into external loopback mode at the line.
local	Places the interface into local loopback mode.
payload	Places the interface into external loopback mode at the payload level.
remote	Keeps the local end of the connection in remote loopback mode.
diagnostic	Loops the outgoing transmit signal back to the receive signal.
iboc	Sends an in-band code to the far-end receiver to cause it to go into line loopback.
esf	Specifies the FDL loopbacks. FDL should be configured on the link.

Defaults

The **line** keyword is the default.

Loopback is disabled by default.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3 MA	This command was modified for the Cisco MC3810.
12.0(5)XK	Support for the Cisco 2600 and 3600 series routers was added.
12.0(5)T	Support for the Cisco 2600 and 3600 series routers was integrated into Cisco IOS Release 12.0(5)T.
12.0(5)XE	Support for the Cisco 720 0 and 7500 series routers was added.

Release	Modification
12.0(7)XE1	Support for the Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100, 7200, and 7500 series routers was integrated into Cisco IOS Release 12.1(5)T.

Usage Guidelines

You can use a loopback test on lines to detect and distinguish equipment malfunctions caused either by line and channel service unit/digital service unit (CSU/DSU) or by the interface. If correct data transmission is not possible when an interface is in loopback mode, the interface is the source of the problem.

The local loopback does not generate any packets automatically. Instead, the **ping** command is used.

Examples

The following example sets up local loopback diagnostics:

```
interface atm 1/0
 loopback local
```

loopback (ATM)

To configure the ATM interface into loopback mode, use the **loopback** interface configuration command. To remove the loopback, use the **no** form of this command.

loopback [**cell** | **line** | **payload**]

no loopback [**cell** | **line** | **payload**]

Syntax Description

cell	(Optional) Places the interface into external loopback at cell level.
line	(Optional) Places the interface into external loopback at the line.
payload	(Optional) Places the interface into external loopback at the payload level.

Defaults

line

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.
11.1	The following keywords were removed: • **diagnostic** • **test**

Usage Guidelines

This command is useful for testing because it loops all packets from the ATM interface back to the interface as well as directing the packets to the network.

Use the **loopback line** command to check that the PA-A3 port adapter is working by looping the receive data back to the transmit data.

Examples

The following example loops all packets back to the ATM interface:

```
interface atm 4/0
 loopback
```

Related Commands

Command	Description
ces dsx1 loopback	Enables a loopback for the CBR interface.

map-class atm

This command is no longer supported.

mid

To set the range of message identifier (MID) values on a permanent virtual circuit (PVC), use the **mid** interface-ATM-VC configuration command. To remove MID value range settings, use the **no** form of this command.

mid *midlow midhigh*

no mid *midlow midhigh*

Syntax Description

midlow	Starting MID number for this PVC. This can be set between 0 and 1023.
midhigh	Ending MID number for this PVC. This can be set between 0 and 1023.

Defaults

0

Command Modes

Interface-ATM-VC configuration

Command History

Release	Modification
11.3(2)T	This command was introduced.

Usage Guidelines

This command is only available when SMDS encapsulation is configured on a PVC.

Use this command to assign different ranges of message identifiers to different PVCs.

Examples

In the following example, the **atm mid-per-vc** command limits the maximum number of message identifiers to 32 for each VC on the ATM interface. Using the **mid** command, the selected range of numbers that are available for the message identifiers on PVC 1/40 is 0 to 31. For PVC 2/50, the range is 32 to 63.

```
interface atm 2/0
 atm mid-per-vc 32
 pvc 1/40 smds
 mid 0 31
 pvc 2/50 smds
 mid 32 63
```

network-clock-select (ATM)

To establish the sources and priorities of the requisite clocking signals for an ATM-CES port adapter, use the **network-clock-select** global configuration command. To remove the clock source, use the **no** form of this command.

network-clock-select *priority* {**cbr** | **atm**} *slot*/*port*

no network-clock-select *priority* {**cbr** | **atm**} *slot*/*port*

Syntax Description

priority	Priority of the clock source. Values are 1 (high priority) to 4 (low priority).
cbr	Specifies a CBR interface to supply the clock source.
atm	Specifies an ATM interface to supply the clock source.
slot/	Backplane slot number.
port	Interface port number.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

To support synchronous or synchronous residual time stamp (SRTS) clocking modes on the CBR interface, you must specify a primary reference source to synchronize the flow of CBR data from its source to its destination.

You can specify up to four clock priorities. The highest priority active interface in the router supplies primary reference source to all other interfaces that require network clock synchronization services. The fifth priority is the local oscillator on the ATM-CES port adapter.

Use the **show network-clocks** command to display currently configured clock priorities on the router.

Examples

The following example defines two clock priorities on the router:

```
network-clock-select 1 cbr 2/0
network-clock-select 2 atm 2/0
```

Related Commands

Command	Description
ces aal1 clock	Configures the AAL1 timing recovery clock for the CBR interface.
ces dsx1 clock source	Configures a transmit clock source for the CBR interface.
show network-clocks	Displays which ports are designated as network clock sources.

oam ais-rdi

To configure an ATM permanent virtual circuit (PVC) to be brought down after a specified number of Operation, Administration, and Maintenance (OAM) alarm indication signal/remote defect indication (AIS/RDI) cells have been received on the PVC or brought up if no OAM AIS/RDI cells have been received in a specified interval, use the **oam ais-rdi** command in ATM VC configuration or VC class configuration mode. To return OAM AIS/RDI behavior to the default, use the **no** form of this command.

oam ais-rdi [*down-count* [*up-count*]]

no oam ais-rdi [*down-count* [*up-count*]]

Syntax Description

down-count	(Optional) Number of consecutive OAM AIS/RDI cells received before the PVC is brought down. The range is from 1 to 60. The default is 1.
up-count	(Optional) Number of seconds after which a PVC will be brought up if no OAM AIS/RDI cells are received. The range is from 3 to 60. The default is 3.

Defaults

Down count: 1
Up count: 3

Command Modes

ATM VC configuration
VC class configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

The default values for the OAM AIS/RDI down count and up count are used in the following situations:

- If the **oam ais-rdi** command has not been entered
- If the **oam ais-rdi** command is entered without the *up-count* or *down-count* argument
- If the **no oam ais-rdi** command is entered

If the **oam ais-rdi** command is entered without the *up-count* or *down-count* argument, the command will not appear in the **show running-config** command output.

Examples

In the following example, PVC 0/400 will be brought down after 25 consecutive OAM AIS/RDI cells have been received on the PVC. The PVC will be brought up when no OAM AIS/RDI cells have been received for 5 seconds.

```
interface ATM2/0/0
 ip address 172.2.222.20 255.255.255.0
 no ip route-cache cef
 no ip route-cache distributed
 no atm ilmi-keepalive
 pvc 0/400
```

```
protocol ip 172.2.223.21
oam-pvc manage 30
oam ais-rdi 25 5
```

oam-pvc

To enable end-to-end F5 Operation, Administration, and Maintenance (OAM) loopback cell generation and OAM management for an ATM permanent virtual circuit (PVC) or virtual circuit (VC) class, use the **oam-pvc** command in the appropriate command mode. To disable generation of OAM loopback cells and OAM management, use the **no** form of this command.

oam-pvc [**manage**] [*frequency*]

no oam-pvc [**manage**] [*frequency*]

Syntax Description

manage	(Optional) Enable OAM management.
frequency	(Optional) Time delay (0 to 600 seconds) between transmitting OAM loopback cells.

Defaults

10 seconds

Command Modes

Interface-ATM-VC configuration (for an ATM PVC)

VC-class configuration (for a VC class)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3	This command was introduced.
12.1(5)T	This command was made available in PVC-in-range configuration mode.

Usage Guidelines

If OAM management is enabled, further control of OAM management is configured using the **oam retry** command.

If the **oam-pvc** command is not explicitly configured on an ATM PVC, the PVC inherits the following default configuration (listed in order of precedence):

- Configuration of the **oam-pvc** command in a VC class assigned to the PVC itself.
- Configuration of the **oam-pvc** command in a VC class assigned to the PVC's ATM subinterface.
- Configuration of the **oam-pvc** command in a VC class assigned to the PVC's ATM main interface.
- Global default: End-to-end F5 OAM loopback cell generation and OAM management are disabled, but if OAM cells are received, they are looped back. The default value for the *frequency* argument is 10 seconds.

Examples

The following example enables end-to-end F5 OAM loopback cell transmission and OAM management on an ATM PVC with a transmission frequency of 3 seconds:

```
oam-pvc manage 3
```

Related Commands

Command	Description
ilmi manage	Enables ILMI management on an ATM PVC.
oam retry	Configures parameters related to OAM management for ATM PVC, SVC, or VC class.

oam retry

To configure parameters related to Operation, Administration, and Maintenance (OAM) management for an ATM permanent virtual circuit (PVC), switched virtual circuit (SVC), VC class, or VC bundle, use the **oam retry** command in the appropriate command mode. To remove OAM management parameters, use the **no** form of this command.

oam retry *up-count down-count retry-frequency*

no oam retry *up-count down-count retry-frequency*

Syntax Description

up-count	Number of consecutive end-to-end F5 OAM loopback cell responses that must be received in order to change a PVC connection state to up. This argument does not apply to SVCs.
down-count	Number of consecutive end-to-end F5 OAM loopback cell responses that are not received in order to change a PVC state to down or tear down an SVC connection.
retry-frequency	The frequency (in seconds) that end-to-end F5 OAM loopback cells are transmitted when a change in the up/down state of a PVC or SVC is being verified. For example, if a PVC is up and a loopback cell response is not received after the *frequency* (in seconds) argument is specified using the **oam-pvc** command, then loopback cells are sent at the *retry-frequency* to verify whether the PVC is down.

Defaults

up-count = 3

down-count = 5

retry-frequency = 1 second

This set of defaults assumes that OAM management is enabled using the **oam-pvc** or **oam-svc** command.

Command Modes

Interface-ATM-VC configuration (for an ATM PVC or SVC)

VC-class configuration (for a VC class)

Bundle configuration mode (for a VC bundle)

PVC range configuration (for an ATM PVC range)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3 T	This command was introduced.
12.0(3)T	This command allows you to configure parameters related to OAM management for ATM VC bundles.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.

Usage Guidelines

The *up-count* argument does not apply to SVCs.

If the **oam retry** command is not explicitly configured on an ATM PVC, SVC, or VC bundle, the VC inherits the following default configuration (listed in order of precedence):

- Configuration of the **oam retry** command in a VC class assigned to the PVC or SVC itself.
- Configuration of the **oam retry** command in a VC class assigned to the PVC's or SVC's ATM subinterface.
- Configuration of the **oam retry** command in a VC class assigned to the PVC's or SVC's ATM main interface.
- Global default: *up-count* = 3, *down-count* = 5, *retry-frequency* = 1 second. This set of defaults assumes that OAM management is enabled using the **oam-pvc** or **oam-svc** command. The *up-count* and *retry-frequency* arguments do not apply to SVCs.

To use this command in bundle configuration mode, enter the bundle command to create the bundle or to specify an existing bundle before you enter this command.

If you use the **oam retry** command to configure a VC bundle, you configure all VC members of that bundle. VCs in a VC bundle are further subject to the following inheritance rules (listed in order of precedence):

- VC configuration in bundle-vc mode
- Bundle configuration in bundle mode (with effect of assigned VC-class configuration)
- Subinterface configuration in subinterface mode

Examples

The following example configures the OAM management parameters with *up-count* 3, *down-count* 3, and the *retry-frequency* at 10 seconds:

```
oam retry 3 3 10
```

Related Commands

Command	Description
broadcast	Configures broadcast packet duplication and transmission for an ATM VC class, PVC, SVC, or VC bundle.
class-int	Assigns a VC class to an ATM main interface or subinterface.
class-vc	Assigns a VC class to an ATM PVC, SVC, or VC bundle member.
encapsulation	Sets the encapsulation method used by the interface.
inarp	Configures the Inverse ARP time period for an ATM PVC, VC class, or VC bundle.
oam-bundle	Enables end-to-end F5 OAM loopback cell generation and OAM management for a virtual circuit class that can be applied to a virtual circuit bundle.
oam-pvc	Enables end-to-end F5 OAM loopback cell generation and OAM management for an ATM PVC or virtual circuit class.
oam-svc	Enables end-to-end F5 OAM loopback cell generation and OAM management for an ATM SVC or virtual circuit class.

Command	Description
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle. Enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).
ubr	Configures UBR QoS and specifies the output peak cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
ubr+	Configures UBR QoS and specifies the output peak cell rate and output minimum guaranteed cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
vbr-nrt	Configures the VBR-NRT QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size for an ATM PVC, SVC, VC class, or VC bundle member.

oam-svc

To enable end-to-end F5 Operation, Administration, and Maintenance (OAM) loopback cell generation and OAM management for an ATM switched virtual circuit (SVC) or virtual circuit (VC) class, use the **oam-svc** command in the appropriate command mode. To disable generation of OAM loopback cells and OAM management, use the **no** form of this command.

oam-svc [**manage**] [*frequency*]

no oam-svc [**manage**] [*frequency*]

Syntax Description

manage	(Optional) Enable OAM management.
frequency	(Optional) Time delay (0 to 600 seconds) between transmitting OAM loopback cells.

Defaults

10 seconds

Command Modes

Interface-ATM-VC configuration (for an ATM SVC)

VC-class configuration (for a VC class)

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

If OAM management is enabled, further control of OAM management is configured using the **oam retry** command.

Note Generally, ATM signalling manages ATM SVCs. Configuring the **oam-svc** command on an SVC verifies the inband integrity of the SVC.

If the **oam-svc** command is not explicitly configured on an ATM SVC, the SVC inherits the following default configuration (listed in order of precedence):

- Configuration of the **oam-svc** command in a VC class assigned to the SVC itself.
- Configuration of the **oam-svc** command in a VC class assigned to the SVC's ATM subinterface.
- Configuration of the **oam-svc** command in a VC class assigned to the SVC's ATM main interface.
- Global default: End-to-end F5 OAM loopback cell generation and OAM management are disabled, but if OAM cells are received, they are looped back. The default value for *frequency* is 10 seconds.

Examples

The following example enables end-to-end F5 OAM loopback cell transmission and OAM management on an ATM SVC with a transmission frequency of 3 seconds:

```
oam-svc manage 3
```

Related Commands

Command	Description
oam retry	Configures parameters related to OAM management for an ATM PVC, SVC, or VC class.

partial-fill

To configure the number of AAL1 user octets per cell for the ATM circuit emulation service (CES) on the OC-3/STM-1 Circuit Emulation Service network module, use the **partial-fill** interface-CES-VC command. To delete the CES partial-fill value, use the **no** form of this command.

partial-fill *octet*

no partial-fil *octet*

Syntax Description

octet	Number of user octets per cell for the CES. Possible values of octet range from 1 to 47.

Defaults

No partial-fill

Command Modes

Interface-CES-VC configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

The **partial-fill** command applies to CES SVCs and PVCs configured on Cisco 2600 series and Cisco 3600 series routers that have OC-3/STM-1 ATM CES network modules.

Examples

The following example sets the CES partial cell fill to 50 octets per cell for SVC “ces1”:

```
interface atm 1/0
  svc ces1 nsap 47.00.00......01.01.00 ces
   partial fill 40
```

Related Commands

Command	Description
svc	Creates an ATM SVC and specifies the destination NSAP address on a main interface or subinterface.

protocol (ATM)

To configure a static map for an ATM permanent virtual circuit (PVC), switched virtual circuit (SVC), or virtual circuit (VC) class or to enable Inverse Address Resolution Protocol (ARP) or Inverse ARP broadcasts on an ATM PVC, use the **protocol** command in the appropriate mode. To remove a static map or disable Inverse ARP, use the **no** form of this command.

protocol *protocol* {*protocol-address* [**virtual-template**] | **inarp**} [[**no**] **broadcast**]

no protocol *protocol* {*protocol-address* [**virtual-template**] | **inarp**} [[**no**] **broadcast**]

Syntax Description

protocol	Choose one of the following values: **aarp**—AppleTalk ARP **appletalk**—AppleTalk **arp**—IP ARP **bridge**—bridging **bstun**—block serial tunnel **cdp**—Cisco Discovery Protocol **clns**—ISO Connectionless Network Service (CLNS) **clns_es**—ISO CLNS end system **clns_is**—ISO CLNS intermediate system **cmns**—ISO CMNS **compressedtcp**—Compressed TCP **decnet**—DECnet **decnet_node**—DECnet node **decnet_prime_router**—DECnet prime router **decnet_router-l1**—DECnet router L1 **decnet_router-l2**—DECnet router L2 **dlsw**—data link switching **ip**—IP **ipx**—Novell IPX **llc2**—llc2 **pad**—packet assembler/disassembler (PAD) links **ppp**—Point-to-Point Protocol carried on the VC **pppoe**—PPP over Ethernet **qllc**—Qualified Logical Link Control protocol **rsrb**—remote source-route bridging **snapshot**—snapshot routing support **stun**—serial tunnel
protocol-address	Destination address that is being mapped to a PVC.
virtual-template	(Optional) Specifies parameters that the point-to-point protocol over ATM (PPoA) sessions will use. **Note** This keyword is valid only for the **ppp** protocol.

inarp	(Valid only for IP and IPX protocols on PVCs) Enables Inverse ARP on an ATM PVC. If you specify a *protocol-address* instead of **inarp**, Inverse ARP is automatically disabled for that protocol.
[**no**] **broadcast**	(Optional) **broadcast** indicates that this map entry is used when the corresponding protocol sends broadcast packets to the interface. Pseudobroadcasting is supported. The **broadcast** keyword of the **protocol** command takes precedence if you previously configured the **broadcast** command on the ATM PVC or SVC.

Defaults

Inverse ARP is enabled for IP and IPX if the protocol is running on the interface and no static map is configured.

Command Modes

Interface-ATM-VC configuration (for an ATM PVC or SVC)
VC-class configuration (for a VC class)
PVC range configuration (for an ATM PVC range)
PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3	This command was introduced.
12.1	The **ppp** and **virtual-template** keywords were added.
12.1(5)T	The **ip** and **ipx** options were made available in PVC range and PVC-in-range configuration modes.
12.2(13)T	The **apollo**, **vines**, **and xns** arguments were removed because Apollo Domain, Banyan VINES, and Xerox Network Systems are no longer supported in the Cisco IOS software.

Usage Guidelines

Command Application

Use this command to perform either of the following tasks:

- Configure a static map for an ATM PVC, SVC, or VC class.
- Enable Inverse ARP or Inverse ARP broadcasts on an ATM PVC or PVC range by configuring Inverse ARP directly on the PVC, in the PVC range, or in a VC class (applies to IP and IPX protocols only).

PVC range and PVC-in-range configuration modes support only the protocols that do not require static map configuration. Those protocol options are **ip** and **ipx**.

Default Configurations

If the **protocol** command is not explicitly configured on an ATM PVC or SVC, the VC inherits the following default configuration (listed in order of precedence):

- Configuration of the **protocol ip inarp** or **protocol ipx inarp** command in a VC class assigned to the PVC or SVC itself.
- Configuration of the **protocol ip inarp** or **protocol ipx inarp** command in a VC class assigned to the ATM subinterface of the PVC or SVC.

- Configuration of the **protocol ip inarp** or **protocol ipx inarp** command in a VC class assigned to the ATM main interface of the PVC or SVC.
- Global default: Inverse ARP is enabled for IP and IPX if the protocol is running on the interface and no static map is configured.

Examples

The following example creates a static map on a VC, indicates that 10.68.34.237 is connected to this VC, and sends ATM pseudobroadcasts:

```
protocol ip 10.68.34.237 broadcast
```

The following example enables Inverse ARP for IPX and does not send ATM pseudobroadcasts:

```
protocol ipx inarp no broadcast
```

The following example removes a static map from a VC and restores the default behavior for Inverse ARP (Refer to the “Default” section described above):

```
no protocol ip 10.68.34.237
```

In the following example, the VC carries PPP traffic and its associated parameters.

```
protocol ppp 10.68.34.237 virtual-template
```

pvc

To create or assign a name to an ATM permanent virtual circuit (PVC), to specify the encapsulation type on an ATM PVC, and to enter interface-ATM-VC configuration mode, use the **pvc** command in interface or subinterface configuration mode. To remove an ATM PVC, use the **no** form of this command.

pvc [*name*] *vpi*/*vci* [**ces** | **ilmi** | **qsaal** | **smds**]

no pvc [*name*] *vpi*/*vci* [**ces** | **ilmi** | **qsaal** | **smds**]

Syntax Description

name	(Optional) The name of the PVC or map. The name can be up to 15 characters long.
vpi/	ATM network virtual path identifier (VPI) for this PVC. The absence of the "/" and a *vpi* value defaults the *vpi* value to 0. The range of valid values is 0 to 255 except for the following routers: • Cisco 4500 and 4700 routers: range is from 0 to 1 less than the quotient of 8192 divided by the value set by the **atm vc-per-vp** command • Cisco 2600 and 3600 series routers using Inverse Multiplexing for ATM (IMA): ranges are 0 to 15, 64 to 79, 128 to 143, and 192 to 207 A value that is out of range is interpreted as a string and is treated as the connection ID. The arguments *vpi* and *vci* cannot both be set to 0; if one is 0, the other cannot be 0.
vci	ATM network virtual channel identifier (VCI) for this PVC. This value ranges from 0 to 1 less than the maximum value set for this interface by the **atm vc-per-vp** command. Typically, lower values 0 to 31 are reserved for specific traffic (for example, F4 OAM, SVC signalling, ILMI, and so on) and should not be used. The VCI is a 16-bit field in the header of the ATM cell. The VCI value is unique only on a single link, not throughout the ATM network, because it has local significance only. A value that is out of range causes an "unrecognized command" error message. The arguments *vpi* and *vci* cannot both be set to 0; if one is 0, the other cannot be 0.
ces	(Optional) Circuit Emulation Service encapsulation. This keyword is available on the OC-3/STM-1 ATM Circuit Emulation Service network module only.
ilmi	(Optional) Used to set up communication with the Interim Local Management Interface (ILMI); the associated *vpi* and *vci* values ordinarily are 0 and 16, respectively.

qsaal	(Optional) A signalling-type PVC used for setting up or tearing down SVCs; the associated *vpi* and *vci* values ordinarily are 0 and 5, respectively.
smds	(Optional) Encapsulation for SMDS networks. If you are configuring an ATM PVC on the ATM Interface Processor (AIP), you must configure AAL3/4SMDS using the **atm aal aal3/4** command before specifying **smds** encapsulation. If you are configuring an ATM network processor module (NPM), the **atm aal aal3/4** command is not required. SMDS encapsulation is not supported on the ATM port adapter.

Defaults

No PVC is defined. When a PVC is defined, the global default of the **encapsulation** command applies (*aal-encap* = **aal5snap**).

Command Modes

Interface or subinterface configuration

Command History

Release	Modification
11.3 T	This command was introduced.
12.1(2)T	The following modifications were made: • The ranges for the VPI were increased for Cisco 2600 and Cisco 3600 series routers using IMA. • The **ces** keyword was added for configuring CES encapsulation when using the OC-3/STM-1 ATM Circuit Emulation Service network module on Cisco 2600 and Cisco 3600 series routers.

Usage Guidelines

Creating and Configuring PVCs

The **pvc** command replaces the **atm pvc** command, which, although still supported and available, will become obsolete in the near future. Use the **pvc** command to configure a single ATM VC only, not a VC that is a bundle member. We recommend that you use the **pvc** command in conjunction with the **encapsulation** and **random-detect attach** commands instead of the **atm pvc** command.

The **pvc** command creates a PVC and attaches it to the VPI and VCI specified. Both the *vpi* and *vci* arguments cannot be simultaneously specified as 0; if one is 0, the other cannot be 0.

When configuring an SVC, use the **pvc** command to configure the PVC that handles SVC call setup and termination. In this case, specify the **qsaal** keyword. See the second example that follows.

ATM PVC Names

Once you specify a *name* for a PVC, you can reenter interface-ATM-VC configuration mode by simply entering the **pvc** *name* command. You can remove a PVC and any associated parameters by entering **no pvc** *name* or **no pvc** *vpi*/*vci*.

Note After configuring the parameters for an ATM PVC, you must exit the interface-ATM-VC configuration mode in order to create the PVC and enable the settings.

Encapsulation Types on ATM PVCs

Specify CES, ILMI, QSAAL, or SMDS as the encapsulation type on an ATM PVC. (To configure other encapsulations types, see the **encapsulation** command.)

Configuring CES encapsulation on a PVC is equivalent to creating a constant bit rate (CBR) class of service.

Rate Queues

The Cisco IOS software dynamically creates rate queues as necessary to satisfy the requests of the **pvc** commands.

Default Configurations

If **ilmi**, **qsaal**, or **smds** encapsulation is not explicitly configured on the ATM PVC, the PVC inherits the following default configuration (listed in order of precedence):

- Configuration of the **encapsulation** command in a VC class assigned to the PVC itself.
- Configuration of the **encapsulation** command in a VC class assigned to the ATM subinterface of the PVC.
- Configuration of the **encapsulation** command in a VC class assigned to the ATM main interface of the PVC.
- Global default: The global default of the **encapsulation** command applies (*aal-encap* = **aal5snap)**.

Examples

The following example creates a PVC with VPI 0 and VCI 16, and communication is set up with the ILMI:

```
pvc cisco 0/16 ilmi
 exit
```

The following example creates a PVC used for ATM signalling for an SVC. It specifies VPI 0 and VCI 5:

```
pvc cisco 0/5 qsaal
 exit
```

The following example configures the PVC called "cisco" to use class-based weighted fair queueing (CBWFQ). It attaches a policy map called "policy1" to the PVC. The classes the make up "policy1" determine the service policy for the PVC:

```
pvc cisco 0/5
 service-policy output policy1
 vbr-nrt 2000 2000
 encap aal5snap
```

Related Commands

Command	Description
atm vc-per-vp	Sets the maximum number of VCIs to support per VPI.
pvc-bundle	Adds a PVC to a bundle as a member of the bundle and enters bundle-vc configuration mode in order to configure that PVC bundle member.

retry

To configure a router to periodically attempt to bring up an active SVC connection after the initial call setup failed, use the **retry** interface-CES-VC command. To disable the retry mechanism, use the **no** form of this command.

retry *timeout_value* [*retry_limit*] [*first_retry_interval*]

no retry

Syntax Description

timeout_value	Number of seconds between attempts to bring up the connection. The range is from 1 to 86400 seconds.
retry_limit	(Optional) Number of attempts the router will make to bring up the connection. The range is from 0 to 65535. The default value of 0 indicates no limit.
first_retry_interval	(Optional) Number of seconds the router will wait after the first call attempt failed before trying the call again. The default is 10 seconds.

Defaults

There is no default *timeout_value*.

The default *retry_limit* is 0.

The default *first_retry_interva*l argument is 10 seconds.

Command Modes

Interface-CES-VC configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

This command is used on Cisco 2600 series and 3600 series routers that have OC-3/STM-1 ATM CES network modules.

The **retry** command applies only to active SVCs.

Examples

In the following example, the router is configured to make up to 20 attempts to bring up a connection on SVC “ces1”. The interval between attempts is set at 10 seconds.

```
interface atm 1/0
 svc ces1 nsap 47.0091.81.000000.0040.0B0A.2501.ABC1.3333.3333.05 ces
  retry 10 20
```

Related Commands

Command	Description
ces	Configures CES on a router port and enters CES configuration mode.
svc	Creates an ATM SVC and specifies the destination NSAP address on a main interface or subinterface.

scrambling cell-payload

To improve data reliability by randomizing the ATM cell payload frames on Cisco 7100, 7200, or 7500 series routers, use the **scrambling cell-payload** interface configuration command. To disable scrambling, use the **no** form of this command.

scrambling cell-payload

no scrambling cell-payload

Syntax Description

This command has no arguments or keywords.

Defaults

No scrambling

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)XE	This command was introduced.
12.0(7)XE1	Support for Cisco 7100 series routers added.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.

Usage Guidelines

Normally, you do not issue the **scrambling cell-payload** command explicitly, because the default value is sufficient. On T1 links, the default b8zs line encoding normally assures sufficient reliability. The default for E1 is hdb3.

The scrambling setting must match that of the far-end receiver.

Examples

On Cisco 7100 or 7200 series routers, the following example sets the link on interface 1 on the port adapter in slot 0 to no scrambling:

```
interface atm0/1
 no scrambling cell-payload
```

Related Commands

Command	Description
scrambling-payload	Improves data reliability by randomizing the ATM cell payload frames on Cisco 2600 and 3600 series routers.

scrambling-payload

To improve data reliability by randomizing the ATM cell payload frames on Cisco 2600 or 3600 series routers, use the **scrambling-payload** interface configuration command. To disable scrambling, use the **no** form of this command.

scrambling-payload

no scrambling-payload

Syntax Description

This command has no arguments or keywords.

Defaults

By default, payload scrambling is on for E1 links and off for T1 links.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)XK	This command was introduced.
12.0(5)T	This command was integrated into Cisco IOS Release 12.0(5)T.

Usage Guidelines

Normally, you do not issue the **scrambling-payload** command explicitly, because the default value is sufficient. On T1 links, the default B8ZS line encoding normally assures sufficient reliability.

The scrambling setting must match that of the far end.

Examples

On a Cisco 2600 or 3600 series router, the following example sets the link on interface 1 on the module in slot 0 to no scrambling:

```
interface atm0/1
 no scrambling-payload
```

Related Commands

Command	Description
scrambling cell-payload	Improves data reliability by randomizing the ATM cell payload frames on Cisco 7100, 7200, or 7500 series routers.

show atm arp-server

To display the ATM Address Resolution Protocol (ARP) server's information about one specific interface or all interfaces, use the **show atm arp-server** user EXEC command.

AIP on Cisco 7500 series with AIP; Cisco 7200 series with ATM, ATM-CES, and enhanced ATM port adapters; Cisco 2600 and 3600 series with 1-port ATM-25 network module

show atm arp-server [**atm** *slot*/*port*[**.***subinterface-number*]]

Cisco 7500 series with ATM and enhanced ATM port adapters

show atm arp-server [**atm** *slot*/*port-adapter*/*port*[**.***subinterface-number*]]

Cisco 4500 and 4700 series with NPM

show atm arp-server [**atm** *number*[**.***subinterface-number*]]

Syntax Description

atm *slot*/*port*	(Optional) ATM slot and port numbers. Use this format for the following platform configurations: • AIP on Cisco 7500 series routers. • ATM port adapter, ATM-CES port adapter, and enhanced ATM port adapter on Cisco 7200 series routers. • 1-port ATM-25 network module on Cisco 2600 and 3600 series routers.
atm *slot*/*port-adapter*/*port*	(Optional) ATM slot, port adapter, and port numbers. Use this format for the ATM port adapter or enhanced ATM port adapter on Cisco 7500 series routers.
atm *number*	(Optional) ATM network processor module (NPM) number on Cisco 4500 and 4700 routers.
.*subinterface-number*	(Optional) Subinterface number.

Command Modes

User EXEC

Command History

Release	Modification
11.1	This command was introduced.

Examples

The following is sample output from the **show atm arp-server** command when no interface is specified:

```
Router# show atm arp-server

Note that a '*' next to an IP address indicates an active call

      IP Address         TTL     ATM Address
ATM1/0:
    * 4.4.4.2            19:50   ac153366020000000000000000000000000000000
```

```
    * 4.4.4.6           19:50   ac153366060000000000000000000000000000000
    * 4.4.4.15          19:14   ac153366150000000000000000000000000000000

ATM1/0.23:
    * 10.0.0.2          19:50   ac153366020000000000000000000000000000023
    * 10.0.0.6          19:50   ac153366060000000000000000000000000000023
```

The following is sample output from the **show atm arp-server** command when a slot and port are specified on the Cisco 7500:

```
Router# show atm arp-server atm 1/0

Note that a '*' next to an IP address indicates an active call

      IP Address        TTL     ATM Address
    * 4.4.4.2           19:00   ac153366020000000000000000000000000000000
    * 4.4.4.6           19:00   ac153366060000000000000000000000000000000
    * 4.4.4.15          19:14   ac153366150000000000000000000000000000000
```

Related Commands

Command	Description
atm arp-server	Identifies an ATM ARP server for the IP network or sets TTL values for entries in the ATM ARP table.

show atm class-links

To display virtual circuit (VC) parameter configurations and where the parameter values are inherited from, use the **show atm class-links** privileged EXEC command.

show atm class-links {*vpi*/*vci* | *name*}

Syntax Description

vpi/*vci*	The ATM VPI and VCI numbers. The absence of the slash character (**/**) and a *vpi* value defaults the *vpi* value to 0.
name	Name of the VC.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3	This command was introduced.

Examples

The following is sample output from the **show atm class-links** command for VPI 0 and VCI 66:

```
Router# show atm class-links 0/66

Displaying vc-class inheritance for ATM2/0.3, vc 0/66:
broadcast - VC-class configured on main-interface
encapsulation aal5mux ip - VC-class configured on subinterface
no ilmi manage - Not configured - using default
oam-pvc manage 3 - VC-class configured on vc
oam retry 3 5 1 - Not configured - using default
ubr 10000 - Configured on vc directly
```

show atm ilmi-configuration

To display ILMI configuration information, use the **show atm ilmi-configuration** command in privileged EXEC mode.

show atm ilmi-configuration

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0	This command was introduced prior to Cisco IOS Release 12.0.

Examples

The following example shows sample output for the **show atm ilmi-configuration** command:

```
Router# show atm ilmi-configuration

LECS Address(s):
11223344556677889900112233445566778899 00
```

Table 4 describes the fields shown in the display.

Table 4 show atm ilmi-configuration Field Descriptions

Field	Description
LECS Address(s)	Current ATM LAN Emulation Clients (LECs) addresses.

Related Commands

Command	Description
show atm ilmi-status	Displays ILMI-related status information.

show atm ilmi-status

To display ILMI-related status information, use the **show atm ilmi-status** command in privileged EXEC configuration mode.

show atm ilmi-status [**atm** *interface-number*]

Syntax Description

atm	ATM interface.
interface-number	Number of the ATM interface.

Defaults

No default behavior or values.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0	This command was introduced in a release prior to Cisco IOS Release 12.0.

Usage Guidelines

Entering the **show atm ilmi-status** command without specifying an interface will display ILMI-related status information for all of the ATM interfaces.

Examples

The following example is sample output for the **show atm ilmi-status** command:

```
Router# show atm ilmi-status

Interface :ATM2/0 Interface Type :Unknown
ILMI VCC :(0, 16) ILMI Keepalive :Disabled
ILMI State:      Restarting

Interface :ATM5/0 Interface Type :Private UNI (User-side)
ILMI VCC :(0, 16) ILMI Keepalive :Disabled
ILMI State:      UpAndNormal
Peer IP Addr:    10.0.52.17      Peer IF Name:    ATM1/1/0
Peer MaxVPIbits: 8               Peer MaxVCIbits: 14
Active Prefix(s) :
47.0091.8100.0000.0040.0b0a.2501
End-System Registered Address(s) :
47.0091.8100.0000.0040.0b0a.2501.bbbb.ccdd.eeff.12(Confirmed)
```

Table 5 describes the fields shown in the display.

Table 5 show atm ilmi-status Field Descriptions

Field	Description
interface	ATM interface.
Interface Type	Type of ATM interface.
ILMI VCC	Number of the current ILMI VCC for the interface.
ILMI Keepalive	Status of ILMI keepalive packets.
ILMI State	Status of ILMI for the interface.
Peer IP Addr	IP address of the peer.
Peer IF Name	Name of the peer interface.
Peer Max VPIbits	Maximum number of bits allowed for VPIs on the peer interface.
Peer Max VCIbits	Maximum number of bits allowed for VCIs on the peer interface.
Active Prefix	Network prefix that is registered from the switch side and is active and valid.
End-System Registered Address(s)	Address that the router registers back to the switch. The router combines the network prefix of the switch with the end-system identifier to form the end-system registered address.

Related Commands

Command	Description
show atm ilmi-configuration	Displays ILMI configuration information.

show atm interface atm

To display ATM-specific information about an ATM interface, use the **show atm interface atm** privileged EXEC command.

Cisco 7500 series with AIP; Cisco 7200 series with ATM, ATM-CES, and enhanced ATM port adapters; Cisco 2600 and 3600 series with 1-port ATM-25 network module

show atm interface atm *slot/port*

Cisco 7500 series with ATM and enhanced ATM port adapters

show atm interface atm *slot/port-adapter/port*

Cisco 4500 and 4700 series with NPM

show atm interface atm *number*

Syntax Description

slot/port	ATM slot number and port number. Use this format on the following platform configurations: • The AIP on Cisco 7500 series routers. • The ATM port adapter, ATM-CES port adapter, or enhanced ATM port adapter on Cisco 7200 series routers. • The 1-port ATM-25 network module on Cisco 2600 and 3600 series routers.
slot/port-adapter/port	ATM slot, port adapter, and port number. Use this format on the ATM port adapter or ATM-CES port adapter on Cisco 7500 series routers.
number	NPM number for Cisco 4500 and 4700 routers.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
11.0	The *number* argument was added.
11.2	The *slot/port-adapter/port* arguments were added.

Examples

The following is sample output for the ATM-CES port adapter to display statistics on slot 4, port 0:

```
Router# show atm interface atm 4/0

ATM interface ATM4/0:
AAL enabled: AAL5, Maximum VCs: 1024, Current VCs: 6
Tx buffers 256, Rx buffers 256, Exception Queue: 32, Raw Queue: 32
VP Filter: 0x7B, VCIs per VPI: 1024, Max Datagram Size:4496, MIDs/VC:16
PLIM Type:4B5B - 100Mbps, No Framing, TX clocking: LINE
4897 input, 2900 output, 0 IN fast, 0 OUT fast
```

```
Rate-Queue 1 set to 100Mbps, reg=0x4EA DYNAMIC, 1 VCCs
ATM4/0.1:AAL3/4-SMDS address c111.1111.1111 Multicast e222.2222.222
Config. is ACTIVE
```

The following is sample output for the enhanced ATM port adapter to display statistics on slot 6, port 0:

```
Router# show atm interface atm 6/0

ATM interface ATM6/0
AAL enabled:  AAL5, Maximum VCs: 2048, Current VCs: 3
Maximum Transmit Channels: 64
Tx buffers: 256, Rx buffers 256, Exception Queue: 32, Raw Queue: 32
VP Filter: 0x7B, VCIs per VPI: 1024, Max Datagram Size: 4496
PLIM Type: SONET - 155Mbps, TX clocking: INTERNAL
0 input, 59 output, 0 IN fast, 0 OUT fast
ABR parameters, rif: 16 rdf: 16
Config. is ACTIVE
```

Table 6 describes the fields shown in the display.

Table 6 show atm interface atm Field Descriptions

Field	Description
ATM interface	Slot and port number of the interface.
AAL enabled	Type of AAL. If both AAL5 and AAL3/4 are enabled on the interface, the output will include both AAL5 and AAL3/4.
Maximum VCs	Maximum number of virtual circuits this interface can support.
Current VCs	Number of active virtual circuits.
Tx buffers, Rx buffers	Number of transmit and receive buffers.
Exception Queue	Number of exception buffers.
Raw Queue	Queue size.
VP Filter	Hexadecimal value of the VP filter.
VCIs per VPI	Maximum number of VCIs to support per VPI.
Max Datagram Size	The configured maximum number of bytes in the largest datagram.
MIDs/VC	The configured maximum number of message identifiers allowed per virtual circuit on this interface.
PLIM Type	Physical Layer Interface Module (PLIM) type (E3, 4B/5B, or SONET).
Framing	For E3, this might be G.804; otherwise, no framing.
TX clocking	Clocking on the router. For E3 or SONET, this might be INTERNAL, meaning that the AIP or NPM generates the clock. Otherwise, LINE indicates that the ATM switch provides the clocking.
input	Number of packets received and process-switched.
output	Number of packets sent from process switch.
IN fast	Number of input packets fast-switched.
OUT fast	Number of output packets fast-switched.

Table 6 show atm interface atm Field Descriptions (continued)

Field	Description
ABR parameters, rif rdf	The amount that the cell transmission rate increases or decreases in response to flow control information from the network or destination for available bit rate (ABR) PVCs. The rate increase factor (RIF) and rate decrease factor (RDF) in this example are 16, the default.
Rate-Queue	List of configured rate queues.
reg=	Actual register value passed to the AIP to define a specific rate queue (AIP only).
DYNAMIC	Indicates that the rate queue is dynamic and was created automatically by the software. Dynamic rate queues are created when an **atm pvc** command specifies a peak or average rate that does not match any user configured rate queue. The value PERMANENT indicates that the rate queue was user-configured.
VCCs	Number of virtual channel connections (VCCs) dynamically attached to this rate queue.
ATM4/0.1	Indicates that the subinterface supports ATM adaptation layer AAL3/4 and displays the SMDS E.164 unicast address and the SMDS E.164 multicast address assigned to the subinterface.
Config. is	ACTIVE or VALID in *n* SECONDS. ACTIVE indicates that the current AIP or NPM configuration has been loaded into the AIP and is being used. There is a 5-second window when a user changes a configuration and the configuration is sent to the AIP.

Related Commands

Command	Description
pvc	Configures the PVC interface.

show atm map

To show the list of all configured ATM static maps to remote hosts on an ATM network and on ATM bundle maps, use the **show atm map** privileged EXEC command.

show atm map

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
11.1 CA	This command was modified to include an example for the ATM-CES port adapter (PA).
12.0(3)T	This command was modified to include display for ATM bundle maps. An ATM bundle map identifies a bundle and all of its related VCs.

Examples

The following is sample output from the **show atm map** command for a bundle called san-jose (0/122, 0/123, 0/124, and 0/126 are the virtual path and virtual channel identifiers of the bundle members):

```
Router# show atm map

Map list san-jose_B_ATM1/0.52 : PERMANENT
ip 10.1.1.1. maps to bundle san-jose, 0/122, 0/123, 0/124, 0/126, ATM1/0.52, broadcast
```

The following is sample output from the **show atm map** command for an ATM-CES PA on the Cisco 7200 series router:

```
Router# show atm map

Map list alien: PERMANENT
ip 10.1.1.1 maps to VC 6
ip 10.1.1.2 maps to VC 6
```

The following is sample output from the **show atm map** command that displays information for a bundle called new-york:

```
Router# show atm map

Map list atm:
vines 3004B310:0001 maps to VC 4, broadcast
ip 172.21.168.110 maps to VC 1, broadcast
clns 47.0004.0001.0000.0c00.6e26.00 maps to VC 6, broadcast
appletalk 10.1 maps to VC 7, broadcast
decnet 10.1 maps to VC 2, broadcast
Map list new-york: PERMANENT
ip 10.0.0.2 maps to bundle new-york, 0/200, 0/205, 0/210, ATM1/0.1
```

The following is sample output from the **show atm map** command for a multipoint connection:

```
Router# show atm map

Map list atm_pri: PERMANENT
ip 10.4.4.4 maps to NSAP CD.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12, broadcast,
aal5mux, multipoint connection up, VC 6
ip 10.4.4.6 maps to NSAP DE.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12, broadcast,
aal5mux, connection up, VC 15, multipoint connection up, VC 6

Map list atm_ipx: PERMANENT
ipx 1004.dddd.dddd.dddd maps to NSAP DE.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12,
broadcast, aal5mux, multipoint connection up, VC 8
ipx 1004.cccc.cccc.cccc maps to NSAP CD.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12,
broadcast, aal5mux, multipoint connection up, VC 8

Map list atm_apple: PERMANENT
appletalk 62000.5 maps to NSAP CD.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12,
broadcast, aal5mux, multipoint connection up, VC 4
appletalk 62000.6 maps to NSAP DE.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12,
broadcast, aal5mux, multipoint connection up, VC 4
```

The following is sample output from the **show atm map** command if you configure an ATM PVC using the **pvc** command:

```
Router# show atm map

Map list endA: PERMANENT
ip 10.11.11.1 maps to VC 4, VPI 0, VCI 60, ATM0.2
```

Table 7 describes the fields shown in the displays.

Table 7 show atm map Field Descriptions

Field	Description
Map list	Name of map list.
PERMANENT	This map entry was entered from configuration; it was not entered automatically by a process.
protocol address maps to VC x or *protocol address* maps to NSAP *address*	Name of protocol, the protocol address, and the VCD or NSAP that the address is mapped to (for ATM VCs configured with the **atm pvc** command).
broadcast	Indicates pseudobroadcasting.
protocol address maps to VPI *x*, VCI *x*, ATM *x.x* or *protocol address* maps to NSAP *address*	Name of protocol, the protocol address, the virtual path identifier (VPI) number, the virtual channel identifier (VCI) number, and the ATM interface or subinterface (for ATM PVCs configured using the **pvc** command). or Name of the protocol, the protocol address, and the NSAP that the address is mapped to (for ATM switched virtual circuits (SVCs) configured using the **svc** command).

Table 7 show atm map Field Descriptions (continued)

Field	Description
aal5mux	Indicates the encapsulation used, a multipoint or point-to-point VC, and the number of the virtual circuit.
multipoint connection up	Indicates that this is a multipoint VC.
VC 6	Number of the VC.
connection up	Indicates a point-to-point VC.
VPI	Virtual path identifier for the VC.
VCI	Virtual channel identifier for the VC.
ATM*x.x*	ATM interface or subinterface number.
Map list	Name of the bundle whose mapping information follows.
ip *address* maps to bundle *bundle-name vc-members*	IP address of bundle and VC members that belong to the bundle.

Related Commands

Command	Description
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle. Enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).
pvc	Creates an ATM PVC on a main interface or subinterface; Assigns a name to an ATM PVC; Specifies ILMI, QSAAL, or SMDS as the encapsulation type on an ATM PVC; or Enters interface-ATM-VC configuration mode.
show atm bundle	Displays the bundle attributes assigned to each bundle virtual circuit member and the current working status of the virtual circuit members.
show atm bundle statistics	Displays statistics on the specified bundle.
svc	Creates an ATM SVC and specifies destination NSAP address on an interface or subinterface.

show atm pvc

To display all ATM permanent virtual connections (PVCs) and traffic information, use the **show atm pvc** privileged EXEC command.

show atm pvc [*vpi*/*vci* | *name* | **interface atm** *interface-number*][**ppp**]

Syntax Description

vpi/*vci*	(Optional) The ATM virtual path identifier (VPI) and virtual channel identifier (VCI) numbers. The absence of the slash character (**/**) and a *vpi* value defaults the *vpi* value to 0.
name	(Optional) Name of the PVC.
interface atm *interface-number*	(Optional) Interface number or subinterface number of the PVC. Displays all PVCs on the specified interface or subinterface. The *interface-number* argument uses one of the following formats, depending on which router platform you are using: • For the ATM Interface Processor (AIP) on Cisco 7500 series routers; for the ATM port adapter, ATM-CES port adapter, and enhanced ATM port adapter on Cisco 7200 series routers; for the 1-port ATM-25 network module on Cisco 2600 and 3600 series routers: *slot*/**0**[**.***subinterface-number* **multipoint**] • For the ATM port adapter and enhanced ATM port adapter on Cisco 7500 series routers: *slot*/*port-adapter*/**0**[**.***subinterface-number* **multipoint**] • For the NPM on Cisco 4500 and 4700 routers: *number*[**.***subinterface-number* **multipoint**] For a description of these arguments, refer to the **interface atm** command.
ppp	(Optional) Displays each PVC configured for PPP over ATM.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3T	This command was introduced.
12.1(1)T	This command was modified to display PPPoE status.

Usage Guidelines

If the *vpi*/*vci* or *name* argument is not specified, the output of this command is the same as that of the **show atm vc** command, but only the configured PVCs are displayed. See the first sample output in the "Examples" section.

If the *vpi*/*vci* or *name* argument is specified, the output of this command is the same as the **show atm vc** *vcd* command, with extra information related to PVC management including connection name, detailed states, and Operation, Administration, and Maintenance (OAM) counters. See the second and third sample output in the "Examples" section.

If the **interface atm** *interface-number* option is included in the command, all PVCs under that interface or subinterface are displayed. See the third sample output in the "Examples" section.

Examples

The following is sample output from the **show atm pvc** command:

```
Router# show atm pvc

           VCD/                                      Peak      Avg/Min   Burst
Interface  Name   VPI   VCI   Type   Encaps      Kbps         Kbps   Cells       Sts
2/0        1        0     5    PVC     SAAL    155000       155000               UP
2/0        2        0    16    PVC     ILMI    155000       155000               UP
2/0.2      101      0    50    PVC     SNAP    155000       155000               UP
2/0.2      102      0    60    PVC     SNAP    155000       155000             DOWN
2/0.2      104      0    80    PVC     SNAP    155000       155000               UP
2/0        hello    0    99    PVC     SNAP      1000                            UP
```

The following is sample output from the **show atm pvc** command with the *vpi*/*vci* argument specified:

```
Router# show atm pvc 0/41

ATM2/0: VCD: 3, VPI: 0, VCI: 41
UBR, PeakRate: 155000
AAL5-LLC/SNAP, etype:0x0, Flags: 0xC20, VCmode: 0x0
OAM frequency: 0 second(s), OAM retry frequency: 1 second(s), OAM retry frequency: 1
second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Disabled
OAM VC state: Not Managed
ILMI VC state: Not Managed
InARP frequency: 15 minutes(s)
InPkts: 31759, OutPkts: 26497, InBytes: 2356434, OutBytes: 1589743
InPRoc: 15785, OutPRoc: 26472, Broadcasts: 0
InFast: 20, OutFast: 20, InAS: 15954, OutAS: 6
OAM cells received: 0
F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0
F4 InEndloop: 0, F4 InSegloop: 0, F4 InAIS: 0, F4 InRDI: 0
OAM cells sent: 0
F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutRDI: 0
F4 OutEndloop: 0, F4 OutSegloop: 0, F4 OutRDI: 0
OAM cell drops: 0
Status: UP
PPPOE enabled.
```

The following is sample output from the **show atm pvc** command with the ATM subinterface specified:

```
Router# show atm pvc interface atm 2/0.2

           VCD/                                      Peak      Avg/Min   Burst
Interface  Name   VPI   VCI   Type   Encaps      Kbps         Kbps   Cells       Sts
2/0.2      101      0    50    PVC     SNAP    155000       155000               UP
2/0.2      102      0    60    PVC     SNAP    155000       155000             DOWN
2/0.2      104      0    80    PVC     SNAP    155000       155000               UP
```

Table 8 describes significant fields shown in the displays.

Table 8 show atm pvc Field Descriptions

Field	Description
Interface	Interface and subinterface slot and port.
VCD/Name	Virtual connection descriptor (virtual connection number). The connection name is displayed if a name for the VC was configured using the **pvc** command.
VPI	Virtual path identifier.
VCI	Virtual channel identifier.
Type	Type of PVC detected from PVC discovery, either PVC-D, PVC-L, or PVC-M: • PVC-D indicates a PVC created due to PVC discovery. • PVC-L indicates that the corresponding peer of this PVC could not be found on the switch. • PVC-M indicates that some or all of the QoS parameters of this PVC mismatch that of the corresponding peer on the switch.
Encaps	Type of ATM adaptation layer (AAL) and encapsulation.
Peak or PeakRate	Kilobits per second sent at the peak rate.
Avg/Min or Average Rate	Kilobits per second sent at the average rate.
Burst Cells	Value that equals the maximum number of ATM cells the VC can send at peak rate.
Sts or Status	Status of the VC connection: • UP indicates that the connection is enabled for data traffic. • DOWN indicates that the connection is not ready for data traffic. When the Status field is DOWN, a State field is shown. See a description of the different values for this field listed later in this table. • INACTIVE indicates that the interface is down.
Connection Name	The name of the PVC.
UBR, UBR+, or VBR–NRT	• UBR—Unspecified bit rate QoS is specified for this PVC. See the **ubr** command for further information. • UBR+—Unspecified bit rate QoS is specified for this PVC. See the **ubr+** command for further information. • VBR–NRT—Variable bit rate—Non real-time QOS rates are specified for this PVC. See the **vbr-nrt** command for further information.
etype	Encapsulation type.

Table 8 show atm pvc Field Descriptions (continued)

Field	Description
Flags	Bit mask describing VC information. The flag values are summed to result in the displayed value: • 0x40—SVC • 0x20—PVC • 0x10—ACTIVE • 0x0—AAL5-SNAP • 0x1—AAL5-NLPID • 0x2—AAL5-FRNLPID • 0x3—AAL5-MUX • 0x4—AAL3/4-SMDS • 0x5—QSAAL • 0x6—ILMI • 0x7—AAL5-LANE • 0x9—AAL5-CISCOPPP
virtual-access	Virtual access interface identifier.
virtual-template	Virtual template identifier.
VCmode	AIP-specific or NPM-specific register describing the usage of the VC. This register contains values such as rate queue, peak rate, and AAL mode, which are also displayed in other fields.
OAM frequency	Number of seconds between sending OAM loopback cells.
OAM retry frequency	The frequency (in seconds) that end-to-end F5 loopback cells should be sent when a change in up/down state is being verified. For example, if a PVC is up and a loopback cell response is not received after the value of the *frequency* argument (in seconds) specified using the **oam-pvc** command, then loopback cells are sent at the value of the *retry-frequency* argument to verify whether the PVC is down.
OAM up retry count	Number of consecutive end-to-end F5 OAM loopback cell responses that must be received in order to change a PVC state to up. Does not apply to SVCs.
OAM down retry count	Number of consecutive end-to-end F5 OAM loopback cell responses that are not received in order to change a PVC state to down or tear down an SVC.
OAM Loopback status	Status of end-to-end F5 OAM loopback cell generation for this VC. This field will have one of the following values: • OAM Disabled—End-to-end F5 OAM loopback cell generation is disabled. • OAM Sent—OAM cell was sent. • OAM Received—OAM cell was received. • OAM Failed—OAM reply was not received within the frequency period or contained bad correlation tag.ssss.

Table 8 show atm pvc Field Descriptions (continued)

Field	Description
OAM VC state	This field will have one of the following states for this VC: • AIS/RDI—The VC received AIS/RDI cells. End-to-end F5 OAM loopback cells are not sent in this state. • Down Retry—An OAM loopback failed. End-to-end F5 OAM loopback cells are sent at retry frequency to verify that the VC is really down. After down-count unsuccessful retries, the VC goes to the Not Verified state. • Not Managed—VC is not being managed by OAM. • Not Verified—VC has not been verified by end-to-end F5 OAM loopback cells. AIS and RDI conditions are cleared. • Up Retry—An OAM loopback was successful. End-to-end F5 OAM loopback cells are sent at retry frequency to verify the VC is really up. After up-count successive and successful loopback retries, the VC goes to the Verified state. • Verified—Loopbacks are successful. AIS/RDI cell was not received.
ILMI VC state	This field will have one of the following states for this VC: • Not Managed—VC is not being managed by ILMI. • Not Verified—VC has not been verified by ILMI. • Verified—VC has been verified by ILMI.
VC is managed by OAM/ILMI	VC is managed by OAM or ILMI.
InARP frequency	Number of minutes for the Inverse Address Resolution Protocol (IARP) time period.
InPkts	Total number of packets received on this VC. This number includes all fast-switched and process-switched packets.
OutPkts	Total number of packets sent on this VC. This number includes all fast-switched and process-switched packets.
InBytes	Total number of bytes received on this VC. This number includes all fast-switched and process-switched bytes.
OutBytes	Total number of bytes sent on this VC. This number includes all fast-switched and process-switched bytes.
InPRoc	Number of process-switched input packets.
OutPRoc	Number of process-switched output packets.
Broadcasts	Number of process-switched broadcast packets.
InFast	Number of fast-switched input packets.
OutFast	Number of fast-switched output packets.
InAS	Number of autonomous-switched or silicon-switched input packets.
OutAS	Number of autonomous-switched or silicon-switched output packets.
OAM cells received	Total number of OAM cells received on this VC.
F5 InEndloop	Number of end-to-end F5 OAM loopback cells received.

Table 8 show atm pvc Field Descriptions (continued)

Field	Description
F5 InSegloop	Number of segment F5 OAM loopback cells received.
F5 InAIS	Number of F5 OAM AIS cells received.
F5 InRDI	Number of F5 OAM RDI cells received.
F4 InEndloop	Number of end-to-end F4 OAM loopback cells received.
F4 InSegloop	Number of segment F4 OAM loopback cells received.
F4 InAIS	Number of F4 OAM AIS cells received.
F4 InRDI	Number of F4 OAM RDI cells received.
OAM cells sent	Total number of OAM cells sent on this VC.
F5 OutEndloop	Number of end-to-end F5 OAM loopback cells sent.
F5 OutSegloop	Number of segment F5 OAM loopback cells sent.
F5 OutRDI	Number of F5 OAM RDI cells sent.
OAM cell drops	Number of OAM cells dropped (or flushed).
PVC Discovery	• NOT_VERIFIED—This PVC is manually configured on the router and not yet verified with the attached adjacent switch. • WELL_KNOWN—This PVC has a VCI value of 0 through 31. • DISCOVERED—This PVC is learned from the attached adjacent switch via ILMI. • MIXED—Some of the traffic parameters for this PVC were learned from the switch via ILMI. • MATCHED—This PVC is manually configured on the router, and the local traffic shaping parameters match the parameters learned from the switch. • MISMATCHED—This PVC is manually configured on the router, and the local traffic shaping parameters do not match the parameters learned from the switch. • LOCAL_ONLY—This PVC is configured locally on the router and not on the remote switch.
Status	When the Status field indicates UP, the VC is established. When the Status field indicates DOWN, refer to the State field for further information about the VC state.

Table 8 show atm pvc Field Descriptions (continued)

Field	Description
State	When the Status field is UP, this field does not appear. When the Status field is DOWN or INACTIVE, the State field will appear with one of the following values: • NOT_VERIFIED—The VC has been established successfully; waiting for OAM (if enabled) and ILMI (if enabled) to verify that the VC is up. • NOT_EXIST—VC has not been created. • HASHING_IN—VC has been hashed into a hash table. • ESTABLISHING—Ready to establish VC connection. • MODIFYING—VC parameters have been modified. • DELETING—VC is being deleted. • DELETED—VC has been deleted. • NOT_IN_SERVICE—ATM interface is shut down.
PPP:	For PPP over ATM, indicates the virtual access interface number and virtual template number being used.

show atm svc

To display all ATM switched virtual circuits (SVCs) and traffic information, use the **show atm svc** privileged EXEC command.

show atm svc [*vpi*/*vci* | *name* | **interface atm** *interface-number*]

Syntax Description

vpi/*vci*	(Optional) The ATM VPI and VCI numbers. The absence of the slash character (/) and a *vpi* value defaults the *vpi* value to 0.
name	(Optional) Name of the SVC.
interface atm *interface-number*	(Optional) Interface number or subinterface number of the SVC. Displays all SVCs on the specified interface or subinterface. The *interface-number* argument uses one of the following formats, depending on what router platform you are using: • For the AIP on Cisco 7500 series routers; For the ATM port adapter, ATM-CES port adapter, and enhanced ATM port adapter on Cisco 7200 series routers; For the 1-port ATM-25 network module on Cisco 2600 and 3600 series routers: *slot*/**0**[**.***subinterface-number* **multipoint**] • For the ATM port adapter and enhanced ATM port adapter on Cisco 7500 series routers: *slot*/*port-adapter*/**0**[**.***subinterface-number* **multipoint**] • For the NPM on Cisco 4500 and 4700 routers: *number*[**.***subinterface-number* **multipoint**] For a description of these arguments, refer to the **interface atm** command.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

If the *vpi*/*vci* or *name* argument is not specified, the output of this command is the same as that of the **show atm vc** command but only the configured SVCs are displayed. See the first sample output below, which uses the **show atm svc** command without any of the optional arguments.

If the *vpi*/*vci* or *name* argument is specified, the output of this command is the same as the **show atm vc** *vcd* command, plus extra information related to SVC management including connection name, detailed states, and OAM counters. See the second sample output below, which uses the s**how atm svc** command with the *vpi/vci* specified as 0/34.

If the **interface atm** *interface-number* option is included in the command, all SVCs under that interface or subinterface are displayed. See the third sample output below, which uses the **show atm svc** command with the ATM subinterface specified as 2/0.2.

Examples

The following is sample output from the **show atm svc** command:

```
Router# show atm svc

           VCD/                                          Peak       Avg/Min   Burst
Interface  Name    VPI   VCI   Type    Encaps     Kbps         Kbps   Cells       Sts
2/0.2        4     0     32    SVC       SNAP   155000       155000               UP
2/0.2        3     0     33    SVC       SNAP   155000       155000               UP
2/0.1        5     0     34    SVC       SNAP   155000                            UP
2/0.2        6     0     35    SVC       SNAP   155000       155000               UP
```

The following is sample output from the **show atm svc** command with VPI 0 and VCI 34 specified:

```
Router# show atm svc 0/34

ATM2/0.1: VCD: 5, VPI: 0, VCI: 34
UBR, PeakRate: 155000
AAL5-LLC/SNAP, etype: 0x0, Flags 0x440, VCmode: 0xE000
OAM frequency: 0 second(s), OAM retry frequency: 1 second(s)
OAM up retry count: 3, OAM down retry count: 5
OAM Loopback status: OAM Disabled
OAM VC state: Not Managed
ILMI VC state: Not Managed
InARP DISABLED
InPkts: 4, OutPkts: 4, InBytes: 432, OutBytes: 432
InPRoc: 4, OutPRoc: 4, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
OAM cells received: 0
F5 InEndloop: 0, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI:0
F4 InEndloop: 0, F4 InSegloop: 0, F4 InAIS: 0, F4 InRDI:0
OAM cells sent: 0
F5 OutEndloop: 0, F5 OutSegloop: 0, F5 OutRDI: 0
OAM cell drops: 0
Status: UP
TTL: 3
interface = ATM2/0.2, call locally initiated, call reference = 8388610
vcnum = 5, vpi = 0, vci = 34, state = Active(U10), point-to-point call
Retry count: Current = 0
timer currently inactive, timer value = 00:00:00
Remote Atm Nsap address:47.00918100000000400B0A2501.0060837B4743.00, VCowner:Static Map
```

The following is sample output from the **show atm svc interface atm** *interface_number* command:

```
Router# show atm svc interface atm 2/0.2

           VCD/                                          Peak       Avg/Min   Burst
Interface  Name    VPI   VCI   Type    Encaps     Kbps         Kbps   Cells       Sts
2/0.2        4     0     32    SVC       SNAP   155000       155000               UP
2/0.2        3     0     33    SVC       SNAP   155000       155000               UP
2/0.2        6     0     35    SVC       SNAP   155000       155000               UP
```

Table 9 describes significant fields shown in the displays.

Table 9 show atm svc Field Descriptions

Field	Description
Interface	Interface and subinterface slot and port.
VCD/Name	Virtual circuit descriptor (virtual circuit number). The connection name is displayed if a name for the VC was configured using the **svc** command.
VPI	Virtual path identifier.

Table 9 show atm svc Field Descriptions (continued)

Field	Description
VCI	Virtual channel identifier.
Type	Type of virtual circuit, either SVC or MSVC (multipoint SVC). • MSVC (with no *-x*) indicates that VCD is a leaf of some other router's multipoint VC. • MSVC-*x* indicates there are *x* leaf routers for that multipoint VC opened by the root.
Encaps	Type of ATM adaptation layer (AAL) and encapsulation.
Peak or PeakRate	Kilobits per second transmitted at the peak rate.
Avg/Min or Average Rate	Kilobits per second transmitted at the average rate.
Burst Cells	Value that equals the maximum number of ATM cells the virtual circuit can transmit at peak rate.
Sts or Status	Status of the VC connection. • UP indicates that the connection is enabled for data traffic. • DOWN indicates that the connection is not ready for data traffic. When the Status field is DOWN, a State field is shown. See a description of the different values for this field listed later in this table. • INACTIVE indicates that the interface is down.
Connection Name	The name of the SVC.
UBR, UBR+, or VBR–NRT	UBR—Unspecified Bit Rate QoS is specified for this SVC. See the **ubr** command for further information. UBR+—Unspecified Bit Rate QoS is specified for this SVC. See the **ubr+** command for further information. VBR–NRT—Variable Bit Rate–Non Real Time QoS rates are specified for this SVC. See the **vbr-nrt** command for further information.
etype	Encapsulation type.

Table 9 show atm svc Field Descriptions (continued)

Field	Description
Flags	Bit mask describing virtual circuit information. The flag values are summed to result in the displayed value. 0x40—SVC 0x20—PVC 0x10—ACTIVE 0x0—AAL5-SNAP 0x1—AAL5-NLPID 0x2—AAL5-FRNLPID 0x3—AAL5-MUX 0x4—AAL3/4-SMDS 0x5—QSAAL 0x6—ILMI 0x7—AAL5-LANE 0x9—AAL5-CISCOPPP
VCmode	AIP-specific or NPM-specific register describing the usage of the virtual circuit. This register contains values such as rate queue, peak rate, and AAL mode, which are also displayed in other fields.
OAM frequency	Number of seconds between sending OAM loopback cells.
OAM retry frequency	The frequency (in seconds) that end-to-end F5 loopback cells should be transmitted when a change in UP/DOWN state is being verified. For example, if an SVC is up and a loopback cell response is not received after the *frequency* (in seconds) specified using the **oam-svc** command, then loopback cells are sent at the *retry-frequency* to verify whether the SVC is down.
OAM up retry count	Number of consecutive end-to-end F5 OAM loopback cell responses that must be received in order to change a PVC state to up. Does not apply to SVCs.
OAM down retry count	Number of consecutive end-to-end F5 OAM loopback cell responses that are not received in order to change a PVC state to down or tear down an SVC.
OAM Loopback status	Status of end-to-end F5 OAM loopback cell generation for this VC. This field will have one of the following values: • OAM Disabled—End-to-End F5 OAM loopback cell generation is disabled. • OAM Sent—OAM cell was sent. • OAM Received—OAM cell was received. • OAM Failed—OAM reply was not received within the frequency period or contained bad correlation tag.ssss.

Table 9 show atm svc Field Descriptions (continued)

Field	Description
OAM VC state	This field will have one of the following states for this VC: • AIS/RDI—The VC received AIS/RDI cells. End-to-end F5 OAM loopback cells are not sent in this state. • Down Retry—An OAM loopback failed. End-to-end F5 OAM loopback cells are sent at retry frequency to verify the VC is really down. After down-count unsuccessful retries, the VC goes to the Not Verified state. • Not Managed—VC is not being managed by OAM. • Not Verified—VC has not been verified by end-to-end F5 OAM loopback cells. AIS and RDI conditions are cleared. • Up Retry—An OAM loopback was successful. End-to-end F5 OAM loopback cells are sent at retry frequency to verify the VC is really up. After up-count successive and successful loopback retries, the VC goes to the Verified state. • Verified—Loopbacks are successful. AIS/RDI cell was not received.
ILMI VC state	This field will have one of the following states for this VC: • Not Managed—VC is not being managed by ILMI. • Not Verified—VC has not been verified by ILMI. • Verified—VC has been verified by ILMI.
VC is managed by OAM/ILMI	VC is managed by OAM and/or ILMI.
InARP frequency	Number of minutes for the Inverse ARP time period.
InPkts	Total number of packets received on this virtual circuit. This number includes all fast-switched and process-switched packets.
OutPkts	Total number of packets sent on this virtual circuit. This number includes all fast-switched and process-switched packets.
InBytes	Total number of bytes received on this virtual circuit. This number includes all fast-switched and process-switched bytes.
OutBytes	Total number of bytes sent on this virtual circuit. This number includes all fast-switched and process-switched bytes.
InPRoc	Number of process-switched input packets.
OutPRoc	Number of process-switched output packets.
Broadcasts	Number of process-switched broadcast packets.
InFast	Number of fast-switched input packets.
OutFast	Number of fast-switched output packets.
InAS	Number of autonomous-switched or silicon-switched input packets.
OutAS	Number of autonomous-switched or silicon-switched output packets.
OAM cells received	Total number of OAM cells received on this virtual circuit.
F5 InEndloop	Number of end-to-end F5 OAM loopback cells received.
F5 InSegloop	Number of segment F5 OAM loopback cells received.

Table 9 show atm svc Field Descriptions (continued)

Field	Description
F5 InAIS	Number of F5 OAM AIS cells received.
F5 InRDI	Number of F5 OAM RDI cells received.
F4 InEndloop	Number of end-to-end F4 OAM loopback cells received.
F4 InSegloop	Number of segment F4 OAM loopback cells received.
F4 InAIS	Number of F4 OAM AIS cells received.
F4 InRDI	Number of F4 OAM RDI cells received.
OAM cells sent	Total number of OAM cells sent on this virtual circuit.
F5 OutEndloop	Number of end-to-end F5 OAM loopback cells sent.
F5 OutSegloop	Number of segment F5 OAM loopback cells sent.
F5 OutRDI	Number of F5 OAM RDI cells sent.
OAM cell drops	Number of OAM cells dropped (or flushed).
State	When the Status field is DOWN or INACTIVE, the State field will appear with one of the following values: NOT_VERIFIED—The VC has been established successfully; Waiting for OAM (if enabled) and ILMI (if enabled) to verify that the VC is up. NOT_EXIST—VC has not been created. HASHING_IN—VC has been hashed into a hash table. ESTABLISHING—Ready to establish VC connection. MODIFYING—VC parameters have been modified. DELETING—VC is being deleted. DELETED—VC has been deleted. NOT_IN_SERVICE—ATM interface is shut down.
TTL	Time-to-live in ATM hops across the VC.
VC owner	IP Multicast address of group.

show atm traffic

To display current, global ATM traffic information to and from all ATM networks connected to the router, use the **show atm traffic** privileged EXEC command.

show atm traffic

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show atm traffic** command for the ATM-CES port adapter on a Cisco 7200 series router:

```
Router# show atm traffic

0 Input packets
1044 Output packets
1021 Broadcast packets
0 Packets received on non-existent VC
0 Packets attempted to send on non-existent VC
0 OAM cells received
0 OAM cells sent
```

The following is sample output from the **show atm traffic** command for the AIP on a Cisco 7500 series router:

```
Router# show atm traffic

276875 Input packets
272965 Output packets
2 Broadcast packets
0 Packets received on non-existent VC
6 Packets attempted to send on non-existent VC
272523 OAM cells received
F5 InEndloop: 272523, F5 InSegloop: 0, F5 InAIS: 0, F5 InRDI: 0
F4 InEndloop: 0, F4 InSegloop: 0, F4 InAIS: 0, F4 InRDI: 0
272963 OAM cells sent
F5 OutEndloop: 272963, F5 OutSegloop: 0, F5 OutRDI: 0
0 OAM cell drops
```

Table 10 describes the fields shown in the display.

Table 10 show atm traffic Field Descriptions

Field	Description
Input packets	Total packets input.
Output packets	Total packets output.
Broadcast packets	Total broadcast packets output.
Packets received on nonexistent VC	Number of packets sent to virtual circuits not configured.
Packets attempted to send on non-existent VC	Number of packets attempted to be sent on a virtual circuit that were not configured.
OAM cells received	Total Operation, Administration, and Maintenance (OAM) cells received.
F5 InEndloop	Number of end-to-end F5 OAM loopback cells received.
F5 InSegloop	Number of segment F5 OAM loopback cells received.
F5 InAIS	Number of F5 OAM AIS cells received.
F5 InRDI	Number of F5 OAM RDI cells received.
F4 InEndloop	Number of end-to-end F4 OAM loopback cells received.
F4 InSegloop	Number of segment F4 OAM loopback cells received.
F4 InAIS	Number of F4 OAM AIS cells received.
F4 InRDI	Number of F4 OAM RDI cells received.
OAM cells sent	Total number of OAM cells sent on this VC.
F5 OutEndloop	Number of end-to-end F5 OAM loopback cells sent.
F5OutSegloop	Number of segment F5 OAM loopback cells sent.
F5 OutRDI	Number of F5 OAM RDI cells sent.
OAM cell drops	Number of OAM cells dropped (or flushed).

Related Commands

Command	Description
pvc	Configures the PVC interface.
svc	Creates an ATM SVC and specifies the destination NSAP address on a main interface or subinterface.

show atm vc

To display all ATM permanent virtual circuits (PVCs) and switched virtual circuits (SVCs) and traffic information, use the **show atm vc** privileged EXEC command.

show atm vc [*vcd* | **interface** *interface-number*]

Syntax Description

vcd	(Optional) Specifies which virtual circuit about which to display information.
interface *interface-number*	(Optional) Interface number or subinterface number of the PVC or SVC. Displays all PVCs and SVCs on the specified interface or subinterface. The *interface-number* uses one of the following formats, depending on what router platform you are using: • For the ATM Interface Processor (AIP) on Cisco 7500 series routers; For the ATM port adapter, ATM-CES port adapter, and enhanced ATM port adapter on Cisco 7200 series routers; For the 1-port ATM-25 network module on Cisco 2600 and 3600 series routers: *slot*/**0**[**.***subinterface-number* **multipoint**] • For the ATM port adapter and enhanced ATM port adapter on Cisco 7500 series routers: *slot*/*port-adapter*/**0**[**.***subinterface-number* **multipoint**] • For the network processing module (NPM) on Cisco 4500 and 4700 routers: *number*[**.***subinterface-number* **multipoint**] For a description of these arguments, refer to the **interface atm** command.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
11.1 CA	Information about VCs on an ATM-CES port adapter was added to the command output.
12.0(5)T	Information about VCs on an extended Multiprotocol Label Switching (MPLS) ATM interface was added to the command output.

Usage Guidelines

If no *vcd* value is specified, the command displays information for all PVCs and SVCs. The output is in summary form (one line per virtual circuit).

VCs on the extended MPLS ATM interfaces do not appear in the **show atm vc** command output. Instead, the **show xtagatm vc** command provides a similar output which shows information only on extended MPLS ATM VCs.

Examples

The following is sample output from the **show atm vc** command when no *vcd* value is specified. The status field is either ACTIVE or INACTIVE.

```
Router# show atm vc

Interface     VCD   VPI   VCI Type  AAL/Encaps     Peak   Avg.  Burst Status
ATM2/0          1     0     5  PVC  AAL5-SAAL     155000 155000    93 ACTIVE
ATM2/0.4        3     0    32  SVC  AAL5-SNAP     155000 155000    93 ACTIVE
ATM2/0.65432   10    10    10  PVC  AAL5-SNAP     100000  40000    10 ACTIVE
ATM2/0         99     0    16  PVC  AAL5-ILMI     155000 155000    93 ACTIVE
ATM2/0.105    250    33    44  PVC  AAL5-SNAP     155000 155000    93 ACTIVE
ATM2/0.100    300    22    33  PVC  AAL5-SNAP     155000 155000    93 ACTIVE
ATM2/0.12345 2047   255 65535  PVC  AAL5-SNAP         56     28  2047 ACTIVE
```

The following is sample output from the **show atm vc** command when a *vcd* value is specified for a circuit emulation service (CES) circuit:

```
Router# show atm vc 2

ATM6/0: VCD: 2, VPI: 10, VCI: 10
PeakRate: 2310, Average Rate: 2310, Burst Cells: 94
CES-AAL1, etype:0x0, Flags: 0x20138, VCmode: 0x0
OAM DISABLED
InARP DISABLED
OAM cells received: 0
OAM cells sent: 334272
Status: ACTIVE
```

The following is sample output from the **show atm vc** command when a *vcd* value is specified, displaying statistics for that virtual circuit only:

```
Router# show atm vc 8

ATM4/0: VCD: 8, VPI: 8, VCI: 8
PeakRate: 155000, Average Rate: 155000, Burst Cells: 0
AAL5-LLC/SNAP, etype:0x0, Flags: 0x30, VCmode: 0xE000
OAM frequency: 0 second(s)
InARP frequency: 1 minute(s)
InPkts: 181061, OutPkts: 570499, InBytes: 757314267, OutBytes: 2137187609
InPRoc: 181011, OutPRoc: 10, Broadcasts: 570459
InFast: 39, OutFast: 36, InAS: 11, OutAS: 6
OAM cells received: 0
OAM cells sent: 0
Status: UP
```

The following is sample output from the **show atm vc** command when a *vcd* value is specified, AAL3/4 is enabled, an ATM SMDS subinterface has been defined, and a range of message identifier numbers (MIDs) has been assigned to the PVC:

```
Router# show atm vc 1

ATM4/0.1: VCD: 1, VPI: 0, VCI: 1
PeakRate: 0, Average Rate: 0, Burst Cells: 0
AAL3/4-SMDS, etype:0x1, Flags: 0x35, VCmode: 0xE200
MID start: 1, MID end: 16
InPkts: 0, OutPkts: 0, InBytes: 0, OutBytes: 0
InPRoc: 0, OutPRoc: 0, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
```

The following is sample output from the **show atm vc** command when a *vcd* value is specified and generation of Operation, Administration, and Maintenance (OAM) F5 loopback cells has been enabled.

```
Router# show atm vc 7

ATM4/0: VCD: 7, VPI: 7, VCI: 7
PeakRate: 0, Average Rate: 0, Burst Cells: 0
AAL5-LLC/SNAP, etype:0x0, Flags: 0x30, VCmode: 0xE000
OAM frequency: 10 second(s)
InARP DISABLED
InPkts: 0, OutPkts: 0, InBytes: 0, OutBytes: 0
InPRoc: 0, OutPRoc: 0, Broadcasts: 0
InFast:0, OutFast:0, InAS:0, OutAS:0
OAM cells received: 0
OAM cells sent: 1
Status: UP
```

The following is sample output from the **show atm vc** command when a *vcd* value is specified, and there is an incoming multipoint virtual circuit.

```
Router# show atm vc 3

ATM2/0: VCD: 3, VPI: 0, VCI: 33
PeakRate: 0, Average Rate: 0, Burst Cells: 0
AAL5-MUX, etype:0x809B, Flags: 0x53, VCmode: 0xE000
OAM DISABLED
InARP DISABLED
InPkts: 6646, OutPkts: 0, InBytes: 153078, OutBytes: 0
InPRoc: 6646, OutPRoc: 0, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
interface =  ATM2/0, call remotely initiated, call reference = 18082
vcnum = 3, vpi = 0, vci = 33, state = Active
 aal5mux vc, multipoint call
Retry count: Current = 0, Max = 10
timer currently inactive, timer value = never
Root Atm Nsap address: DE.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12
```

The following is sample output from the **show atm vc** command when a *vcd* value is specified, and there is an outgoing multipoint virtual circuit:

```
Router# show atm vc 6

ATM2/0: VCD: 6, VPI: 0, VCI: 35
PeakRate: 0, Average Rate: 0, Burst Cells: 0
AAL5-MUX, etype:0x800, Flags: 0x53, VCmode: 0xE000
OAM DISABLED
InARP DISABLED
InPkts: 0, OutPkts: 818, InBytes: 0, OutBytes: 37628
InPRoc: 0, OutPRoc: 0, Broadcasts: 818
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
interface =  ATM2/0, call locally initiated, call reference = 3
vcnum = 6, vpi = 0, vci = 35, state = Active
 aal5mux vc, multipoint call
Retry count: Current = 0, Max = 10
timer currently inactive, timer value = never
Leaf Atm Nsap address: DE.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12
Leaf Atm Nsap address: CD.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.12
```

The following is sample output from the **show atm vc** command when a *vcd* value is specified and there is a PPP-over-ATM connection:

```
Router# show atm vc 1

ATM8/0.1: VCD: 1, VPI: 41, VCI: 41
PeakRate: 155000, Average Rate: 155000, Burst Cells: 96
AAL5-CISCOPPP, etype:0x9, Flags: 0xC38, VCmode: 0xE000
virtual-access: 1, virtual-template: 1
OAM DISABLED
InARP DISABLED
InPkts: 13, OutPkts: 10, InBytes: 198, OutBytes: 156
InPRoc: 13, OutPRoc: 10, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
OAM cells received: 0
OAM cells sent: 0
```

The following is sample output from the **show atm vc** command for IP multicast virtual circuits. The display shows the leaf count for multipoint VCs opened by the root. VCD 3 is a root of a multipoint VC with three leaf routers. VCD 4 is a leaf of some other router's multipoint VC. VCD 12 is a root of a multipoint VC with only one leaf router.

```
Router# show atm vc

           VCD/                                    Peak     Avg/Min     Burst
Interface  Name  VPI   VCI    Type     Encaps       Kbps      Kbps      Cells         Sts
0/0        1       0     5     PVC      SAAL      155000    155000       96          UP
0/0        2       0    16     PVC      ILMI      155000    155000       96          UP
0/0        3       0   124 MSVC-3      SNAP      155000    155000       96          UP
0/0        4       0   125   MSVC      SNAP      155000    155000       96          UP
0/0        5       0   126   MSVC      SNAP      155000    155000       96          UP
0/0        6       0   127   MSVC      SNAP      155000    155000       96          UP
0/0        9       0   130   MSVC      SNAP      155000    155000       96          UP
0/0        10      0   131    SVC      SNAP      155000    155000       96          UP
0/0        11      0   132 MSVC-3      SNAP      155000    155000       96          UP
0/0        12      0   133 MSVC-1      SNAP      155000    155000       96          UP
0/0        13      0   134    SVC      SNAP      155000    155000       96          UP
0/0        14      0   135 MSVC-2      SNAP      155000    155000       96          UP
0/0        15      0   136 MSVC-2      SNAP      155000    155000       96          UP
```

The following is sample output from the **show atm vc** command for an IP multicast virtual circuit. The display shows the owner of the VC and leafs of the multipoint VC. This VC was opened by IP multicast and the three leaf routers' ATM addresses are included in the display. The VC is associated with IP group address 10.1.1.1.

```
Router# show atm vc 11

ATM0/0: VCD: 11, VPI: 0, VCI: 132
PeakRate: 155000, Average Rate: 155000, Burst Cells: 96
AAL5-LLC/SNAP, etype:0x0, Flags: 0x650, VCmode: 0xE000
OAM DISABLED
InARP DISABLED
InPkts: 0, OutPkts: 12, InBytes: 0, OutBytes: 496
InPRoc: 0, OutPRoc: 0, Broadcasts: 12
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
OAM cells received: 0
OAM cells sent: 0
Status: ACTIVE, TTL: 2, VC owner: IP Multicast (10.1.1.1)                <<<
interface =  ATM0/0, call locally initiated, call reference = 2
vcnum = 11, vpi = 0, vci = 132, state = Active
 aal5snap vc, multipoint call
Retry count: Current = 0, Max = 10
timer currently inactive, timer value = 00:00:00
```

```
Leaf Atm Nsap address: 47.0091810000000002BA08E101.444444444444.02       <<<
Leaf Atm Nsap address: 47.0091810000000002BA08E101.333333333333.02       <<<
Leaf Atm Nsap address: 47.0091810000000002BA08E101.222222222222.02       <<<
```

The following is sample output from the **show atm vc** command where no VCD is specified and private VCs are present.

```
Router# show atm vc

AAL /          Peak   Avg.  Burst
Interface     VCD   VPI    VCI Type  Encapsulation  Kbps   Kbps  Cells Status
ATM1/0          1     0     40  PVC  AAL5-SNAP          0      0      0 ACTIVE
ATM1/0          2     0     41  PVC  AAL5-SNAP          0      0      0 ACTIVE
ATM1/0          3     0     42  PVC  AAL5-SNAP          0      0      0 ACTIVE
ATM1/0          4     0     43  PVC  AAL5-SNAP          0      0      0 ACTIVE
ATM1/0          5     0     44  PVC  AAL5-SNAP          0      0      0 ACTIVE
ATM1/0         15     1     32  PVC  AAL5-XTAGATM       0      0      0 ACTIVE
ATM1/0         17     1     34  TVC  AAL5-XTAGATM       0      0      0 ACTIVE
ATM1/0         26     1     43  TVC  AAL5-XTAGATM       0      0      0 ACTIVE
ATM1/0         28     1     45  TVC  AAL5-XTAGATM       0      0      0 ACTIVE
ATM1/0         29     1     46  TVC  AAL5-XTAGATM       0      0      0 ACTIVE
ATM1/0         33     1     50  TVC  AAL5-XTAGATM       0      0      0 ACTIVE
```

When you specify a VCD value and the VCD corresponds to that of a private VC on a control interface, the display output appears as follows:

```
Router# show atm vc 15

ATM1/0 33     1    50  TVC  AAL5-XTAGATM       0      0      0 ACTIVE
ATM1/0: VCD: 15, VPI: 1, VCI: 32, etype:0x8, AAL5 - XTAGATM, Flags: 0xD38
PeakRate: 0, Average Rate: 0, Burst Cells: 0, VCmode: 0x0
XTagATM1, VCD: 1, VPI: 0, VCI: 32
OAM DISABLED, InARP DISABLED
InPkts: 38811, OutPkts: 38813, InBytes: 2911240, OutBytes: 2968834
InPRoc: 0, OutPRoc: 0, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
OAM F5 cells sent: 0, OAM cells received: 0
Status: ACTIVE
```

Table 11 describes the fields shown in the displays.

Table 11 show atm vc Field Descriptions

Field	Description
Interface	Interface slot and port.
VCD/Name	Virtual circuit descriptor (virtual circuit number). The connection name is displayed if the VC was configured using the **pvc** command and the name was specified.
VPI	Virtual path identifier.
VCI	Virtual channel identifier.

Table 11 show atm vc Field Descriptions (continued)

Field	Description
Type	Type of virtual circuit, either PVC, SVC, or multipoint SVC (MSVC). • MSVC (with no -*x*) indicates that VCD is a leaf of some other router's multipoint VC. • MSVC-*x* indicates there are *x* leaf routers for that multipoint VC opened by the root. Type of PVC detected from PVC discovery, either PVC-D, PVC-L, or PVC-M. • PVC-D indicates a PVC created due to PVC discovery. • PVC-L indicates that the corresponding peer of this PVC could not be found on the switch. • PVC-M indicates that some or all of the QOS parameters of this PVC mismatch that of the corresponding peer on the switch.
Encaps	Type of ATM adaptation layer (AAL) and encapsulation.
PeakRate	Kilobits per second transmitted at the peak rate.
Average Rate	Kilobits per second transmitted at the average rate.
Burst Cells	Value that equals the maximum number of ATM cells the virtual circuit can send at peak rate.
Status	Status of the VC connection. • UP indicates that the connection is enabled for data traffic. • DOWN indicates that the connection is not ready for data traffic. When the Status field is DOWN, a State field is shown. See a description of the different values for this field listed later in this table. • INACTIVE indicates that the interface is down.
etype	Encapsulation type.

Table 11 show atm vc Field Descriptions (continued)

Field	Description
Flags	Bit mask describing virtual circuit information. The flag values are summed to result in the displayed value. 0x10000 ABR VC 0x20000 CES VC 0x40000 TVC 0x100 TEMP (automatically created) 0x200 MULTIPOINT 0x400 DEFAULT_RATE 0x800 DEFAULT_BURST 0x10 ACTIVE 0x20 PVC 0x40 SVC 0x0 AAL5-SNAP 0x1 AAL5-NLPID 0x2 AAL5-FRNLPID 0x3 AAL5-MUX 0x4 AAL3/4-SMDS 0x5 QSAAL 0x6 AAL5-ILMI 0x7 AAL5-LANE 0x8 AAL5-XTAGATM 0x9 CES-AAL1 0xA F4-OAM
VCmode	AIP-specific or NPM-specific register describing the usage of the virtual circuit. This register contains values such as rate queue, peak rate, and AAL mode, which are also displayed in other fields.
OAM frequency	Seconds between OAM loopback messages, or DISABLED if OAM is not in use on this VC.
InARP frequency	Minutes between InARP messages, or DISABLED if InARP is not in use on this VC.
virtual-access	Virtual access interface identifier.
virtual-template	Virtual template identifier.
InPkts	Total number of packets received on this virtual circuit. This number includes all fast-switched and process-switched packets.
OutPkts	Total number of packets sent on this virtual circuit. This number includes all fast-switched and process-switched packets.
InBytes	Total number of bytes received on this virtual circuit. This number includes all fast-switched and process-switched packets.
OutBytes	Total number of bytes sent on this virtual circuit. This number includes all fast-switched and process-switched packets.
InPRoc	Number of process-switched input packets.
OutPRoc	Number of process-switched output packets.
Broadcast	Number of process-switched broadcast packets.
InFast	Number of fast-switched input packets.

Table 11 show atm vc Field Descriptions (continued)

Field	Description
OutFast	Number of fast-switched output packets.
InAS	Number of autonomous-switched or silicon-switched input packets.
OutAS	Number of autonomous-switched or silicon-switched output packets.
OAM cells received	Number of OAM cells received on this virtual circuit.
OAM cells sent	Number of OAM cells sent on this virtual circuit.
TTL	Time-to-live in ATM hops across the VC.
VC owner	IP Multicast address of group.

Related Commands

Command	Description
atm nsap-address	Sets the NSAP address for an ATM interface using SVC mode.

show atm vp

To display the statistics for all virtual paths (VPs) on an interface or for a specific VP, use the **show atm vp** privileged EXEC command.

show atm vp [*vpi*]

Syntax Description

vpi	(Optional) ATM network virtual path identifier (VPI) of the permanent virtual path. The range is 0 to 255. The VPI is an 8-bit field in the header of the ATM cell.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1	This command was introduced.

Examples

The following is sample output from the **show atm vp** command. This output shows the interface name, the status of the interface, the administrative status of the interface, the port type, and the number of channels in use on the interface. The status of the interface can be UP (in operation) or DOWN (not in operation).

```
Router# show atm vp 1

ATM6/0  VPI: 1, PeakRate: 155000, CesRate: 1742, DataVCs: 1, CesVCs:1, Status: ACTIVE

     VCD    VCI   Type   InPkts   OutPkts   AAL/Encap     Status
     1      100   PVC    n/a      n/a       CES-AAL1      ACTIVE
     13     13    PVC    0        0         AAL5-SNAP     ACTIVE
     409    3     PVC    0        0         F4 OAM        ACTIVE
     410    4     PVC    0        0         F4 OAM        ACTIVE

   TotalInPkts: 0, TotalOutPkts: 0, TotalInFast: 0, TotalOutFast: 0, TotalBroadcasts: 0
```

Table 12 describes the fields shown in the display.

Table 12 show atm vp Field Descriptions

Field	Description
ATM6/0	Interface type, slot, and port number of the VP.
VPI	Virtual path identifier of the VP.
PeakRate	Maximum rate, in kbps, at which the VP can send data. Range is 84 kbps to line rate. The default is the line rate.
CesRate	Total circuit emulation service (CES) bandwidth allocated for the VP.
DataVCs	Number of data virtual circuits (VCs) on the VP.
CesVCs	Number of CES VC on the VP.
Status	Current status of the VP. Values are ACTIVE and INACTIVE.

Table 12 show atm vp Field Descriptions (continued)

Field	Description
VCD	Virtual circuit descriptor of the VC associated with this VP.
VCI	Virtual channel identifier of the VC associated with this VP.
Type	Type of VC associated with this VP. Values are PVC and SVC.
InPkts	Number of packets received on the VP.
OutPkts	Number of packets transmitted on the VP.
AAL/Encap	Type of encapsulation used on the VC associated with this VP.
Status	Status of the VP (ACTIVE or INACTIVE).
TotalInPkts:	Total number of input packets process-switched and fast-switched on the VP.
TotalOutPkts:	Total number of output packets process-switched and fast-switched on the VP.
TotalInFast	Total number of input packets fast-switched.
TotalOutFast:	Total number of output packets fast-switched.
TotalBroadcasts:	Total number of broadcast packets fast-switched.

Related Commands

Command	Description
atm pvp	Creates a PVP used to multiplex (or bundle) one or more VCs (especially CES and data VCs).

show ces

To display details about a Circuit Emulation Service (CES) connection, use the **show ces** privileged EXEC command.

show ces [*slot*/*port*]

Syntax Description

slot/*port*	(Optional) Slot and port number of the CES interface.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

This command is used on Cisco 2600 series and Cisco 3600 series routers that have OC-3/STM-1 ATM CES network modules.

Examples

The following is sample output from the **show ces** command.

```
Router#show ces 3/0

CURRENT VPD CES CLOCK:Set to ATM
ATM CLOCKING:Clock Source is Line
VPD BASE ADDRESS->(0x3DE00000)
Multi Mode VPD Installed
VIC/WIC PRESENT->  2 port drop&insert T1 humvee installed
CONTROLLER CLOCKING-> PORT[0]:Clock is Internal
CONTROLLER CLOCKING-> PORT[1]:Clock is Internal
DCU [0]:
 port State:   active       alarm State:normal         Loop Type:   noloop
 Clocking Mode:loopTimed  Data Mode:  crossConnect   Framing Type:  d4
 Line Coding:  ami          t1Cas:      off            tsInUse:     0000001C
  VPI/VCI 6/78  CES AAL1 Input cells 210252  CES AAL1 Output cells 210252
        imRestart 0  xcUndfrmslp 2  overflow 0
DCU [1]:
 port State:   inactive     alarm State:normal         Loop Type:   noloop
 Clocking Mode:synchronous  Data Mode:  clearChannel   Framing Type:none
 Line Coding:  ami          t1Cas:      off            tsInUse:     00000000
DCU [2]:
 port State:   inactive     alarm State:normal         Loop Type:   noloop
 Clocking Mode:synchronous  Data Mode:  clearChannel   Framing Type:none
 Line Coding:  ami          t1Cas:      off            tsInUse:     00000000
DCU [3]:
 port State:   inactive     alarm State:normal         Loop Type:   noloop
 Clocking Mode:synchronous  Data Mode:  clearChannel   Framing Type:none
 Line Coding:  ami          t1Cas:      off            tsInUse:     00000000
```

Table 13 describes significant fields shown in the display.

Table 13 show ces Field Descriptions

Field	Description
CURRENT VPD CES CLOCK	Clock being used by the CES function.
ATM CLOCKING	Clock being used by the ATM interface.
VIC/WIC PRESENT	Type of WIC plugged into the Network Module.
CONTROLLER CLOCKING	Clock being used by the T1 controller.
port State	Current state of port. Values areactive or inactive.
alarm State	Current state of the CES port.
Clocking Mode	CES circuit clocking mode.
Data Mode	CES circuit data mode.
Framing Type	CES port framing type. Values are d4 and esf.
Line Coding	CES port line code type. Values are ami and b8zs.
t1Cas	Current state of T1 Channel Associated Signalling on CES port. Values are on and off.
tsInUse	Bit mask of timeslots in use.
VPI/VCI	VPI/VCI used by CES circuit.
CES AAL1 Input cells	Number of CES cells received.
CES AAL1 Output cells	Number of CES cells transmitted.
xcUndfrmslp	Structured CES circuit Under Frame Slips.
overflow	CES circuit overflows.

Related Commands

Command	Description
ces	Configures CES on a router port.

show ces circuit

To display detailed circuit information for the constant bit rate (CBR) interface, use the **show ces circuit** privileged EXEC command.

show ces circuit [**interface cbr** *slot/port* [*circuit-number*]]

Syntax Description

interface cbr *slot/port*	(Optional) Slot and port number of the CBR interface.
circuit-number	(Optional) Circuit identification. For unstructured service, use 0. For T1 structure service, the range is 1 through 24. For E1 structure service, the range is 1 through 31.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1	This command was introduced.

Examples

The following is sample output from the **show ces circuit** command.

```
Router # show ces circuit

Interface  Circuit  Circuit-Type     X-interface   X-vpi   X-vci  Status
 CBR6/0      1       HardPVC           ATM6/0        0       34   UP
 CBR6/1      1       HardPVC           ATM6/1        0       34   UP
```

Table 14 describes the fields shown in the display.

Table 14 show ces circuit Field Descriptions

Field	Description
Interface	Type, slot, and port number of the interface.
Circuit	Circuit number assigned to the PVC.
Circuit-Type	Type of circuit.Values are HardPVC or SoftPVC. Only HardPVC is supported on the ATM-CES port adapter.
X-interface	Type, slot, and port number of the destination interface.
X-vpi	Virtual path identifier of the destination interface.
X-vci	Virtual channel identifier of the destination interface.
Status	State of the circuit. Values are Up and Down.

The following is sample output from the **show ces circuit** command for a circuit 1 on CBR interface 6/0:

```
Switch# show ces circuit interface cbr 6/0 1

circuit: Name CBR6/0:1, Circuit-state ADMIN_UP / Interface CBR6/0, Circuit_id 1,
Port-Type T1, Port-State UP
```

```
Port Clocking network-derived, aal1 Clocking Method CESIWF_AAL1_CLOCK_Sync
Channel in use on this port: 1
Channels used by this circuit: 1
Cell-Rate: 171, Bit-Rate 64000
cas OFF, cell-header 0X3E80 (vci = 1000)
Configured CDV 2000 usecs, Measured CDV unavailable
ErrTolerance 8, idleCircuitdetect OFF, onHookIdleCode 0x0
state: VcActive, maxQueueDepth       128, startDequeueDepth       111
Partial Fill:       47, Structured Data Transfer 24
HardPVC
src: CBR6/0 vpi 0, vci 16
Dst: ATM6/0 vpi0, vci 1000
```

Table 15 describes the fields shown in the display.

Table 15 show ces circuit interface Field Descriptions

Field	Description
circuit Name	Name of the circuit specified with the **ces circuit** interface command.
Circuit-state	Current configuration state of the circuit. Values are ADMIN_UP or ADMIN_DOWN.
Interface	Type, slot, and port number of the interface.
Circuit_ID	Circuit identification specified with the **ces pvc** interface command.
Port-Type	Type of interface on the ATM-CES port adapter. Values are T1 and E1.
Port-State	Current status of the port. Values are Up and Down.
Port Clocking	Clocking mode used by the interface specified with the **ces dsx1 clock** interface command. Values are Loop-Timed and Network-Derived Adaptive.
aal1 Clocking Method	AAL1 clocking mode used by the interface specified with the **ces aal1 clock** interface command. Values are Adaptive, Synchronous Residual Time Stamp (SRTS), and Synchronous.
Channel in use on this port	Number of active channels used by this interface.
Channels used by this circuit	Number of channels used by the circuit.
Cell-Rate	Number of cells transmitted or received on the interface per second.
Bit-Rate	Speed at which the cells are transmitted or received.
cas	Indicates whether channel-associated signaling (CAS) is enabled on the interface with the **ces circuit** interface command.
cell-header	ATM cell header VCI bytes used for debugging only.
Configured CDV	Indicates the peak-to-peak cell delay variation (CDV) requirement (CDV) in milliseconds specified with the **ces circuit** interface command. The range for CDV is 1 through 65535 milliseconds. The default is 2000 milliseconds.
Measured CDV	Indicates the actual cell delay variation in milliseconds.
ErrTolerance	For internal use only.
idleCircuitdetect	Indicates whether idle circuit detection is enabled (ON) or disabled (OFF).

Table 15 show ces circuit interface Field Descriptions (continued)

Field	Description
onHookIdleCode	Indicates that the on-hook detection feature is enabled with the **ces circuit** interface command and the hex value (0 through F) that indicates a 2 or 4 bit AB[CD] pattern to detect on-hook. The AB[CD] bits are determined by the manufacturer of the voice/video telephony device that is generating the CBR traffic.
state	Current state of the circuit. Values are VcActive, VcInactive, VcLOC (loss of cell), or VcAlarm (alarm condition).
maxQueueDepth	Maximum queue depth in bits.
startDequeueDepth	Start dequeue depth in bits.
Partial Fill	Indicates the partial AAL1 cell fill service for structured service only specified by the **ces circuit** interface command. The range is 0 through 47. The default is 47.
Structured Data Transfer	Size (in bytes) of the structured data transfer frame.
HardPVC	Only hard PVC are supported by the ATM-CES port adapter.
src	Source interface type, slot, and port number and VPI and VCI for the circuit.
Dst	Destination interface interface type, slot, and port number and the VPI and VCI for the circuit.

Related Commands

Command	Description
show ces circuit	Displays detailed circuit information for the CBR interface.
show ces status	Displays the status of the ports on the ATM-CES port adapter.

show ces interface cbr

To display detailed constant bit rate (CBR) port information, use the **show ces interface cbr** privileged EXEC command.

show ces interface cbr *slot/port*

Syntax Description

slot/port	Slot and port number of the CES interface.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1	This command was introduced.

Examples

The following is sample output from the **show ces interface cbr** command for CBR interface 6/0:

```
Router# show ces interface cbr 6/0

Interface:      CBR6/0          Port-type:T1-DCU
IF Status:      UP              Admin Status: UP
Channels in use on this port: 1
LineType: ESF           LineCoding: B8ZS  LoopConfig: NoLoop
SignalMode: NoSignalling   XmtClockSrc: network-derived
DataFormat: Structured     AAL1 Clocking Mode: Synchronous  LineLength: 0_110
LineState: LossOfSignal
Errors in the Current Interval:
  PCVs        0   LCVs        0   ESs         0   SESs        0   SEFSs       0
  UASs        0   CSSs        0   LESs        0   BESs        0   DMs         0
Errors in the last 24Hrs:
  PCVs      514   LCVs        0   ESs         0   SESs        1   SEFSs       0
  UASs        0   CSSs        0   LESs        0   BESs        0   DMs         0
Input  Counters: 0 cells, 0 bytes
Output Counters: 0 cells, 0 bytes
```

Table 16 describes the fields shown in the display.

Table 16 show ces interface cbr Field Descriptions

Field	Description
Interface	Type, slot, and port number of the interface.
Port-type	Type of port on the ATM-CES port adapter. Values are T1-DCU and E1-DCU.
IF Status	Status of the interface. Values are Up and Down.
Admin Status	Configured status of the interface. Values are Up and Down (administratively configured down).
Channels in use on this port	Number of active channels used by this interface.

Table 16 show ces interface cbr Field Descriptions (continued)

Field	Description
LineType	Framing used on the interface specified with the **ces dsx1 framing** interface command. Values (for T1) are ESF and SF; (for E1) E1-CRC-MFCASLT, E1-CRC-MFLT, E1-LT, and E1-MFCASLT.
LineCoding	Line coding used on the interface specified with the **ces dsx1 linecode** interface command. Values (for T1) are AMI and B8ZS; (for E1) HDB3.
LoopConfig	Indicates whether the interface in in a loop state specified by the **ces dsx1 loopback** interface command. Values are line loopback, payload loopback, and noloop.
SignalMode	For T1 to use robbed bit signaling or not.
XmitClockSrc	Transmit clock source specified by the **ces dsx1 clock** interface command. Values are loop-timed or network-derived.
DataFormat	Type of CES services specified by the **ces aal1 service** interface command. Values are structured or unstructured.
AAL1 Clocking Mode	AAL1 clocking mode used by the interface specified with the **ces aal1 clock** interface command. Values are adaptive, synchronous residual time stamp (SRTS), or synchronous.
LineLength	Cable length specified by the **ces dsx1 lbo** interface command. Values are 0-110, 10-200, 220-330, 330-440, 440-550, 550-660, 660-above, and square-pulse.
LineState	Current status of the line. Values are: • Unknown • NoAlarm • RcvFarEndLOF • XmtFarEndLOF • RcvAIS • XmtAIS • LossOfFrame • LossOfSignal • LoopbackState • T16AIS
Errors in the Current Interval	Error statistics received during the current 15-minute interval.
PCVs	Number of Path Code Violations (PCVs). PCVs indicate a frame synchronization bit error in the D4 and E1 no-CRC formats, or a CRC error in the ESF and E1 CRC formats.
LCVs	Number of Line Code Violations (LCVs). LCVs indicate the occurrence of either a Bipolar Violation (BPV) or Excessive Zeros (EXZ) error event.

Table 16 show ces interface cbr Field Descriptions (continued)

Field	Description
ESs	Number of errored seconds. In ESF and E1 CRC links, an Errored Second is a second in which one of the following are detected: one or more Path Code Violations, one or more Out of Frame defects, one or more Controlled Slip events, or a detected AIS defect. For SF and E1 no-CRC links, the presence of Bipolar Violations also triggers an Errored Second.
SESs	Number of Severely Errored Seconds (SESs). A SESs is a second with 320 or more path code violation errors events, one or more Out of Frame defects, or a detected AIS defect.
SEFSs	Number of Severely Errored Framing Seconds (SEFS). SEFS is a second with one or more Out of Frame defects or a detected incoming AIS.
UASs	Number of Unavailable Seconds (UASs). UAS is a count of the total number of seconds on the interface.
CSSs	Number of Controlled Slip Second (CSS). CSS is a 1-second interval containing one or more controlled slips.
LESs	Number of Line Errored Seconds (LES). LES is a second in which one or more Line Code Violation errors are detected.
BESs	Number of Bursty Errored Seconds (BES). BES is a second with fewer than 320 and more than one Path Coding Violation error, no Severely Errored Frame defects, and no detected incoming AIS defects. Controlled slips are not included in this parameter.
DMs	Number of Degraded Minutes (DMs). A degraded minute is one in which the estimated error rate exceeds 1E-6 but does not exceed 1E-3. For more information, refer to RFC 1406.
Errors in the last 24Hrs	Error statistics received during the during the last 24 hours.
Input Counters	Number of cells and bytes received on the interface.
Output Counters	Number of cells and bytes.

Related Commands

Command	Description
show interface cbr	Displays the information about the CBR interface on the ATM-CES port adapter.

show ces status

To display the status of the ports on the ATM-CES port adapter, use the **show ces status** privileged EXEC command.

show ces status

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1	This command was introduced.

Examples

The following is sample output from the **show ces status** command. This output shows the interface name, the status of the interface, the administrative status of the interface, the port type, and the number of channels in use on the interface. The status of the interface can be UP (in operation) or DOWN (not in operation).

```
Router# show ces status

Interface          IF      Admin         Port    Channels in
  Name           Status   Status         Type        use
-------------- -------- --------- ------------ -----------
     CBR0/0/0       UP        UP           T1         1-24
     CBR0/0/1       UP        UP           T1         1-24
     CBR0/0/2       UP        UP           T1         1-24
     CBR0/0/3       UP        UP           T1
```

Related Commands

Command	Description
show ces circuit	Displays detailed circuit information for the CBR interface.

show controllers atm

To display information about an inverse multiplexing over ATM (IMA) group, use the **show controllers atm** privileged EXEC command.

Cisco 2600 and 3600 Series

show controllers atm [*slot*/**ima** *group-number*]

Cisco 7200 Series

show controller atm [*slot*/*port*]

or

show controllers atm [*slot*/**ima***group-number*]

Cisco 7500 Series (physical port hardware information)

show controllers atm [*slot*/*port-adapter*/*port*]

Cisco 7500 Series (IMA group hardware information)

show controllers atm [*slot*/*port-adapter*/**ima***group-number*]

Syntax Description

slot/	(Optional) ATM slot number.
ima	(Optional) This keyword indicates an IMA group specification rather than a port value for a UNI interface.
group-number	(Optional) Enter an IMA group number from 0 to 3. If you specify the group number, do not insert a space between **ima** and the number.
port	(Optional) ATM port number.
port-adapter/	(Optional) ATM port adapter.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.2 GS	This command was introduced.
12.0(5)T and 12.0(5)XK	This command was modified to support IMA groups on Cisco 2600 and 3600 series routers.
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100,7200, and 7500 series routers was integrated into Cisco IOS Release 12.1(5)T.

Usage Guidelines

Use this command to monitor and diagnose ATM IMA links and groups.

Examples

Cisco 7100 or 7200 Series Example

On Cisco 7100 series or 7200 series routers, the following example displays detailed information about IMA group hardware related information. It includes the configuration of IMA hardware and IMA alarms.

```
Router# show controllers atm 1/ima0

Interface ATM1/ima0 is up
Hardware is IMA PA - DS1 (1Mbps)
Framer is PMC PM7344, SAR is LSI ATMIZER II
Firmware rev:G102, ATMIZER II rev:3
  idb=0x61DE9F10, ds=0x6185C0A0, vc=0x6187D3C0, pa=0x6184AF40
  slot 1, unit 9, subunit 0, fci_type 0x00BA, ticks 701720
  400 rx buffers:size=512, encap=64, trailer=28, magic=4
Curr Stats:
  rx_cell_lost=0, rx_no_buffer=0, rx_crc_10=0
  rx_cell_len=0, rx_no_vcd=0, rx_cell_throttle=0, tx_aci_err=0
Rx Free Ring status:
  base=0x3CFF0040, size=1024, write=320
Rx Compl Ring status:
  base=0x338DCE40, size=2048, read=1275
Tx Ring status:
  base=0x3CFE8040, size=8192, write=700
Tx Compl Ring status:
  base=0x338E0E80, size=2048, read=344
BFD Cache status:
  base=0x61878340, size=5120, read=5107
Rx Cache status:
  base=0x61863D80, size=16, write=11
Tx Shadow status:
  base=0x618641C0, size=8192, read=687, write=700
Control data:
  rx_max_spins=12, max_tx_count=25, tx_count=13
  rx_threshold=267, rx_count=11, tx_threshold=3840
  tx bfd write indx=0x27, rx_pool_info=0x61863E20
Control data base address:
       rx_buf_base = 0x038A15A0        rx_p_base = 0x6185CB40
            rx_pak = 0x61863AF0              cmd = 0x6185C320
       device_base = 0x3C800000     ima_pa_stats = 0x038E2FA0
        sdram_base = 0x3CE00000       pa_cmd_buf = 0x3CFFFC00
       vcd_base[0] = 0x3CE3C100      vcd_base[1] = 0x3CE1C000
         chip_dump = 0x038E3D7C       dpram_base = 0x3CD80000
   sar_buf_base[0] = 0x3CE4C000  sar_buf_base[1] = 0x3CF22000
       bfd_base[0] = 0x3CFD4000      bfd_base[1] = 0x3CFC0000
       acd_base[0] = 0x3CE88360      acd_base[1] = 0x3CE5C200
     pci_atm_stats = 0x038E2EC0
ATM1/ima0 is up
        hwgrp number = 1
grp tx up reg= 0x5, grp rx up reg= 0x3, rx dcb reg= 0xD4 0x4, tx links grp reg=
0x3, scci reg= 0x3C, ima id reg= 0x0, group status  reg= 0xA2, tx timing reg= 0x
20, tx test reg= 0x21, tx test pattern reg= 0x41, rx test pattern reg= 0x42, icp
 cell link info  reg= 0xFC, icp cell link info  reg= 0xFC, icp cell link info  r
eg= 0x0, icp cell link info  reg= 0x0, icp cell link info  reg= 0x0, icp cell li
nk info  reg= 0x0, icp cell link info  reg= 0x0, icp cell link info  reg= 0x0
```

Cisco 2600 or 3600 Series Example

On a Cisco 2600 or 3600 series router, the following example displays detailed information about IMA

group 0 on ATM interface 2:

```
router# show controller atm 0/ima3

Interface ATM0/IMA3 is up
  Hardware is ATM IMA
LANE client MAC address is 0050.0f0c.148b
  hwidb=0x61C2E990, ds=0x617D498C
  slot 0, unit 3, subunit 3
  rs8234 base 0x3C000000, slave base 0x3C000000
  rs8234 ds 0x617D498C
  SBDs - avail 2048, guaranteed 3, unguaranteed 2045, starved 0
 Seg VCC table 3C00B800, Shadow Seg VCC Table 617EF76C, VCD Table 61805798
 Schedule table 3C016800, Shadow Schedule table 618087C4, Size 63D
 RSM VCC Table 3C02ED80, Shadow RSM VCC Table 6180C994
 VPI Index Table 3C02C300, VCI Index Table 3C02E980
 Bucket2 Table 3C01E500, Shadow Bucket2 Table 6180A0E4
 MCR Limit Table 3C01E900, Shadow MCR Table 617D2160
 ABR template 3C01EB00, Shadow template 614DEEAC
 RM Cell RS Queue 3C02C980
 Queue            TXQ Addr  Pos  StQ Addr  Pos
 0  UBR CHN0      3C028B00  0    03118540  0
 1  UBR CHN1      3C028F00  0    03118D40  0
 2  UBR CHN2      3C029300  0    03119540  0
 3  UBR CHN3      3C029700  0    03119D40  0
 4  VBR/ABR CHN0 3C029B00  0    0311A540  0
 5  VBR/ABR CHN1 3C029F00  0    0311AD40  0
 6  VBR/ABR CHN2 3C02A300  0    0311B540  0
 7  VBR/ABR CHN3 3C02A700  0    0311BD40  0
 8  VBR-RT CHN0  3C02AB00  0    0311C540  0
 9  VBR-RT CHN1  3C02AF00  0    0311CD40  0
 10 VBR-RT CHN2  3C02B300  0    0311D540  0
 11 VBR-RT CHN3  3C02B700  0    0311DD40  0
 12 SIG          3C02BB00  0    0311E540  0
 13 VPD          3C02BF00  0    0311ED40  0

 Queue            FBQ Addr  Pos  RSQ Addr  Pos
 0  OAM          3C0EED80  255  0311F600  0
 1  UBR CHN0     3C0EFD80  0    03120600  0
 2  UBR CHN1     3C0F0D80  0    03121600  0
 3  UBR CHN2     3C0F1D80  0    03122600  0
 4  UBR CHN3     3C0F2D80  0    03123600  0
 5  VBR/ABR CHN0 3C0F3D80  0    03124600  0
 6  VBR/ABR CHN1 3C0F4D80  0    03125600  0
 7  VBR/ABR CHN2 3C0F5D80  0    03126600  0
 8  VBR/ABR CHN3 3C0F6D80  0    03127600  0
 9  VBR-RT CHN0  3C0F7D80  0    03128600  0
 10 VBR-RT CHN1  3C0F8D80  255  03129600  0
 11 VBR-RT CHN2  3C0F9D80  0    0312A600  0
 12 VBR-RT CHN3  3C0FAD80  0    0312B600  0
 13 SIG          3C0FBD80  255  0312C600  0
SAR Scheduling channels:  -1 -1 -1 -1 -1 -1 -1 -1
ATM channel number is 1
link members are 0x7, active links are 0x0
Group status is blockedNe, 3 links configured,
Group Info: Configured links bitmap 0x7, Active links bitmap 0x0,
    Tx/Rx IMA_id 0x3/0x63,
    NE Group status is startUp,
    frame length 0x80, Max Diff Delay 0,
    1 min links, clock mode ctc, symmetry symmetricOperation, trl 0,
    Group Failure status is startUpNe.
    Test pattern procedure is disabled
SAR counter totals across all links and groups:
   0 cells output, 0 cells stripped
```

```
0 cells input, 0 cells discarded, 0 AAL5 frames discarded
0 pci bus err, 0 dma fifo full err, 0 rsm parity err
0 rsm syn err, 0 rsm/seg q full err, 0 rsm overflow err
0 hs q full err, 0 no free buff q err, 0 seg underflow err
0 host seg stat q full err
```

Related Commands

Command	Description
show controllers atm	Displays information about an IMA group.
show ima interface atm	Provides information about all configured IMA groups or a specific IMA group.

show dxi map

To display all the protocol addresses mapped to a serial interface, use the **show dxi map** EXEC command.

show dxi map

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.3	This command was introduced.

Examples

The following is sample output from the **show dxi map** command. It displays output for several previously defined ATM-DXI maps that defined Apollo, IP, DECnet, CLNS, and AppleTalk protocol addresses, various encapsulations, and broadcast traffic.

```
Router# show dxi map

Serial0 (administratively down): ipx 123.0000.1234.1234
   DFA 69(0x45,0x1050), static, vpi = 4, vci = 5,
   encapsulation: SNAP
Serial0 (administratively down): appletalk 2000.5
   DFA 52(0x34,0xC40), static, vpi = 3, vci = 4,
   encapsulation: NLPID
Serial0 (administratively down): ip 172.21.177.1
   DFA 35(0x23,0x830), static,
   broadcast, vpi = 2, vci = 3,
   encapsulation: VC based MUX,
   Linktype IP
```

Table 17 explains significant fields shown in the display.

Table 17 show dxi map Field Descriptions

Field	Description
DFA	Data Exchange Interface (DXI) Frame Address, similar to a data-link connection identifier (DLCI) for Frame Relay. The DFA is shown in decimal, hexadecimal, and DXI header format. The router computes this address value from the virtual path identifier (VPI) and virtual channel identifier (VCI) values.
encapsulation	Encapsulation type selected by the **dxi pvc** command. Displayed values can be *SNAP*, *NLPID*, or *VC based MUX*.
Linktype	Value used only with MUX encapsulation and therefore with only a single network protocol defined for the permanent virtual circuit (PVC). Maps configured on a PVC with MUX encapsulation must have the same link type.

show dxi pvc

To display the permanent virtual circuit (PVC) statistics for a serial interface, use the **show dxi pvc** EXEC command.

show dxi pvc

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.3	This command was introduced.

Examples

The following is sample output from the **show dxi pvc** command. It displays output for ATM-DXI PVCs previously defined for serial interface 0.

```
Router# show dxi pvc

PVC Statistics for interface Serial0 (ATM DXI)

DFA = 17, VPI = 1, VCI = 1, PVC STATUS = STATIC, INTERFACE = Serial0

  input pkts 0             output pkts 0            in bytes 0
  out bytes 0              dropped pkts 0

DFA = 34, VPI = 2, VCI = 2, PVC STATUS = STATIC, INTERFACE = Serial0

  input pkts 0             output pkts 0            in bytes 0
  out bytes 0              dropped pkts 0

DFA = 35, VPI = 2, VCI = 3, PVC STATUS = STATIC, INTERFACE = Serial0

  input pkts 0             output pkts 0            in bytes 0
  out bytes 0              dropped pkts 0
```

Table 18 describes significant fields shown in the display.

Table 18 show dxi pvc Field Descriptions

Field	Description
DFA	Data Exchange Interface (DXI) Frame Address, similar to a data-link connection identifier (DLCI) for Frame Relay. The DFA is shown in decimal, hexadecimal, and DXI header format. The router computes this address value from the virtual path identifier (VPI) and virtual channel identifier (VCI) values.
PVC STATUS = STATIC	Only static maps are supported. Maps are not created dynamically.
input pkts	Number of packets received.

Table 18 show dxi pvc Field Descriptions (continued)

Field	Description
output pkts	Number of packets transmitted.
in bytes	Number of bytes in all packets received.
out bytes	Number of bytes in all packets transmitted.
dropped pkts	Should display a zero (0) value. A nonzero value indicates a configuration problem, specifically that a PVC does not exist.

show ima interface atm

To display information about all configured inverse multiplexing over ATM (IMA) groups or a specific group, use the **show ima interface atm** privileged EXEC command.

Cisco 2600 and 3600 Series

show ima interface atm [*slot*/**ima***group-number*] [**detail**]

Cisco 7200 Series

show ima interface atm [*slot*/*port*] [**detail**]

or

show ima interface atm [*slot*/*port-adapter*/**ima***group-number*] [**detail**]

Cisco 7500 Series

show ima interface atm [*slot*/*port-adapter*/*slot*] [**detail**]

or

show ima interface atm [*slot*/*port-adapter*/**ima***group-number*] [**detail**]

Syntax Description

slot/	(Optional) ATM slot number.
ima	(Optional) This keyword indicates an IMA group specification rather than a port value for a UNI interface.
group-number	(Optional) Enter an IMA group number from 0 to 3. If you specify the group number, do not insert a space between **ima** and the number.
port	(Optional) ATM port number.
port-adapter/	(Optional) ATM port adapter.
detail	(Optional) To obtain detailed information, use this keyword.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(5)XK	This command was introduced.
12.0(5)XE	Support for Cisco 7200 and 7500 series routers was added.
12.0(7)XE1	Support for Cisco 7100 series routers was added.
12.1(5)T	Support for Cisco 7100, 7200, and 7500 series routers was integrated in Cisco IOS Release 12.1(5)T.

Usage Guidelines

Use this command to monitor the status of IMA group links.

Examples

On Cisco 7100 or 7200 series routers, the following example displays detailed information about IMA group 0 on ATM interface 2. If you do not enter the **detail** keyword, you do not see the IMA MIB information or the "Detailed Link Information" output.

```
Router# show ima interface atm 5/ima0 detail

ATM5/ima0 is up
        ImaGroupState:NearEnd = operational, FarEnd = operational
        ImaGroupFailureStatus  = noFailure
IMA Group Current Configuration:
        ImaGroupMinNumTxLinks = 2    ImaGroupMinNumRxLinks = 2
        ImaGroupDiffDelayMax  = 250  ImaGroupNeTxClkMode   = common(ctc)
        ImaGroupFrameLength   = 128  ImaTestProcStatus     = disabled
        ImaGroupTestLink      = 0    ImaGroupTestPattern   = 0xFF
IMA MIB Information:
        ImaGroupSymmetry        = symmetricOperation
        ImaGroupFeTxClkMode     = common(ctc)
        ImaGroupRxFrameLength   = 128
        ImaGroupTxTimingRefLink = 0     ImaGroupRxTimingRefLink = 0
        ImaGroupTxImaId         = 0     ImaGroupRxImaId         = 0
        ImaGroupNumTxCfgLinks   = 2     ImaGroupNumRxCfgLinks   = 2
        ImaGroupNumTxActLinks   = 2     ImaGroupNumRxActLinks   = 2
        ImaGroupLeastDelayLink  = 0     ImaGroupDiffDelayMaxObs = 0
IMA group counters:
        ImaGroupNeNumFailures   = 1     ImaGroupFeNumFailures   = 2
        ImaGroupUnAvailSecs     = 18    ImaGroupRunningSecs     = 241
IMA Detailed Link Information:

ATM5/0 is up
        ImaLinkRowStatus = active
        ImaLinkIfIndex   = 1            ImaLinkGroupIndex = 47
        ImaLinkState:
                NeTx = active
                NeRx = active
                FeTx = active
                FeRx = active
        ImaLinkFailureStatus:
                NeRx = noFailure
                FeRx = noFailure
        ImaLinkTxLid           = 0      ImaLinkRxLid           = 0
        ImaLinkRxTestPattern   = 64     ImaLinkTestProcStatus  = disabled
        ImaLinkRelDelay        = 0
IMA Link counters :
        ImaLinkImaViolations   = 1
        ImaLinkNeSevErroredSec = 10     ImaLinkFeSevErroredSec = 10
        ImaLinkNeUnavailSec    = 7      ImaLinkFeUnAvailSec    = 8
        ImaLinkNeTxUnusableSec = 17     ImaLinkNeRxUnUsableSec = 16
        ImaLinkFeTxUnusableSec = 17     ImaLinkFeRxUnusableSec = 16
        ImaLinkNeTxNumFailures = 0      ImaLinkNeRxNumFailures = 2
        ImaLinkFeTxNumFailures = 1      ImaLinkFeRxNumFailures = 1

ATM5/1 is up
        ImaLinkRowStatus = active
        ImaLinkIfIndex   = 2            ImaLinkGroupIndex = 47
        ImaLinkState:
                NeTx = active
                NeRx = active
                FeTx = active
                FeRx = active
        ImaLinkFailureStatus:
                NeRx = noFailure
                FeRx = noFailure
        ImaLinkTxLid           = 1      ImaLinkRxLid           = 1
```

```
        ImaLinkRxTestPattern   = 64     ImaLinkTestProcStatus  = disabled
        ImaLinkRelDelay        = 0
IMA Link counters :
        ImaLinkImaViolations   = 1
        ImaLinkNeSevErroredSec = 10     ImaLinkFeSevErroredSec = 10
        ImaLinkNeUnavailSec    = 7      ImaLinkFeUnAvailSec    = 8
        ImaLinkNeTxUnusableSec = 16     ImaLinkNeRxUnUsableSec = 16
        ImaLinkFeTxUnusableSec = 16     ImaLinkFeRxUnusableSec = 16
        ImaLinkNeTxNumFailures = 0      ImaLinkNeRxNumFailures = 2
        ImaLinkFeTxNumFailures = 1      ImaLinkFeRxNumFailures = 1
```

On a Cisco 2600 or 3600 series router, the following example displays detailed information about IMA group 0 on ATM interface 2. Without the **detail** keyword, only the information up to "Detailed group Information:" appears.

```
Router# show ima interface atm 4/ima0 detail

Interface ATM2/IMA2 is up
        Group index is 2
        Ne state is operational, failure status is noFailure
        active links bitmap 0x30
    IMA Group Current Configuration:
        Tx/Rx configured links bitmap 0x30/0x30
        Tx/Rx minimum required links 1/1
        Maximum allowed diff delay is 25ms, Tx frame length 128
        Ne Tx clock mode CTC, configured timing reference link ATM2/4
        Test pattern procedure is disabled
    Detailed group Information:
        Tx/Rx Ima_id 0x22/0x40, symmetry symmetricOperation
        Number of Tx/Rx configured links 2/2
        Number of Tx/Rx active links 2/2
        Fe Tx clock mode ctc, Rx frame length 128
        Tx/Rx timing reference link 4/4
        Maximum observed diff delay 0ms, least delayed link 5
        Running seconds 32
        GTSM last changed 10:14:41 UTC Wed Jun 16 1999
    IMA Group Current Counters (time elapsed 33 seconds):
        3 Ne Failures, 3 Fe Failures, 4 Unavail Secs
    IMA Group Total Counters (last 0 15 minute intervals):
        0 Ne Failures, 0 Fe Failures, 0 Unavail Secs
    Detailed IMA link Information:

Interface ATM2/4 is up
        ifIndex 13, Group Index 2, Row Status is active
        Tx/Rx Lid 4/4, relative delay 0ms
        Ne Tx/Rx state active/active
        Fe Tx/Rx state active/active
        Ne Rx failure status is noFailure
        Fe Rx failure status is noFailure
        Rx test pattern 0x41, test procedure disabled
    IMA Link Current Counters (time elapsed 35 seconds):
        1 Ima Violations, 0 Oif Anomalies
        1 Ne Severely Err Secs, 2 Fe Severely Err Secs
        0 Ne Unavail Secs, 0 Fe Unavail Secs
        2 Ne Tx Unusable Secs, 2 Ne Rx Unusable Secs
        0 Fe Tx Unusable Secs, 2 Fe Rx Unusable Secs
        0 Ne Tx Failures, 0 Ne Rx Failures
        0 Fe Tx Failures, 0 Fe Rx Failures
    IMA Link Total Counters (last 0 15 minute intervals):
        0 Ima Violations, 0 Oif Anomalies
        0 Ne Severely Err Secs, 0 Fe Severely Err Secs
        0 Ne Unavail Secs, 0 Fe Unavail Secs
        0 Ne Tx Unusable Secs, 0 Ne Rx Unusable Secs
        0 Fe Tx Unusable Secs, 0 Fe Rx Unusable Secs
```

```
        0 Ne Tx Failures, 0 Ne Rx Failures
        0 Fe Tx Failures, 0 Fe Rx Failures

Interface ATM2/5 is up
        ifIndex 14, Group Index 2, Row Status is active
        Tx/Rx Lid 5/5, relative delay 0ms
        Ne Tx/Rx state active/active
        Fe Tx/Rx state active/active
        Ne Rx failure status is noFailure
        Fe Rx failure status is noFailure
        Rx test pattern 0x41, test procedure disabled
    IMA Link Current Counters (time elapsed 46 seconds):
        1 Ima Violations, 0 Oif Anomalies
        1 Ne Severely Err Secs, 2 Fe Severely Err Secs
        0 Ne Unavail Secs, 0 Fe Unavail Secs
        2 Ne Tx Unusable Secs, 2 Ne Rx Unusable Secs
        0 Fe Tx Unusable Secs, 2 Fe Rx Unusable Secs
        0 Ne Tx Failures, 0 Ne Rx Failures
        0 Fe Tx Failures, 0 Fe Rx Failures
    IMA Link Total Counters (last 0 15 minute intervals):
        0 Ima Violations, 0 Oif Anomalies
        0 Ne Severely Err Secs, 0 Fe Severely Err Secs
        0 Ne Unavail Secs, 0 Fe Unavail Secs
        0 Ne Tx Unusable Secs, 0 Ne Rx Unusable Secs
        0 Fe Tx Unusable Secs, 0 Fe Rx Unusable Secs
        0 Ne Tx Failures, 0 Ne Rx Failures
        0 Fe Tx Failures, 0 Fe Rx Failures
```

Related Commands

Command	Description
show controllers atm	Displays information about an IMA group.

show interface cbr

To display information about the constant bit rate (CBR) interface on the ATM-CES port adapter, use the **show interface cbr** privileged EXEC command.

show interface cbr

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1	This command was introduced.

Examples

The following is sample output from the **show interface cbr** command.

```
Router# show interface cbr 6/0

CBR6/0 is up, line protocol is up
  Hardware is DCU
  MTU 0 bytes, BW 1544 Kbit, DLY 0 usec, rely 255/255, load 248/255
  Encapsulation ET_ATMCES_T1, loopback not set
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/0, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 1507000 bits/sec, 3957 packets/sec
  5 minute output rate 1507000 bits/sec, 3955 packets/sec
     3025960 packets input, 142220120 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     3030067 packets output, 142413149 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Table 19 describes the fields shown in the display.

Table 19 show interface cbr Field Descriptions

Field	Description
CBR6/0 is...	Type, slot, and port number of the interface and indicates whether the interface hardware is currently active (whether carrier detect is present), down, or if it has been taken down by an administrator.
line protocol is...	Indicates whether the software processes that handle the line protocol think the line is usable (that is, whether keepalives are successful). Values are up, down, and administratively down.
Hardware is...	Hardware type.
MTU	Maximum transmission unit of the interface.

Table 19 show interface cbr Field Descriptions (continued)

Field	Description
BW	Bandwidth of the interface in kilobits per second.
DLY	Delay of the interface, in microseconds.
rely	Reliability of the interface as a fraction of 255 (255/255 is 100% reliability), calculated as an exponential average over 5 minutes.
load	Load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes. The calculation uses the value from the **bandwidth** interface configuration command.
Encapsulation	Encapsulation method assigned to interface.
loopback not set	Indicates whether or not loopback is set.
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface. Useful for knowing when a dead interface failed. This counter is updated only when packets are process switched, not when packets are fast switched.
Last output	Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface. This counter is updated only when packets are process switched, not when packets are fast switched.
output hang	Number of hours, minutes, and seconds (or never) since the interface was last reset because of a transmission that took too long. When the number of hours in any of the "last" fields exceeds 24 hours, the number of days and hours is printed. If that field overflows, asterisks are printed.
Last clearing	The time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Note that variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared. *** indicates that the elapsed time is too large to be displayed. 0:00:00 indicates that the counters were cleared more than 2^{31}ms (and less than 2^{32}ms) ago.
Queueing strategy	First-in, first-out queuing strategy (other queueing strategies you might see are priority-list, custom-list, and weighted fair).
Output queue, drops input queue, drops	Number of packets in output and input queues. Each number is followed by a slash, the maximum size of the queue, and the number of packets dropped due to a full queue.
5 minute input rate, 5 minute output rate	Average number of bits and packets transmitted per second in the last 5 minutes.
packets input	Total number of error-free packets received by the system.
bytes input	Total number of bytes, including data and MAC encapsulation, in the error-free packets received by the system.
no buffer	Number of received packets discarded because there was no buffer space in the main system. Compare with ignored count. Broadcast storms on Ethernets and bursts of noise on serial lines are often responsible for no input buffer events.
broadcasts	Total number of broadcast or multicast packets received by the interface.

Table 19 show interface cbr Field Descriptions (continued)

Field	Description
runts	Number of packets that are discarded because they are smaller than the medium's minimum packet size.
giants	Number of packets that are discarded because they exceed the medium's maximum packet size.
input errors	Total number of no buffer, runts, giants, CRCs, frame, overrun, ignored, and abort counts. Other input-related errors can also increment the count, so that this sum may not balance with the other counts.
CRC	Cyclic redundancy checksum generated by the originating LAN station or far end device does not match the checksum calculated from the data received. On a LAN, this usually indicates noise or transmission problems on the LAN interface or the LAN bus itself. A high number of CRCs is usually the result of collisions or a station transmitting bad data. On a serial link, CRCs usually indicate noise, gain hits or other transmission problems on the data link.
frame	Number of packets received incorrectly having a CRC error and a noninteger number of octets.
overrun	Number of times the serial receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data.
ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. These buffers are different than the system buffers mentioned previously in the buffer description. Broadcast storms and bursts of noise can cause the ignored count to be incremented.
abort	Illegal sequence of one bits on the interface. This usually indicates a clocking problem between the interface and the data link equipment.
packets output	Total number of messages transmitted by the system.
bytes	Total number of bytes, including data and MAC encapsulation, transmitted by the system.
underruns	Number of times that the transmitter has been running faster than the router can handle. This may never be reported on some interfaces.
output errors	Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this may not balance with the sum of the enumerated output errors, as some datagrams may have more than one error, and others may have errors that do not fall into any of the specifically tabulated categories.
collisions	Because collisions do not occur on CBR interfaces, this statistic is always zero.
interface resets	Number of times an interface has been reset. The interface may be reset by the administrator or automatically when an internal error occurs.
output buffer failures	Number of no resource errors received on the output.
output buffers swapped out	Number of packets swapped to DRAM.

Related Commands

Command	Description
show ces interface cbr	Displays detailed CBR port information.

show interfaces atm

To display information about the ATM interface, use the **show interfaces atm** privileged EXEC command.

Cisco 7500 series with AIP; Cisco 7200 series with ATM, ATM-CES, and enhanced ATM port adapter; Cisco 2600 and 3600 series with 1-port ATM-25 network module

show interfaces atm [*slot*/*port*]

Cisco 7500 series routers with the ATM port adapter and enhanced ATM port adapter

show interfaces atm [*slot*/*port-adapter*/*port*]

Syntax Description

slot/*port*	(Optional) ATM slot number and port number. Use this format for the following platform configurations: • The AIP on Cisco 7500 series routers. • The ATM port adapter, ATM-CES port adapter, or enhanced ATM port adapter on Cisco 7200 series routers. • The 1-port ATM-25 network module on Cisco 2600 and 3600 series routers.
slot/*port-adapter*/*port*	(Optional) ATM slot, port adapter, and port numbers. Use this format for the ATM port adapter or enhanced ATM port adapter on Cisco 2600 and 3600 series routers.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show interfaces atm** command:

```
Router# show interfaces atm 4/0

ATM4/0 is up, line protocol is up
 Hardware is cxBus ATM
 Internet address is 10.108.97.165, subnet mask is 255.255.255.0
 MTU 4470 bytes, BW 100000 Kbit, DLY 100 usec, rely 255/255, load 1/255
 ATM E164 Auto Conversion Interface
 Encapsulation ATM, loopback not set, keepalive set (10 sec)
 Encapsulation(s): AAL5, PVC mode
 256 TX buffers, 256 RX buffers, 1024 Maximum VCs, 1 Current VCs
 Signalling vc = 1, vpi = 0, vci = 5
 ATM NSAP address: BC.CDEF.01.234567.890A.BCDE.F012.3456.7890.1234.13
 Last input 0:00:05, output 0:00:05, output hang never
 Last clearing of "show interface" counters never
 Output queue 0/40, 0 drops; input queue 0/75, 0 drops
```

```
 Five minute input rate 0 bits/sec, 0 packets/sec
 Five minute output rate 0 bits/sec, 0 packets/sec
     144 packets input, 3148 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     154 packets output, 4228 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets, 0 restarts
```

The following is sample output from the **show interfaces atm** command for the ATM port adapter on a Cisco 7500 series router:

```
Router# show interfaces atm 0/0/0

ATM0/0/0 is up, line protocol is up
 Hardware is cyBus ATM
 Internet address is 10.1.1.1/24
 MTU 4470 bytes, sub MTU 4470, BW 156250 Kbit, DLY 80 usec, rely 255/255, load 1/255
 Encapsulation ATM, loopback not set, keepalive set (10 sec)
 Encapsulation(s): AAL5, PVC mode
 256 TX buffers, 256 RX buffers,
 2048 maximum active VCs, 1024 VCs per VP, 1 current VCCs
 VC idle disconnect time: 300 seconds
 Last input never, output 00:00:05, output hang never
 Last clearing of "show interface" counters never
 Queueing strategy: fifo
 Output queue 0/40, 0 drops; input queue 0/75, 0 drops
 5 minute input rate 0 bits/sec, 1 packets/sec
 5 minute output rate 0 bits/sec, 1 packets/sec
     5 packets input, 560 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     5 packets output, 560 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Table 20 describes the fields shown in both the displays.

Table 20 show interfaces atm Field Descriptions

Field	Description
ATM... is {up | down| administratively down}	Indicates whether the interface hardware is currently active (whether carrier detect is present) and if it has been taken down by an administrator.
line protocol is {up | down | administratively down}	Indicates whether the software processes that handle the line protocol think the line is usable (that is, whether keepalives are successful).
Hardware is	Hardware type.
Internet address is	Internet address and subnet mask.
MTU	Maximum Transmission Unit of the interface.
sub MTU	Maximum Transmission Unit of the subinterface.
BW	Bandwidth of the interface in kilobits per second.
DLY	Delay of the interface in microseconds.
rely	Reliability of the interface as a fraction of 255 (255/255 is 100% reliability), calculated as an exponential average over 5 minutes.

Table 20 show interfaces atm Field Descriptions (continued)

Field	Description
load	Load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes. The calculation uses the value from the **bandwidth** interface configuration command.
ATM E164 Auto Conversion Interface	Indicates that ATM E164 auto conversion is enabled. When this field is not present, ATM E164 auto conversion is disabled.
Encapsulation	Encapsulation method assigned to interface.
loopback	Indicates whether the interface is configured for loopback testing.
keepalive	Indicates whether keepalives are set or not.
Encapsulation(s)	Type of encapsulation used on the interface (for example, AAL5, and either PVC or SVC mode).
TX buffers	Number of buffers configured with the **atm txbuff** command.
RX buffers	Number of buffers configured with the **atm rxbuff** command.
Maximum active VCs	Maximum number of virtual circuits.
VCs per VP	Number of virtual circuits per virtual path (the default is 1024).
Current VCs	Number of virtual circuit connections currently open.
VC idle disconnect time	Number of seconds the SVC must be idle before the SVC is disconnected.
Signalling vc	Number of the signaling PVC.
vpi	Virtual path identifier number.
vci	Virtual channel identifier number.
ATM NSAP address	NSAP address of the ATM interface.
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface. Useful for knowing when a dead interface failed. This counter is updated only when packets are process switched, not when packets are fast switched.
Last output	Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface. This counter is updated only when packets are process switched, not when packets are fast switched.
output hang	Number of hours, minutes, and seconds (or never) since the interface was last reset because of a transmission that took too long. When the number of hours in any of the "last" fields exceeds 24 hours, the number of days and hours is printed. If that field overflows, asterisks are printed.
Last clearing	The time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Note that variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared. *** indicates that the elapsed time is too large to be displayed. 0:00:00 indicates that the counters were cleared more than 2^{31}ms (and less than 2^{32}ms) ago.
Queueing strategy	First-in, first-out queueing strategy (other queueing strategies you might see are priority-list, custom-list, and weighted fair).

Table 20 show interfaces atm Field Descriptions (continued)

Field	Description
Output queue, drops input queue, drops	Number of packets in output and input queues. Each number is followed by a slash, the maximum size of the queue, and the number of packets dropped due to a full queue.
5 minute input rate, 5 minute output rate	Average number of bits and packets transmitted per second in the last 5 minutes.
packets input	Total number of error-free packets received by the system.
bytes input	Total number of bytes, including data and MAC encapsulation, in the error free packets received by the system.
no buffer	Number of received packets discarded because there was no buffer space in the main system. Compare with ignored count. Broadcast storms on Ethernets and bursts of noise on serial lines are often responsible for no input buffer events.
Received broadcasts	Total number of broadcast or multicast packets received by the interface.
runts	Number of packets that are discarded because they are smaller than the medium's minimum packet size.
giants	Number of packets that are discarded because they exceed the medium's maximum packet size.
input errors	Total number of no buffer, runts, giants, CRCs, frame, overrun, ignored, and abort counts. Other input-related errors can also increment the count, so that this sum may not balance with the other counts.
CRC	Cyclic redundancy checksum generated by the originating LAN station or far-end device does not match the checksum calculated from the data received. On a LAN, this usually indicates noise or transmission problems on the LAN interface or the LAN bus itself. A high number of CRCs is usually the result of collisions or a station transmitting bad data. On a serial link, CRCs usually indicate noise, gain hits or other transmission problems on the data link.
frame	Number of packets received incorrectly having a CRC error and a noninteger number of octets.
overrun	Number of times the serial receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data.
ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. These buffers are different than the system buffers mentioned previously in the buffer description. Broadcast storms and bursts of noise can cause the ignored count to be incremented.
abort	Illegal sequence of one bits the interface. This usually indicates a clocking problem between the interface and the data link equipment.
packets output	Total number of messages transmitted by the system.
bytes	Total number of bytes, including data and MAC encapsulation, transmitted by the system.
underruns	Number of times that the transmitter has been running faster than the router can handle. This may never be reported on some interfaces.

Table 20 show interfaces atm Field Descriptions (continued)

Field	Description
output errors	Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this may not balance with the sum of the enumerated output errors, as some datagrams may have more than one error, and others may have errors that do not fall into any of the specifically tabulated categories.
collisions	This feature is not applicable for ATM interfaces.
interface resets	Number of times an interface has been completely reset. This can happen if packets queued for transmission were not sent within several seconds. On a serial line, this can be caused by a malfunctioning modem that is not supplying the transmit clock signal, or by a cable problem. If the system notices that the carrier detect line of a serial interface is up, but the line protocol is down, it periodically resets the interface in an effort to restart it. Interface resets can also occur when an interface is looped back or shut down.
output buffer failures	Number of times that a packet was not output from the output hold queue because of a shortage of MEMD shared memory.
output buffers swapped out	Number of packets stored in main memory when the output queue is full; swapping buffers to main memory prevents packets from being dropped when output is congested. The number is high when traffic is bursty.
restarts	Number of times the controller was restarted because of errors.

show network-clocks

To display the current configured and active network clock sources, use the **show network-clocks** privileged EXEC command.

show network-clocks

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

This command applies to Voice over Frame Relay, Voice over ATM, and Voice over HDLC on the Cisco MC3810.

The Cisco MC3810 has a background task that verifies whether a valid clocking configuration exists every 120 seconds. If this task detects an error, you will be reminded every 120 seconds until the error is corrected. A clocking configuration error may be generated for various reasons. Using the **show network-clocks** command, you can display the clocking configuration status.

Examples

The following is sample output from the **show network-clocks** EXEC command.

```
Router# show network-clocks

Priority 1 clock source: ATM3/0/0
Priority 2 clock source: System clock
Priority 3 clock source: System clock
Priority 4 clock source: System clock

Current clock source:ATM3/0/0, priority:1
```

The following is sample output from the **show network-clocks** command on the Cisco MC3810:

```
Router# show network-clocks

Priority 1 clock source(inactive config): T1 0
Priority 1 clock source(active config) : T1 0
Clock switch delay: 10
Clock restore delay: 10
T1 0 is clocking system bus for 9319 seconds.
Run Priority Queue: controller0
```

In this display, inactive configuration is the new configuration that has been established. Active configuration is the run-time configuration. Should an error be made in the new configuration, the inactive and active configurations will be different. In the above example, the clock priority configuration is valid, and the system is being clocked as indicated.

The following is another sample output from the **show network-clocks** command:

```
Router# show network-clocks

Priority 1 clock source(inactive config) : T1 0
Priority 2 clock source(inactive config) : T1 1
Priority 1 clock source(active config) : T1 0
Clock switch delay: 10
Clock restore delay: 10
T1 0 is clocking system bus for 9319 seconds.
Run Priority Queue: controller0
```

In this display, the new clocking configuration has an error for controller T1 1. This is indicated by checking differences between the last valid configuration (active) and the new proposed configuration (inactive). The error may result from hardware (the system controller board or MFT) unable to support this mode, or controller T1 1 is currently configured as “clock source internal.”

Since the active and inactive configurations are different, the system will periodically display the warning message about the wrong configuration.

Related Commands

Command	Description
network-clock-select (ATM)	Establishes the sources and priorities of the requisite clocking signals for an ATM-CES port adapter.

show sscop

To show Service-Specific Connection-Oriented Protocol (SSCOP) details for all ATM interfaces, use the **show sscop** privileged EXEC command.

show sscop

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show sscop** command:

```
Router# show sscop

SSCOP details for interface ATM4/0
   Current State = Data Transfer Ready
   Send Sequence Number: Current = 2,  Maximum = 9
   Send Sequence Number Acked = 3
   Rcv Sequence Number: Lower Edge = 2, Upper Edge = 2, Max = 9
   Poll Sequence Number = 1876, Poll Ack Sequence Number = 2
   Vt(Pd) = 0
   Connection Control:  timer = 1000
   Timer currently Inactive
   Keep Alive Timer = 30000
   Current Retry Count = 0, Maximum Retry Count = 10
      Statistics -
      Pdu's Sent = 0, Pdu's Received = 0, Pdu's Ignored = 0
      Begin = 0/1, Begin Ack = 1/0, Begin Reject = 0/0
      End = 0/0, End Ack = 0/0
      Resync = 0/0, Resync Ack = 0/0
      Sequenced Data = 2/0, Sequenced Poll Data = 0/0
      Poll = 1591/1876, Stat = 0/1591, Unsolicited Stat = 0/0
      Unassured Data = 0/0, Mgmt Data = 0/0, Unknown Pdu's = 0
```

Table 21 describes the fields shown in the display. Interpreting this output requires a good understanding of the SSCOP; it is usually displayed by our technicians to help diagnose network problems.

Table 21 show sscop Field Descriptions

Field	Description
SSCOP details for interface	Interface slot and port.
Current State	SSCOP state for the interface.
Send Sequence Number	Current and maximum send sequence number.
Send Sequence Number Acked	Sequence number of packets already acknowledged.

Table 21 show sscop Field Descriptions (continued)

Field	Description
Rcv Sequence Number	Sequence number of packets received.
Poll Sequence Number	Current poll sequence number.
Poll Ack Sequence Number	Poll sequence number already acknowledged.
Vt(Pd)	Number of sequenced data (SD) frames sent, which triggers a sending of a Poll frame.
Connection Control	Timer used for establishing and terminating SSCOP.
Keep Alive Timer	Timer used to send keepalives on an idle link.
Current Retry Count	Current count of the retry counter.
Maximum Retry Count	Maximum value the retry counter can take.
Pdu's Sent	Total number of SSCOP frames sent.
Pdu's Received	Total number of SSCOP frames received.
Pdu's Ignored	Number of invalid SSCOP frames ignored.
Begin	Number of Begin frames sent/received.
Begin Ack	Number of Begin Ack frames sent/received.
Begin Reject	Number of Begin Reject frames sent/received.
End	Number of End frames sent/received.
End Ack	Number of End Ack frames sent/received.
Resync	Number of Resync frames sent/received.
Resync Ack	Number of Resync Ack frames sent/received.
Sequenced Data	Number of Sequenced Data frames sent/received.
Sequenced Poll Data	Number of Sequenced Poll Data frames sent/received.
Poll	Number of Poll frames sent/received.
Stat	Number of Stat frames sent/received.
Unsolicited Stat	Number of Unsolicited Stat frames sent/received.
Unassured Data	Number of Unassured Data frames sent/received.
Mgmt Data	Number of Mgmt Data frames sent/received.
Unknown Pdu's	Number of Unknown Pdu's frames sent/received.

sscop cc-timer

To change the connection control timer, use the **sscop cc-timer** interface configuration command. To restore the default value, use the **no** form of this command.

sscop cc-timer *seconds*

no sscop cc-timer

Syntax Description

seconds	Number of seconds between Begin messages.

Defaults

1 second

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The connection control timer determines the time between transmission of BGN (establishment), END (release), or RS (resynchronization) protocol data units (PDUs) as long as an acknowledgment has not been received.

Examples

The following example sets the connection control timer 15 seconds:

```
sscop cc-timer 15
```

Related Commands

Command	Description
sscop max-cc	Changes the SSCOP retry count of connection control.

sscop keepalive-timer

To change the keepalive timer, use the **sscop keepalive-timer** interface configuration command. To restore the default value, use the **no** form of this command.

sscop keepalive-timer *seconds*

no sscop keepalive-timer *seconds*

Syntax Description

seconds	Number of seconds the router waits between transmission of POLL PDUs when no sequential data (SD) or SDP PDUs are queued for transmission or are outstanding pending acknowledgments.

Defaults

5 seconds

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the keepalive timer to 15 seconds:

```
sscop keepalive-timer 15
```

sscop max-cc

To change the retry count of connection control, use the **sscop max-cc** interface configuration command. To restore the default value, use the **no** form of this command.

sscop max-cc *retries*

no sscop max-cc

Syntax Description

retries	Number of times that SSCOP will retry to transmit BGN (establishment), END (release), or RS (resynchronization) PDUs as long as an acknowledgment has not been received. Valid range is from 1 to 6000.

Defaults

10 retries

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the retry count of the connection control to 20:

```
sscop max-cc 20
```

Related Commands

Command	Description
sscop cc-timer	Changes the SSCOP connection control timer.

sscop poll-timer

To change the poll timer, use the **sscop poll-timer** interface configuration command. To restore the default value, use the **no** form of this command.

sscop poll-timer *seconds*

no sscop poll-timer

Syntax Description

seconds	Number of seconds that the router waits between transmission of POLL PDUs.

Defaults

100 seconds

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The poll timer controls the maximum time between transmission of POLL PDUs when SD or SDP PDUs are queued for transmission or are outstanding pending acknowledgments.

Examples

The following example sets the poll timer to 15 seconds:

```
sscop poll-timer 15
```

sscop receive-window

To change the receiver window, use the **sscop receive-window** interface configuration command. To restore the default value, use the **no** form of this command.

sscop receive-window *packets*

no sscop receive-window

Syntax Description

packets	Number of packets the interface can receive before it must send an acknowledgment to the ATM switch. Valid range is from 1 to 6000.

Defaults

7 packets

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the receiver's window to 10 packets:

```
sscop rcv-window 10
```

sscop send-window

To change the transmitter window, use the **sscop send-window** interface configuration command. To restore the default value, use the **no** form of this command.

sscop send-window *packets*

no sscop send-window

Syntax Description

packets	Number of packets the interface can send before it must receive an acknowledgment from the ATM switch. Valid range is from 1 to 6000.

Defaults

7 packets

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the transmitter's window to 10 packets:

```
sscop send-window 10
```

SVC

To create an ATM switched virtual circuit (SVC) and specify the destination network service access point (NSAP) address on a main interface or subinterface, use the **svc** interface configuration command. To disable the SVC, use the **no** form of this command.

svc [*name*] [**nsap** *address*] [**ces**]

no svc [*name*] [**nsap** *address*] [**ces**]

Syntax Description

name	(Optional) The name of the SVC and map. The name can be up to 16 characters long. A name is required when creating passive a CES SVC.
nsap *address*	(Optional) The destination ATM NSAP address. Must be exactly 40 hexadecimal digits long and in the correct format. See the "Usage Guidelines" section. An NSAP address is required when creating an active CES SVC.
ces	(Optional) Circuit Emulation Service encapsulation. This keyword is available on the OC-3/STM-1 ATM Circuit Emulation Service network module only.

Defaults

No NSAP address is defined.

Command Modes

Interface configuration

Command History

Release	Modification
11.3	This command was introduced.
12.1(2)T	The **ces** keyword was added to configure CES encapsulation when using the OC-3/STM-1 ATM Circuit Emulation Service network module on Cisco 2600 and Cisco 3600 series platform.
12.1(3)T	This command was modified to allow an SVC to be created without having a specific NSAP address associated with it.

Usage Guidelines

After configuring the parameters for an ATM SVC, you must exit the interface-ATM-VC or interface-CES-VC configuration mode in order to enable the SVC settings.

Once you specify a *name* for an SVC, you can reenter the interface-ATM-VC or interface-CES-VC configuration mode by simply entering **svc** *name*.

You can remove an NSAP address and any associated parameters by entering **no svc** *name* or **no svc** *nsap address*.

ACreating an SVC without a specific NSAP address will allow a router to accept calls from any ATM address, and allow multiple VCs to be set up using the same configuration.

Use the **ces** keyword to configure an active or passive CES SVC. An active CES SVC can originate and terminate SVC calls. A passive CES SVC can only terminate calls.

Examples

SVC Example

The following example creates an SVC called “chicago” on ATM interface 2/0/0:

```
interface atm 2/0/0
  svc chicago
```

SVC with NSAP Address Example

The following example creates an SVC with the name “lion” and specifies the 40-digit hexadecimal destination ATM NSAP address:

```
svc lion nsap 47.0091.81.000000.0040.0B0A.2501.ABC1.3333.3333.05
```

Active CES SVC Example

The following example creates an active CES SVC named "ces1":

```
interface atm 1/0
  svc ces1 nsap 47.00.00.000000.0040.0B0A.2501.ABC1.01.01.00 ces
```

Passive CES SVC Example

The following example creates a passive CES SVC named "ces2":

```
interface atm 1/0
  svc ces2 ces
```

ubr

To configure unspecified bit rate (UBR) quality of service (QoS) and specify the output peak cell rate (PCR) for an ATM permanent virtual circuit (PVC), PVC range, switched virtual circuit (SVC), virtual circuit (VC) class, or VC bundle member, use the **ubr** command in the appropriate command mode. To remove the UBR parameter, use the **no** form of this command.

ubr *output-pcr* [*input-pcr*]

no ubr *output-pcr* [*input-pcr*]

Syntax Description

output-pcr	The output PCR in kbps.
input-pcr	(Optional for SVCs only) The input peak cell rate (PCR) in kilobits per second. If this value is omitted, the *input-pcr* will equal the *output-pcr*.

Defaults

UBR QoS at the maximum line rate of the physical interface.

Command Modes

Interface-ATM-VC configuration (for an ATM PVC or SVC)

VC-class configuration (for a VC class)

Bundle-vc configuration (for ATM VC bundle members)

PVC range configuration (for an ATM PVC range)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3 T	This command was introduced.
12.0(3)T	This command was enhanced to support selection of UBR QoS and configuration of output PCR for ATM VC bundles and ATM VC bundle members.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.

Usage Guidelines

To configure ATM SVCs with an output PCR and an input PCR that differ from each other, you must expressly configure an output value and an input value using the *output-pcr* and *input-pcr* arguments, respectively.

Configure QoS parameters using the **ubr**, **ubr+**, or **vbr-nrt** command. The last command you enter will apply to the PVC or SVC you are configuring.

If the **ubr** command is not explicitly configured on an ATM PVC, SVC, or VC bundle member, the VC inherits the following default configuration (listed in order of next highest precedence):

- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC or SVC itself.
- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC's or SVC's ATM subinterface.

- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC's or SVC's ATM main interface.
- Global default: UBR QoS at the maximum line rate of the PVC or SVC.

To use this command in VC-class configuration mode, enter the **vc-class atm** global configuration command. This command has no effect if the VC class that contains the command is attached to a standalone VC, that is, if the VC is not a bundle member.

To use this command in bundle-vc configuration mode, first enter the **bundle** command to specify the bundle, then enter bundle configuration mode. Then enter the **pvc-bundle** configuration command to add the VC to the bundle as a member of it and enter bundle-vc configuration mode.

VCs in a VC bundle are subject to the following configuration inheritance rules (listed in order of next highest precedence):

- VC configuration in bundle-vc mode
- Bundle configuration in bundle mode (with effect of assigned VC-class configuration)
- Subinterface configuration in subinterface mode

Examples

The following example specifies the *output-pcr* argument for an ATM PVC to be 100,000 kbps:

```
pvc 1/32
 ubr 100000
```

The following example specifies the *output-pcr* and *input-pcr* arguments for an ATM SVC to be 10,000 kbps and 9,000 kbps, respectively:

```
svc lion nsap 47.0091.81.000000.0040.0B0A.2501.ABC1.3333.3333.05
 ubr 10000 9000
```

Related Commands

Command	Description
abr	Selects ABR QoS and configures output peak cell rate and output minimum guaranteed cell rate for an ATM PVC or virtual circuit class.
broadcast	Configures broadcast packet duplication and transmission for an ATM VC class, PVC, SVC, or VC bundle.
bump	Configures the bumping rules for a virtual circuit class that can be assigned to a virtual circuit bundle.
bundle	Creates a bundle or modifies an existing bundle to enter bundle configuration mode.
class-int	Assigns a VC class to an ATM main interface or subinterface.
class-vc	Assigns a VC class to an ATM PVC, SVC, or VC bundle member.
encapsulation	Sets the encapsulation method used by the interface.
inarp	Configures the Inverse ARP time period for an ATM PVC, VC class, or VC bundle.
oam-bundle	Enables end-to-end F5 OAM loopback cell generation and OAM management for a virtual circuit class that can be applied to a virtual circuit bundle.
oam retry	Configures parameters related to OAM management for an ATM PVC, SVC, VC class, or VC bundle.

Command	Description
precedence	Configures precedence levels for a virtual circuit class that can be assigned to a virtual circuit bundle and thus applied to all virtual circuit members of that bundle.
protect	Configures a virtual circuit class with protected group or protected virtual circuit status for application to a virtual circuit bundle member.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle. Enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).
pvc-bundle	Adds a PVC to a bundle as a member of the bundle and enters bundle-vc configuration mode in order to configure that PVC bundle member.
ubr+	Configures UBR QoS and specifies the output peak cell rate and output minimum guaranteed cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
vbr-nrt	Configures the VBR-NRT QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size for an ATM PVC, SVC, VC class, or VC bundle member.

ubr+

To configure unspecified bit rate (UBR) quality of service (QoS) and specify the output peak cell rate and output minimum guaranteed cell rate for an ATM permanent virtual circuit (PVC), PVC range, switched virtual circuit (SVC), virtual circuit (VC) class, or VC bundle member, use the **ubr+** command in the appropriate command mode. To remove the UBR+ parameters, use the **no** form of this command.

ubr+ *output-pcr output-mcr* [*input-pcr*] [*input-mcr*]

no ubr+ *output-pcr output-mcr* [*input-pcr*] [*input-mcr*]

Syntax Description

output-pcr	The output peak cell rate (PCR) in kbps.
output-mcr	The output minimum guaranteed cell rate in kbps.
input-pcr	(Optional for SVCs only) The input PCR in kbps. If this value is omitted, the *input-pcr* will equal the *output-pcr.*
input-mcr	(Optional for SVCs only) The input minimum guaranteed cell rate in kbps. If this value is omitted, the *input-mcr* will equal the *output-mcr.*

Defaults

UBR QoS at the maximum line rate of the physical interface.

Command Modes

Interface-ATM-VC configuration (for an ATM PVC or SVC)

VC-class configuration (for a VC class)

Bundle-vc configuration (for ATM VC bundle members)

PVC range configuration (for an ATM PVC range)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3 T	This command was introduced.
12.0(3)T	This command was enhanced to support selection of UBR+ QoS and configuration of output PCR and output minimum guaranteed cell rate ATM VC bundles, and VC bundle members.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.

Usage Guidelines

To configure ATM SVCs with an output PCR and an input PCR that differ from each other, you must expressly configure an output value and an input value using the *output-pcr, output-mcr, input-pcr,* and *input-mcr* arguments, respectively.

Configure QoS parameters using the **ubr**, **ubr+**, or **vbr-nrt** command. The last command you enter will apply to the PVC or SVC that you are configuring.

If the **ubr+** command is not explicitly configured on an ATM PVC or SVC, the VC inherits the following default configuration (listed in order of precedence):

- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC or SVC itself.
- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC's or SVC's ATM subinterface.
- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC's or SVC's ATM main interface.
- Global default: UBR QoS at the maximum line rate of the PVC or SVC.

To use this command in VC-class configuration mode, enter the **vc-class atm** global configuration command before you enter the **ubr+** command. This command has no effect if the VC class that contains the command is attached to a standalone VC, that is, if the VC is not a bundle member.

To use this command in bundle-vc configuration mode, first enter the **bundle** command to specify the bundle the VC member belongs to, then enter bundle configuration mode. Then enter the **pvc-bundle** bundle configuration command to add the VC to the bundle as a member of it.

VCs in a VC bundle are subject to the following configuration inheritance rules (listed in order of next highest precedence):

- VC configuration in bundle-vc mode
- Bundle configuration in bundle mode (with effect of assigned VC-class configuration)
- Subinterface configuration in subinterface mode

Examples

The following example specifies the *output-pcr* argument for an ATM PVC to be 100,000 kbps and the *output-mcr* to be 3000 kbps:

```
pvc 1/32
 ubr+ 100000 3000
```

The following example specifies the *output-pcr*, *output-mcr*, *input-pcr*, and *input-mcr* arguments for an ATM SVC to be 10,000 kbps, 3000 kbps, 9000 kbps, and 1000 kbps, respectively:

```
svc lion nsap 47.0091.81.000000.0040.0B0A.2501.ABC1.3333.3333.05
 ubr+ 10000 3000 9000 1000
```

Related Commands

Command	Description
abr	Selects ABR QoS and configures output peak cell rate and output minimum guaranteed cell rate for an ATM PVC or virtual circuit class.
broadcast	Configures broadcast packet duplication and transmission for an ATM VC class, PVC, SVC, or VC bundle.
bump	Configures the bumping rules for a virtual circuit class that can be assigned to a virtual circuit bundle.
bundle	Creates a bundle or modifies an existing bundle to enter bundle configuration mode.
class	Assigns a VC-class to an ATM main interface, subinterface, PVC, SVC, VC bundle, or VC bundle member.
encapsulation	Sets the encapsulation method used by the interface.

Command	Description
inarp	Configures the Inverse ARP time period for an ATM PVC, VC class, or VC bundle.
oam-bundle	Enables end-to-end F5 Operation, Administration, and Maintenance (OAM) loopback cell generation and OAM management for a virtual circuit class that can be applied to a virtual circuit bundle.
oam retry	Configures parameters related to OAM management for an ATM PVC, SVC, VC class, or VC bundle.
precedence	Configures precedence levels for a virtual circuit class that can be assigned to a virtual circuit bundle and thus applied to all virtual circuit members of that bundle.
protect	Configures a virtual circuit class with protected group or protected virtual circuit status for application to a virtual circuit bundle member.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle. Enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).
pvc-bundle	Adds a PVC to a bundle as a member of the bundle and enters bundle-vc configuration mode in order to configure that PVC bundle member.
ubr	Configures UBR QoS and specifies the output peak cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
vbr-nrt	Configures the VBR-NRT QoS and specifies output peak cell rate, output sustainable cell rate, and output maximum burst cell size for an ATM PVC, SVC, VC class, or VC bundle member.

vbr-nrt

To configure the variable bit rate-nonreal time (VBR-NRT) quality of service (QoS) and specify output peak cell rate (PCR), output sustainable cell rate, and output maximum burst cell size for an ATM permanent virtual circuit (PVC), PVC range, switched virtual circuit (SVC), VC class, or VC bundle member, use the **vbr-nrt** command in the appropriate command mode. To remove the VBR-NRT parameters, use the **no** form of this command.

vbr-nrt *output-pcr output-scr output-mbs* [*input-pcr*] [*input-scr*] [*input-mbs*]

no vbr-nrt *output-pcr output-scr output-mbs* [*input-pcr*] [*input-scr*] [*input-mbs*]

Syntax Description

output-pcr	The output PCR, in kbps.
output-scr	The output SCR, in kbps.
output-mbs	The output maximum burst cell size, expressed in number of cells.
input-pcr	(Optional for SVCs only) The input PCR, in kbps.
input-scr	(Optional for SVCs only) The input SCR, in kbps.
input-mbs	(Optional for SVCs only) The input maximum burst cell size, expressed in number of cells.

Defaults

UBR QoS at the maximum line rate of the physical interface.

Command Modes

Interface-ATM-VC configuration (for an ATM PVC or SVC)

VC-class configuration (for a VC class)

Bundle-vc configuration (for ATM VC bundle members)

PVC range configuration (for an ATM PVC range)

PVC-in-range configuration (for an individual PVC within a PVC range)

Command History

Release	Modification
11.3 T	This command was introduced.
12.0(3)T	This command was enhanced to support configuration of VBR-NRT QoS and specification of output PCR, output SCR, and output maximum burst cell size for ATM bundles and VC bundle members.
12.1(5)T	This command was made available in PVC range and PVC-in-range configuration modes.

Usage Guidelines

Configure QoS parameters using the **ubr**, **ubr+**, or **vbr-nrt** command. The last command you enter will apply to the PVC or SVC you are configuring.

If the **vbr-nrt** command is not explicitly configured on an ATM PVC or SVC, the VC inherits the following default configuration (listed in order of precedence):

- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC or SVC itself.
- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC's or SVC's ATM subinterface.
- Configuration of any QoS command (**ubr**, **ubr+**, or **vbr-nrt**) in a VC class assigned to the PVC's or SVC's ATM main interface.
- Global default: UBR QoS at the maximum line rate of the PVC or SVC.

To use this command in VC-class configuration mode, enter the **vc-class atm** global configuration command before you enter the **vbr-nrt** command. This command has no effect if the VC class that contains the command is attached to a standalone VC, that is, if the VC is not a bundle member.

To use this command in bundle-vc configuration mode, first enter the **pvc-bundle** configuration command to add the VC to the bundle as a member of it, then and enter bundle-vc configuration mode.

VCs in a VC bundle are subject to the following configuration inheritance rules (listed in order of precedence):

- VC configuration in bundle-vc mode
- Bundle configuration in bundle mode (with effect of assigned VC-class configuration)
- Subinterface configuration in subinterface mode

Examples

The following example specifies the *output-pcr* argument for an ATM PVC to be 100,000 kbps, the *output-scr* argument to be 50,000 kbps, and the *output-mbs* to be 64:

```
pvc 1/32
 vbr-nrt 100000 50000 64
```

The following example specifies the VBR-NRT output and input parameters for an ATM SVC:

```
svc lion nsap 47.0091.81.000000.0040.0B0A.2501.ABC1.3333.3333.05
 vbr-nrt 10000 5000 32 20000 10000 64
```

Related Commands

Command	Description
abr	Selects ABR QoS and configures output peak cell rate and output minimum guaranteed cell rate for an ATM PVC or virtual circuit class.
broadcast	Configures broadcast packet duplication and transmission for an ATM VC class, PVC, SVC, or VC bundle.
bump	Configures the bumping rules for a virtual circuit class that can be assigned to a virtual circuit bundle.
bundle	Creates a bundle or modifies an existing bundle to enter bundle configuration mode.
class-int	Assigns a VC class to an ATM main interface or subinterface.
class-vc	Assigns a VC class to an ATM PVC, SVC, or VC bundle member.
encapsulation	Sets the encapsulation method used by the interface.
inarp	Configures the Inverse ARP time period for an ATM PVC, VC class, or VC bundle.

Command	Description
oam-bundle	Enables end-to-end F5 OAM loopback cell generation and OAM management for a virtual circuit class that can be applied to a virtual circuit bundle.
oam retry	Configures parameters related to OAM management for an ATM PVC, SVC, VC class, or VC bundle.
precedence	Configures precedence levels for a virtual circuit class that can be assigned to a virtual circuit bundle and thus applied to all virtual circuit members of that bundle.
protect	Configures a virtual circuit class with protected group or protected virtual circuit status for application to a virtual circuit bundle member.
protocol (ATM)	Configures a static map for an ATM PVC, SVC, VC class, or VC bundle. Enables Inverse ARP or Inverse ARP broadcasts on an ATM PVC by either configuring Inverse ARP directly on the PVC, on the VC bundle, or in a VC class (applies to IP and IPX protocols only).
pvc-bundle	Adds a PVC to a bundle as a member of the bundle and enters bundle-vc configuration mode in order to configure that PVC bundle member.
ubr	Configures UBR QoS and specifies the output peak cell rate for an ATM PVC, SVC, VC class, or VC bundle member.
ubr+	Configures UBR QoS and specifies the output peak cell rate and output minimum guaranteed cell rate for an ATM PVC, SVC, VC class, or VC bundle member.

vc-class atm

To create a virtual circuit (VC) class for an ATM permanent virtual circuit (PVC), switched virtual circuit (SVC), or ATM interface and enter vc-class configuration mode, use the **vc-class atm** global configuration command. To remove a VC class, use the **no** form of this command.

vc-class atm *name*

no vc-class atm *name*

Syntax Description

name	Name of your VC class.

Defaults

No VC class is defined.

Command Modes

Global configuration

Command History

Release	Modification
11.3 T	This command was introduced.

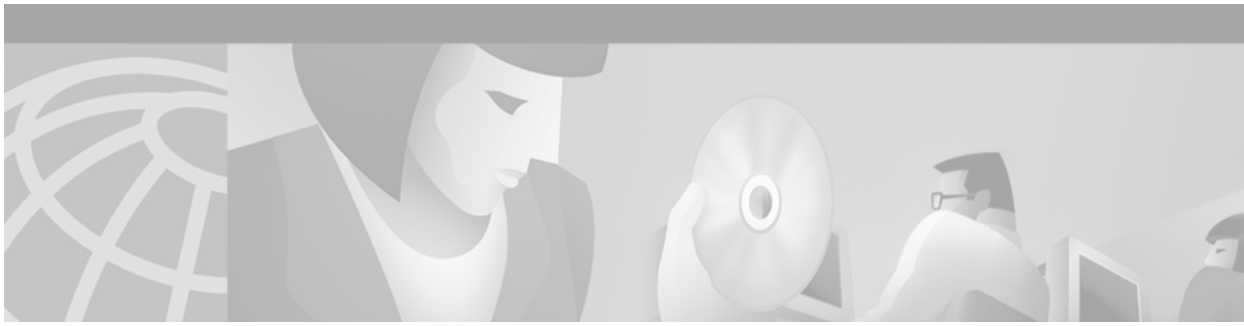
Usage Guidelines

If an SVC command (for example, the **idle-timeout** or **oam-svc** command) is applied on a PVC, the command is ignored. This is also true if a PVC command is applied to an SVC.

Examples

The following example creates a VC class named “pvc-qos”:

```
vc-class atm pvc-qos
```



Broadband Access: PPP and Routed Bridge Encapsulation Commands

Use the commands described in this chapter to configure broadband access using PPP and routed bridge encapsulation.

For information about configuring broadband access using PPP and routed bridge encapsulation, refer to the chapter "Configuring Broadband Access: PPP and Routed Bridge Encapsulation" in the *Cisco IOS Wide-Area Networking Configuration Guide.*

atm route-bridge

To configure an interface to use the ATM routed bridge encapsulation, use the **atm route-bridge** interface configuration command.

atm route-bridge *protocol*

Syntax Description

protocol	Protocol to be route-bridged. IP is the only protocol that can be route-bridged using ATM routed bridge encapsulation.

Defaults

ATM routed bridge encapsulation is not configured.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)DC	This command was introduced.
12.1(2)T	This command was integrated in Cisco IOS Release 12.1(2)T.

Examples

The following example configures ATM routed bridge encapsulation on an interface:

```
interface atm 4/0.100 point-to-point
 ip address 172.16.5.9 255.255.255.0
 pvc 0/32
 atm route-bridge ip
```

class-range

To assign a virtual circuit (VC) class to an ATM permanent virtual circuit (PVC) range, use the **class-range** PVC range configuration command. To remove the VC class, use the **no** form of this command.

class-range *class-name*

no class-range *class-name*

Syntax Description

class-name	Name of the VC class.

Defaults

No VC class is assigned to the PVC range.

Command Modes

PVC range configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

When you create a VC class for an ATM PVC range, you can use the following commands to define your parameters: **abr**, **broadcast**, **cbr**, **encapsulation aal5**, **ilmi manage**, **inarp**, **oam-pvc**, **oam retry**, **protocol**, **ubr**, **ubr+**, **vbr-nrt**, and **vbr-rt**.

Parameters that are configured for a PVC range through discrete commands entered in PVC range configuration mode supersede VC class parameters assigned to an ATM PVC range using the **class-range** command.

Examples

In the following example, a class called “classA” is created and then applied to an ATM PVC range called “range-pppoa-1”:

```
! The following commands create the class classA:
vc-class atm classA
 ubr 10000
 encapsulation aal5snap

! The following commands apply classA to an ATM PVC range:
interface atm 6/0.110 multipoint
 range range-pppoa-1 pvc 0/102 0/199
  class-range classA
```

Related Commands

Command	Description
abr	Selects ABR QoS and configures the output peak cell rate and output minimum guaranteed cell rate for an ATM PVC.
broadcast	Configures broadcast packet duplication and transmission for an ATM PVC.
cbr	Configures the CBR for the ATM CES for an ATM PVC.
class-vc	Assigns a VC class to an ATM PVC.
encapsulation aal5	Configures the AAL and encapsulation type for an ATM PVC.
ilmi manage	Enables ILMI management on an ATM PVC.
inarp	Configures the Inverse ARP time period for an ATM PVC.
oam-pvc	Enables end-to-end F5 OAM loopback cell generation and OAM management for an ATM PVC.
oam retry	Configures parameters related to OAM management for an ATM PVC.
protocol (ATM)	Configures a protocol for an ATM PVC. A PVC within a PVC range supports only the protocols that do not require static map configuration.
shutdown (PVC-in-range)	Deactivates an individual PVC within a PVC range.
shutdown (PVC range)	Deactivates an ATM PVC range.
ubr	Configures an UBR QoS and specifies the output PCR for an ATM PVC range.
ubr+	Configures an UBR QoS and specifies the output PCR and output minimum guaranteed cell rate for an ATM PVC range.
vbr-nrt	Configures the VBR-NRT QoS and specifies output PCR, output sustainable cell rate, and output maximum burst cell size for an ATM PVC range.
vbr-rt	Configures the real-time VBR for an ATM PVC range.

max bandwidth

To specify the total amount of outgoing bandwidth available to SVCs in the current configuration, use the **max bandwidth** interface-ATM-VC configuration command. To remove the current bandwidth setting, use the **no** form of this command.

max bandwidth *kbps*

no max bandwidth *kbps*

Syntax Description

kbps	Total amount of outgoing bandwidth in kilobits per second available to all SVCs in the current configuration.

Defaults

No default behavior or values.

Command Modes

Interface-ATM-VC configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

Only the guaranteed cell rate of an SVC is counted toward the maximum bandwidth.

Examples

In following example, an SVC called “anna” on ATM interface 2/0/0 is configured using the **max bandwidth** command to allow a maximum of 50 Mbps of bandwidth to be used by all of the SVCs in this configuration:

```
interface ATM 2/0/0
 svc anna
  encapsulation aal5auto
  protocol ppp virtual-template 1
  max bandwidth 50000
```

Related Commands

Command	Description
max vc	Specifies the maximum number of SVCs that can be established using the current configuration.

max vc

To specify the maximum number of switched virtual circuits (SVCs) that can be established using the current configuration, use the **max vc** interface-ATM-VC configuration command. To restore the maximum number of SVCs to the default setting, use the **no** form of this command.

max vc *number*

no max vc *number*

Syntax Description

number	Maximum number of SVCs to be established using the current SVC configuration.

Defaults

4096 SVCs

Command Modes

Interface-ATM-VC configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Examples

In following example, an SVC called “anna” on ATM interface 2/0/0 is configured using the **max vc** command to allow a maximum of 100 SVCs to be established using this configuration:

```
interface ATM 2/0/0
 svc anna
  encapsulation aal5auto
  protocol ppp virtual-template 1
  max vc 100
```

Related Commands

Command	Description
max bandwidth	Specifies the maximum amount of bandwidth available to all SVCs in the current configuration.
svc	Creates an ATM SVC.

oam-range

To enable end-to-end F5 Operation, Administration, and Maintenance (OAM) loopback cell generation and OAM management for an ATM permanent virtual circuit (PVC) range, use the **oam-range** PVC range configuration command. To disable generation of OAM loopback cells and OAM management, use the **no** form of this command.

oam-range [**manage**] [*frequency*]

no oam-range [**manage**] [*frequency*]

Syntax Description

manage	(Optional) Enables OAM management.
frequency	(Optional) Time delay (0 to 600 seconds) between transmissions of OAM loopback cells.

Defaults

10 seconds

Command Modes

PVC range configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

If OAM management is enabled, further control of OAM management is configured using the **oam retry** command.

If the **oam-range** command is not explicitly configured for an ATM PVC range, the range inherits the following default configuration (listed in order of precedence):

- Configuration of the **oam-range** command in a VC class assigned to the range.
- Configuration of the **oam-range** command in a VC class assigned to the ATM subinterface for the range.
- Configuration of the **oam-range** command in a VC class assigned to the ATM main interface for the range.
- Global default: End-to-end F5 OAM loopback cell generation and OAM management are disabled, but if OAM cells are received, they are looped back. The default value for the *frequency* argument is 10 seconds.

Examples

The following example enables end-to-end F5 OAM loopback cell transmission and OAM management on an ATM PVC range called “range1” with a transmission frequency of 11 seconds:

```
interface atm 6/0.1
 range range1 pvc 7/101 7/103
  oam-range manage 11
  oam retry 8 9 10
```

Related Commands

Command	Description
ilmi manage	Enables ILMI management on an ATM PVC.
oam-pvc	Enables end-to-end F5 OAM loopback cell generation and OAM management for an ATM PVC or VC class.
oam retry	Configures parameters related to OAM management for ATM PVC, SVC, or VC class.

pppoe enable

To enable PPP over Ethernet (PPPoE) sessions on an Ethernet interface, use the **pppoe enable** interface configuration command. To disable PPPoE, use the **no** form of this command.

pppoe enable

no pppoe enable

Syntax Description

This command has no arguments or keywords.

Defaults

PPPoE is disabled by default.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.
12.1(5)T	This command was modified to enable PPPoE on IEEE 802.1Q encapsulated virtual LAN (VLAN) interfaces.

Examples

PPPoE on an 802.1Q VLAN Subinterface Example

The following example shows how to enable PPPoE on an 802.1Q VLAN subinterface:

```
interface FastEthernet0/0.10
 encapsulation dot1Q 10
 pppoe enable
```

PPPoE on an Ethernet Interface Example

The following example enables PPPoE sessions on Ethernet interface 1/0:

```
interface ethernet1/0
 pppoe enable
```

Related Commands

Command	Description
debug vpdn pppoe-data	Displays data packets of PPPoE sessions.
debug vpdn pppoe-error	Displays PPPoE protocol errors that prevent a session from being established or errors that cause an established session to be closed.
debug vpdn pppoe-events	Displays PPPoE protocol messages about events that are part of normal session establishment or shutdown.
pppoe limit per-mac	Specifies the maximum number of PPPoE sessions to be sourced from a MAC address.
pppoe limit per-vlan	Specifies the maximum number of PPPoE sessions under each VLAN.

pppoe limit per-mac

To specify the maximum number of PPPoE sessions to be sourced from a MAC address, use the **pppoe limit per-mac** command in VPDN configuration mode.

pppoe limit per-mac *number*

Syntax Description

number	Maximum number of PPPoE sessions that can be sourced from a MAC address.

Defaults

100 sessions

Command Modes

VPDN configuration

Command History

Release	Modification
12.1(1)T	This command was introduced.

Examples

The following example sets a limit of 10 sessions to be sourced from a MAC address:

```
pppoe limit per-mac 10
```

Related Commands

Command	Description
pppoe limit per-vc	Specifies the maximum number of PPPoE sessions to be established over a VC.
pppoe limit per-vlan	Specifies the maximum number of PPPoE sessions under each VLAN.

pppoe limit per-vc

To specify the maximum number of PPPoE sessions to be established over a VC, use the **pppoe limit per-vc** command in VPDN configuration mode.

pppoe limit per-vc *number*

Syntax Description

number	Maximum number of PPPoE sessions that can be established over an ATM PVC.

Defaults

100 sessions

Command Modes

VPDN configuration

Command History

Release	Modification
12.1(1)T	This command was introduced.

Examples

The following example sets a limit of 10 sessions to be established over a VC:

```
pppoe limit per-vc 10
```

Related Commands

Command	Description
pppoe limit per-mac	Specifies the maximum number of PPPoE sessions to be sourced from a MAC address.
pppoe limit per-vlan	Specifies the maximum number of PPPoE sessions under each VLAN.

pppoe limit per-vlan

To specify the maximum number of PPP over Ethernet (PPPoE) sessions permitted under each virtual LAN (VLAN), use the **pppoe limit per-vlan** VPDN configuration command. To remove this specification, use the **no** form of this command.

pppoe limit per-vlan *number*

no pppoe limit per-vlan

Syntax Description

number	Maximum number of PPP over Ethernet sessions permitted under each VLAN.

Defaults

100 PPPoE sessions per VLAN

Command Modes

VPDN configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

If the **pppoe max-session** command is configured on a VLAN, that command will take precedence over the **pppoe limit per-vlan** command. The **pppoe limit per-vlan** command applies to all VLANs on which the **pppoe max-session** command has not been configured.

The **pppoe limit per-vlan** command must be configured after the accept dial-in VPDN group has been configured using the **accept-dialin** VPDN configuration command.

Examples

The following example shows a maximum of 200 PPPoE sessions configured for an 802.1Q VLAN subinterface:

```
interface FastEthernet0/0.10
 encapsulation dot1Q 10
 pppoe enable
!
vpdn enable
vpdn-group 1
 accept dialin
  protocol pppoe
  virtual-template 1
 pppoe limit per-vlan 200
```

Related Commands

Command	Description
accept dial-in	Creates an accept dial-in VPDN subgroup.
debug vpdn pppoe-data	Displays data packets of PPPoE sessions.
debug vpdn pppoe-error	Displays PPPoE protocol errors that prevent a session from being established or errors that cause an established session to be closed.
debug vpdn pppoe-events	Displays PPPoE protocol messages about events that are part of normal session establishment or shutdown.
debug vpdn pppoe-packet	Displays each PPPoE protocol packet exchanged.
pppoe enable	Enables PPPoE sessions on an Ethernet interface.
pppoe limit per-mac	Specifies the maximum number of PPPoE sessions to be sourced from a MAC address.
pppoe limit per-vc	Specifies the maximum number of PPPoE sessions to be established over a VC.
pppoe max-session	Specifies the maximum number of PPPoE sessions permitted under a VLAN.

pppoe max-session

To specify the maximum number of PPP over Ethernet (PPPoE) sessions permitted under a virtual LAN (VLAN), use the **pppoe max-session** Ethernet subinterface configuration command. To remove this specification, use the **no** form of this command.

pppoe max-session *number*

no pppoe max-session

Syntax Description

number	Maximum number of PPP over Ethernet sessions permitted under a VLAN.

Defaults

No default behavior or values.

Command Modes

Ethernet subinterface configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

Use the **pppoe max-session** command to specify the maximum number of PPPoE session under a VLAN. The **pppoe limit per-vlan** global configuration command can also be used to specify the maximum number of PPPoE sessions. If the **pppoe max-session** command and the **pppoe limit per-vlan** command are both configured, the **pppoe max-session** command takes precedence on the VLAN.

Examples

The following example shows a maximum of 200 PPPoE sessions configured for an 802.1Q VLAN subinterface:

```
interface FastEthernet0/0.10
 encapsulation dot1Q 10
 pppoe enable
 pppoe max-session 200
```

Related Commands

Command	Description
debug vpdn pppoe-data	Displays data packets of PPPoE sessions.
debug vpdn pppoe-error	Displays PPPoE protocol errors that prevent a session from being established or errors that cause an established session to be closed.
debug vpdn pppoe-events	Displays PPPoE protocol messages about events that are part of normal session establishment or shutdown.
debug vpdn pppoe-packet	Displays each PPPoE protocol packet exchanged.
pppoe enable	Enables PPPoE sessions on an Ethernet interface.

Command	Description
pppoe limit per-mac	Specifies the maximum number of PPPoE sessions to be sourced from a MAC address.
pppoe limit per-vc	Specifies the maximum number of PPPoE sessions to be established over a VC.
pppoe limit per-vlan	Specifies the maximum number of PPPoE sessions permitted under each VLAN.

pvc-in-range

To configure an individual permanent virtual circuit (PVC) within a PVC range, use the **pvc-in-range** PVC range configuration command. To delete the individual PVC configuration, use the **no** form of this command.

pvc-in-range [*pvc-name*] [*vpi*/*vci*]

no pvc-in-range [*pvc-name*] [*vpi*/*vci*]

Syntax Description

pvc-name	(Optional) Name given to the PVC. The PVC name can have a maximum of 15 characters.
vpi/	(Optional) ATM network virtual path identifier (VPI) for this PVC. In the absence of the "/" and a *vpi* value, the *vpi* value defaults to 0. The *vpi* value ranges from 0 to 255.
vci	(Optional) ATM network virtual channel identifier (VCI) for this PVC. The *vci* value ranges from 32 to 2047.

Defaults

No default behavior or values.

Command Modes

PVC range configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

The **pvc-in-range** command defines an individual PVC within a PVC range and enables PVC-in-range configuration mode.

Examples

In the following example, a PVC called "pppoa" is deactivated. The PVC "pppoa" is an individual PVC within a configured PVC range.

```
pvc-in-range pppoa 0/130
 shutdown
```

Related Commands

Command	Description
range pvc	Defines a range of ATM PVCs.

range pvc

To define a range of ATM permanent virtual circuits (PVCs), use the **range pvc** subinterface configuration command. To delete the range of ATM PVCs, use the **no** form of this command.

range [*range-name*] **pvc** *start-vpi*/*start-vci end-vpi*/*end-vci*

no range [*range-name*] **pvc**

Syntax Description

range-name	(Optional) Name of the range. The range name can be a maximum of 15 characters.
start-vpi/	Beginning value for a range of virtual path identifiers (VPIs). In the absence of the "/" and a *vpi* value, the *vpi* value defaults to 0. The *vpi* value ranges from 0 to 255.
start-vci/	Beginning value for a range of virtual channel identifiers (VCIs). The *vci* value ranges from 32 to 65535.
end-vpi	End value for a range of virtual path identifiers (VPIs). In the absence of an *end-vpi* value, the *end-vpi* value defaults to the *start-vpi* value.The *vpi* value ranges from 0 to 255.
end-vci	End value for a range of virtual channel identifiers (VCIs). The *vci* value ranges from 32 to 65535.

Defaults

An ATM PVC range is not configured.

Command Modes

Subinterface configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Usage Guidelines

The **range pvc** command defines a range of PVCs and enables PVC range configuration mode.

The number of PVCs in a range can be calculated using the following formula:

number of PVCs = (*end-vpi* – *start-vpi* + 1) x (*end-vci* – *start-vci* +1).

The *start-vpi* argument may be omitted if it is zero. The *end_vpi* argument may be omitted, but if it is omitted, it is assigned the value of *start-vpi*. The *end-vpi* and *end-vci* arguments are always greater than or equal to *start-vpi* and *start-vci* respectively.

When applied to multipoint subinterfaces, the **range pvc** command creates a range of ATM PVCs. When applied to point-to-point subinterfaces, the **range pvc** command creates range of PVCs and a corresponding range of point-to-point subinterfaces.

For point-to-point subinterfaces, subinterface numbering begins with the subinterface on which the PVC range is configured and increases sequentially through the range.

Examples

ATM PVC Range Example

In the following example, 100 PVCs with VCI values from 100 to 199 for each VPI value from 0 to 4 are created for a PVC range called “range-pppoa-1”. This configuration creates a total of 500 PVCs in the range. PVC parameters are then configured for the range.

```
interface atm 6/0.110 multipoint
 range range-pppoa-1 pvc 100 4/199
  class-range class-pppoa-1
  ubr 1000
  encapsulation aal5snap
  protocol ppp virtual-Template 2
```

Subinterface Grouping by PVC Range for Routed Bridge Encapsulation Example

In the following example, a PVC range called “range1” is created with a total of 100 PVCs in the range. A point-to-point subinterface will be created for each PVC in the range. ATM routed bridge encapsulation is also configured.

```
interface atm 6/0.200 point-to-point
 ip unnumbered loopback 1
 atm route-bridged ip
 range range1 pvc 1/200 1/299
  # end
```

Related Commands

Command	Description
pvc-in-range	Configures an individual PVC within a PVC range.

show atm svc ppp

To display information about each switched virtual circuit (SVC) configured for PPP over ATM, use the **show atm svc ppp** privileged EXEC command.

show atm svc ppp

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(3)T	This command was introduced.

Examples

The following is sample output for the **show atm svc ppp** command:

```
Router# show atm svc ppp

ATM Int.       VCD/Name      VPI   VCI  Type   VCSt  VA  VASt
2/0.1          10             0    60   SVC     UP   1   UP
```

Table 22 describes the fields shown in the displays.

Table 22 show atm svc ppp Field Descriptions

Field	Description
ATM Int.	Interface on which the SVC is configured.
VCD/Name	Virtual circuit descriptor (VCD) or name associated with the SVC.
VPI	Virtual path identifier.
VCI	Virtual channel identifier.
Type	Type of virtual circuit.
VCSt	Virtual circuit state.
VA	Virtual access interface number.
VASt	Virtual access interface state.

shutdown (PVC-in-range)

To deactivate an individual permanent virtual circuit (PVC) within a PVC range, use the **shutdown** PVC-in-range configuration command. To reactivate an individual PVC within PVC range, use the **no** form of this command.

shutdown

no shutdown

Syntax Description

This command has no arguments or keywords.

Defaults

The PVC is active.

Command Modes

PVC-in-range configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

Examples

In the following example, “pvc1” within the PVC range called “range1” is deactivated:

```
interface atm 6/0.110 multipoint
 range range1 pvc 100 4/199
  pvc-in-range pvc1 7/104
   shutdown
```

Related Commands

Command	Description
pvc-in-range	Configures an individual PVC within a PVC range.
shutdown (PVC range)	Deactivates a PVC range.

shutdown (PVC range)

To deactivate a PVC range, use the **shutdown** PVC range configuration command. To reactivate a PVC range, use the **no** form of this command.

shutdown

no shutdown

Syntax Description

This command has no arguments or keywords.

Defaults

PVC range is active.

Command Modes

PVC range configuration

Command History

Release	Modification
12.1(5)T	This command was introduced.

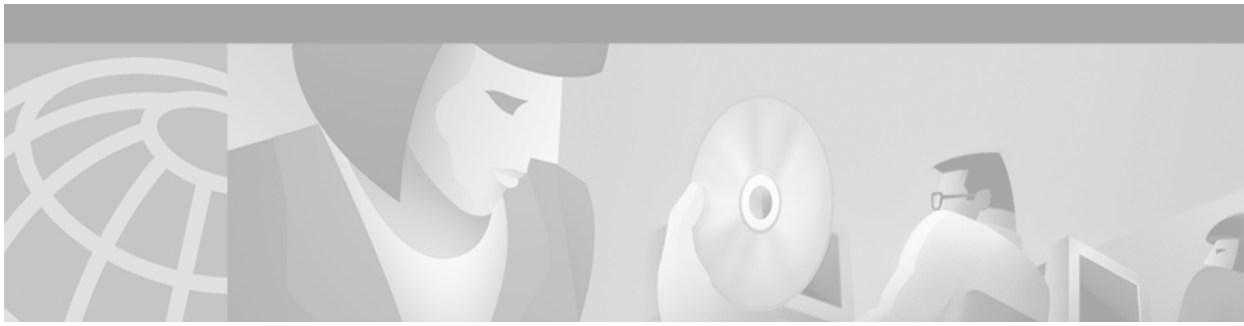
Examples

In the following example, a PVC range called “range1” is deactivated:

```
interface atm 6/0.110 multipoint
 range range1 pvc 100 4/199
  shutdown
```

Related Commands

Command	Description
range pvc	Defines a range of ATM PVCs.
shutdown (PVC-in-range)	Deactivates an individual PVC within a PVC range.



Frame Relay Commands

Use the commands described in this chapter to configure access to Frame Relay networks.

For Frame Relay configuration information and examples, refer to the chapter "Configuring Frame Relay" in the *Cisco IOS Wide-Area Networking Configuration Guide*.

For a description of the commands used to configure Frame Relay-ATM Interworking, refer to the chapter "Frame Relay-ATM Interworking Commands" later in this book.

For information about how to configure FRF.5 Frame Relay-ATM Network Interworking and FRF.8 Frame Relay-ATM Service Interworking, refer to the chapter "Configuring Frame Relay-ATM Interworking" of the *Cisco IOS Wide-Area Networking Configuration Guide*.

class (map-list)

To associate a map class with a protocol-and-address combination, use the **class** map-list configuration command.

protocol protocol-address **class** *map-class* [**broadcast**] [**trigger**] [**ietf**]

Syntax Description

protocol	Supported protocol, bridging, or logical link control keywords: **appletalk**, **bridging**, **clns**, **decnet**, **dlsw**, **ip**, **ipx**, **llc2**, **rsrb**, **vines**, and **xns**.
protocol-address	Protocol address. The **bridge** and **clns** keywords do not use protocol addresses.
map-class	Name of the map class from which to derive quality of service (QoS) information.
broadcast	(Optional) Allows broadcasts on this SVC.
trigger	(Optional) Enables a broadcast packet to trigger an SVC. If an SVC already exists that uses this map class, the SVC will carry the broadcast. This keyword can be configured only if **broadcast** is also configured.
ietf	(Optional) Specifies RFC 1490 encapsulation. The default is Cisco encapsulation.

Defaults

No protocol, protocol address, and map class are defined. If the **ietf** keyword is not specified, the default is Cisco encapsulation. If the **broadcast** keyword is not specified, no broadcasts are sent.

Command Modes

Map-list configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command is used for Frame Relay switched virtual circuits (SVCs); the parameters within the map class are used to negotiate for network resources. The class is associated with a static map that is configured under a map list.

Examples

In the following example, if IP triggers the call, the SVC is set up with the QoS parameters defined within the class hawaii. However, if AppleTalk triggers the call, the SVC is set up with the QoS parameters defined in the class rainbow. An SVC triggered by either protocol results in two SVC maps, one for IP and one for AppleTalk. Two maps are set up because these protocol-and-address combinations are heading for the same destination, as defined by the **dest-addr** keyword and the values following it in the **map-list** command.

```
map-list bermuda source-addr E164 14085551212 dest-addr E164 15085551212
 ip 131.108.177.100 class hawaii
 appletalk 1000.2 class rainbow
```

In the following example, the **trigger** keyword allows AppleTalk broadcast packets to trigger an SVC:

```
ip 172.21.177.1 class jamaica broadcast ietf
appletalk 1000.2 class jamaica broadcast trigger ietf
```

Related Commands

Command	Description
map-class frame-relay	Specifies a map class to define QoS values for an SVC.
map-list	Specifies a map group and link it to a local E.164 or X.121 source address and a remote E.164 or X.121 destination address for Frame Relay SVCs.

class (virtual circuit)

To associate a map class with a specified data-link connection identifier (DLCI), use the **class** virtual circuit configuration command. To remove the association between the DLCI and the map class, use the **no** form of this command.

class *name*

no class *name*

Syntax Description

name	Name of map class to associate with this DLCI.

Defaults

No map class is defined.

Command Modes

Virtual circuit configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command applies to DLCIs. The class parameter values are specified with the **map-class frame-relay** command.

Examples

The following example shows how to define map class “slow_vcs’ and apply it to DLCI 100:

```
interface serial 0.1 point-to-point
 frame-relay interface-dlci 100
  class slow_vcs

map-class frame-relay slow_vcs
frame-relay cir out 9600
```

The following example shows how to apply a map class to a DLCI for which a **frame-relay map** statement exists. The **frame-relay interface-dlci** command must also be used.

```
interface serial 0.2 point-to-multipoint
 frame-relay map ip 131.26.13.2 100
 frame-relay interface-dlci 100
  class slow_vcs

interface serial 0
 frame-relay interface-dlci 100
  class fast_vc

map-class frame-relay fast_vc
 frame-relay traffic-rate 56000 128000
 frame-relay idle-timer 30
```

Related Commands

Command	Description
frame-relay interface-dlci	Assigns a DLCI to a specified Frame Relay subinterface on the router or access server.
frame-relay map	Defines mapping between a destination protocol address and the DLCI used to connect to the destination address.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

clear frame-relay-inarp

To clear dynamically created Frame Relay maps, which are created by the use of Inverse Address Resolution Protocol (ARP), use the **clear frame-relay-inarp** EXEC command.

clear frame-relay-inarp

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example clears dynamically created Frame Relay maps:

```
clear frame-relay-inarp
```

Related Commands

Command	Description
frame-relay inverse-arp	Reenables Inverse ARP on a specified interface or subinterface, if the Inverse ARP was previously disabled on a router or access server configured for Frame Relay.
show frame-relay map	Displays the current map entries and information about the connections.

connect (Frame Relay)

To define connections between Frame Relay PVCs, use the **connect** global configuration command. To remove connections, use the **no** form of this command.

connect *connection-name interface dlci interface dlci*

no connect *connection-name interface dlci interface dlci*

Syntax Description

connection-name	A name for this connection.
interface	Interface on which a PVC connection will be defined.
dlci	Data-link connection identifier (DLCI) number of the PVC that will be connected.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

When Frame Relay switching is enabled, the **connect** command creates switched PVCs in Frame Relay networks.

Examples

The following example shows how to enable Frame Relay switching and define a connection called "one" between DLCI 16 on serial interface 0 and DLCI 100 on serial interface 1.

```
frame-relay switching
connect one serial0 16 serial1 100
```

Related Commands

Command	Description
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.

encapsulation frame-relay

To enable Frame Relay encapsulation, use the **encapsulation frame-relay** interface configuration command. To disable Frame Relay encapsulation, use the **no** form of this command.

encapsulation frame-relay [**cisco** | **ietf**]

no encapsulation frame-relay [**ietf**]

Syntax Description

cisco	(Optional) Uses Cisco's own encapsulation, which is a 4-byte header, with 2 bytes to identify the data-link connection identifier (DLCI) and 2 bytes to identify the packet type.
ietf	(Optional) Sets the encapsulation method to comply with the Internet Engineering Task Force (IETF) standard (RFC 1490). Use this keyword when connecting to another vendor's equipment across a Frame Relay network.

Defaults

The default is **cisco** encapsulation.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Use this command with no keywords to restore the default Cisco encapsulation, which is a 4-byte header with 2 bytes for the DLCI and 2 bytes to identify the packet type.

You should shut down the interface prior to changing encapsulation types. Although this is not required, shutting down the interface ensures the interface is reset for the new encapsulation.

Examples

The following example configures Cisco Frame Relay encapsulation on interface serial 1:

```
interface serial 1
 encapsulation frame-relay
```

Use the **ietf** keyword if your router or access server is connected to another vendor's equipment across a Frame Relay network to conform with RFC 1490:

```
interface serial 1
 encapsulation frame-relay ietf
```

fr-atm connect dlci

To connect a Frame Relay data-link connection identifier (DLCI) to an ATM virtual circuit descriptor for FRF.5 Frame Relay-ATM Interworking (currently only available for the Cisco MC 3810), use the **fr-atm connect dlci** interface configuration command. The encapsulation type of the current interface must be Frame Relay or Frame Relay 1490 Internet Engineering Task Force (IETF). To remove the DLCI-to-VCD connection, use the **no** form of this command.

fr-atm connect dlci *dlci atm-interface* [**pvc** *name* | [**pvc** *vpi/*]*vci*] [**clp-bit** {**map-de | 0 | 1**}] [**de-bit** {**no-map-clp | map-clp**}]

no fr-atm connect dlci *dlci atm-interface* [**pvc** *name* | [**pvc** *vpi/*]*vci*] [**clp-bit** {**map-de | 0 | 1**}] [**de-bit** {**no-map-clp | map-clp**}]

Syntax Description

dlci	Frame Relay DLCI number.
atm-interface	The ATM interface connected to the DLCI.
pvc *name*	(Optional) The ATM PVC name.
pvc *vpi/vci*	(Optional) The ATM PVC virtual path identifier (VPI)/virtual channel identifier (VCI). The default value for *vpi* is 0 if no value is entered. When specifying the ATM PVC, enter one of the following PVC designations: • The *name* value • The *vpi* value alone • The *vpi/vci* combination
clp-bit {**map-de	0	1**}	(Optional) Sets the mode of Discard Eligibility/Cell Loss Priority (DE/CLP) mapping in the Frame Relay to ATM direction. The default is **map-de**. **map-de**—Specifies Mode 1 (as described in section 4.4.2 of FRF.5). **0** or **1**—Specifies Mode 2 (as described in section 4.4.2 of FRF.5).
de-bit {**no-map-clp	map-clp**}	(Optional) Sets the mode of DE/CLP mapping in the ATM to Frame Relay direction. The default is **map-clp**. **map-clp**—Specifies Mode 1 (as described in section 4.4.2 of FRF.5). **no-map-clp**—Specifies Mode 2 (as described in section 4.4.2 of FRF.5).

Defaults

No Frame Relay-ATM connection is configured.

Command Modes

Interface configuration

Command History

Release	Modification
11.3 MA	This command was introduced.

Release	Modification
12.0 PVC	Management CLI support was added.
12.0(7)T	This command was implemented in Cisco IOS Release 12.0 T. The **clp-bit** and **de-bit** keywords were added.

Usage Guidelines

This command only applies to Frame Relay-ATM Network Interworking (FRF.5) on the Cisco MC3810.

Note The Cisco MC3810 provides only *network interworking* (FRF.5). The Cisco MC3810 can be used with *service interworking* (FRF.8), which is provided by the carrier's ATM network equipment.

Examples

The following example configures a Frame Relay-ATM Interworking connection on FR-ATM interface 20, in which Frame Relay DLCI 100 is connected to ATM VPI/VCI 100/200 for ATM interface 0:

```
interface fr-atm 20
 fr-atm connect dlci 100 atm0 100/200 clp-bit map-de de-bit map-clp
```

The following example configures a Frame Relay-ATM Interworking connection on FR-ATM interface 10, in which Frame Relay DLCI 150 is connected to ATM VPI/VCI 0/150 for ATM interface 0:

```
interface fr-atm 10
 fr-atm connect dlci 150 atm0 0/150 clp-bit map-de de-bit map-clp
```

Related Commands

Command	Description
interface fr-atm	Creates a Frame Relay-ATM Interworking interface on the Cisco MC3810 multiservice concentrator.

frame-relay accounting adjust

To enable byte count adjustment at the permanent virtual circuit (PVC) level so that the number of bytes sent and received at the PVC corresponds to the actual number of bytes sent and received on the physical interface, use the **frame-relay accounting adjust** command in interface configuration mode. To disable byte count adjustment, use the **no** form of this command.

frame-relay accounting adjust

no frame-relay accounting adjust [**frf9**]

Syntax Description

frf9	(Optional) Payload compression using the Stacker method.

Note Use the **frf9** keyword only with the **no** form of this command.

Defaults

Byte count adjustment is enabled.

Command Modes

Interface configuration

Command History

Release	Modification
12.2	This command was introduced.

Usage Guidelines

Use this command to return the number of bytes shown at the PVC level back to the number of bytes received at the PVC level without any adjustments. This command takes into consideration any dropped packets as well as compression and decompression that may occur after initial processing.

If you use the **no frame-relay accounting adjust frf9** command, then byte count includes dropped packets and traffic shaping, but not compression and decompression savings from FRF.9.

Examples

The following example enables Frame-Relay accounting adjustment:

```
Router# configure terminal
Router(config)# interface serial3/0
Router(config-if) frame-relay accounting adjust
```

The following example disables Frame-Relay accounting adjustment:

```
Router# configure terminal
Router(config)# interface serial3/0
Router(config-if) no frame-relay accounting adjust
Router(config-if)# end
```

The following example verifies that Frame-Relay accounting adjustment is disabled:

```
Router# show run interface serial3/0
```

```
Building configuration...

Current configuration :266 bytes
!
interface Serial3/0
 no ip address
 encapsulation frame-relay
 no frame-relay accounting adjust
end
```

Related Commands

Command	Description
show frame-relay pvc	Displays the total input and output bytes for a PVC and an interface as equal. **Note** In order for the PVC and the interface input and output byte count to be equal, no other PVCs or network traffic can be passing data. Otherwise the interface shows aggregate totals for PVCs, the Local Management Interface (LMI), and other network traffic.

frame-relay adaptive-shaping

To select the type of backward notification you want to use, use the **frame-relay adaptive-shaping** map-class configuration command. To disable backward notification, use the **no** form of the command.

frame-relay adaptive-shaping {**becn** | **foresight**}

no frame-relay adaptive-shaping

Syntax Description

becn	Enables rate adjustment in response to backward explicit congestion notification (BECN).
foresight	Enables rate adjustment in response to ForeSight and BECN messages.

Defaults

Disabled

Command Modes

Map-class configuration

Command History

Release	Modification
11.3	This command was introduced.

Usage Guidelines

This command replaces the **frame-relay becn-response-enable** command. If you use the **frame-relay becn-response-enable** command in scripts, you should replace it with the **frame-relay adaptive-shaping** command.

The **frame-relay adaptive-shaping** command configures a router to respond to either BECN or ForeSight backward congestion notification messages. When BECN is enabled, Frame Relay traffic shaping will adapt to BECN messages. When ForeSight is enabled, Frame Relay traffic shaping will adapt to ForeSight and BECN messages.

Include this command in a map-class definition and apply the map class to either the main interface or to a subinterface.

Examples

This example shows the map-class definition for a router configured with traffic shaping and Router ForeSight enabled:

```
interface Serial0
 no ip address
 encapsulation frame-relay
 frame-relay traffic-shaping
 frame-relay class control-A
 map-class frame-relay control-A
  frame-relay adaptive-shaping foresight
  frame-relay cir 56000
  frame-relay bc 64000
```

Related Commands

Command	Description
frame-relay traffic-shaping	Enables both traffic shaping and per-VC queueing for all PVCs and SVCs on a Frame Relay interface.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay address registration auto-address

To enable a router to automatically select a management IP address for ELMI address registration, use the **frame-relay address registration auto-address** global configuration command. To disable automatic address selection, use the **no** form of this command.

frame-relay address registration auto-address

no frame-relay address registration auto-address

Syntax Description

This command has no arguments or keywords.

Defaults

Auto address selection is enabled.

Command Modes

Global configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

During system initialization, if no management IP address is configured, then the router automatically selects the IP address of one of the interfaces. The router will choose an Ethernet interface first and then serial and other interfaces. If you do not want the router to select a management IP address during system initialization, you can store the **no** form of this command in the configuration.

When automatic address selection is disabled and an IP address has not been configured using the **frame-relay address registration ip** global configuration command, the IP address for ELMI address registration will be set to 0.0.0.0.

The **no frame-relay address registration ip** command will set the IP address to 0.0.0.0, even when Frame Relay automatic address selection is enabled.

If you configure the IP address using the **frame-relay address registration ip** global configuration command, the IP address you configure will overwrite the IP address chosen automatically by the router.

If you enable automatic address selection after configuring the IP address using the **frame-relay address registration ip** global configuration command, the IP address chosen automatically by the router will overwrite the IP address you originally configured.

Examples

The following example shows ELMI enabled on serial interface 0. The automatic IP address selection mechanism is disabled, and no other management IP address has been configured, so the device will share a valid ifIndex and a management IP address of 0.0.0.0.

```
interface Serial 0
 no ip address
 encapsulation frame-relay
 frame-relay lmi-type ansi
 frame-relay qos-autosense
```

```
!
no frame-relay address registration auto-address
```

Related Commands

Command	Description
frame-relay address-reg enable	Enables ELMI address registration on an interface.
frame-relay address registration ip	Configures the IP address to be used for ELMI address registration.
frame-relay qos-autosense	Enables ELMI on the Cisco router.

frame-relay address registration ip

To configure the IP address for ELMI address registration, use the **frame-relay address registration ip** global configuration command. To set the IP address to 0.0.0.0, use the **no** form of this command.

frame-relay address registration ip *address*

no frame-relay address registration ip

Syntax Description

address	IP address to be used for ELMI address registration.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

A management IP address configured by using the **frame-relay address registration ip** command will overwrite the IP address chosen by the router when automatic address selection is enabled.

The **no frame-relay address registration ip** command will disable automatic IP address selection and set the management IP address to 0.0.0.0.

If you enable automatic address selection with the **frame-relay address registration auto-address** global command after configuring the IP address using the **frame-relay address registration ip** global configuration command, the IP address chosen automatically by the router will overwrite the IP address you originally configured.

Examples

The following example shows ELMI enabled on serial interface 0. The IP address to be used for ELMI address registration is configured, so automatic IP address selection is disabled by default.

```
interface Serial 0
 no ip address
 encapsulation frame-relay
 frame-relay lmi-type ansi
 frame-relay qos-autosense
!
frame-relay address registration ip address 139.85.242.195
```

Related Commands

Command	Description
frame-relay address-reg enable	Enables ELMI address registration on an interface.
frame-relay address registration auto-address	Enables a router to automatically select the IP address to be used for ELMI address registration.
frame-relay qos-autosense	Enables ELMI on a Cisco router.

frame-relay address-reg enable

To enable ELMI address registration on an interface, use the **frame-relay address-reg enable** interface configuration command. To disable ELMI address registration, use the **no** form of this command.

frame-relay address-reg enable

no frame-relay address-reg enable

Syntax Description

This command has no arguments or keywords.

Defaults

ELMI address registration is enabled.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

ELMI address registration is enabled by default when ELMI is enabled.

Examples

The following example shows ELMI address registration disabled on serial interface 0.

```
interface Serial 0
 no ip address
 encapsulation frame-relay
 frame-relay lmi-type ansi
 frame-relay qos-autosense
 no frame-relay address-reg enable
```

Related Commands

Command	Description
frame-relay address registration auto-address	Enables a router to automatically select the IP address to be used for ELMI address registration.
frame-relay address registration ip	Configures the IP address to be used for ELMI address registration.
frame-relay qos-autosense	Enables ELMI on a Cisco router.

frame-relay bc

To specify the incoming or outgoing committed burst size (Bc) for a Frame Relay virtual circuit, use the **frame-relay bc** map-class configuration command. To reset the committed burst size to the default, use the **no** form of this command.

frame-relay bc {**in** | **out**} *bits*

no frame-relay bc {**in** | **out**} *bits*

Syntax Description

in | **out**	Incoming or outgoing; if neither is specified, both in and out values are set.
bits	Committed burst size, in bits.

Defaults

7000 bits

Command Modes

Map-class configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

The Frame Relay committed burst size is specified within a map class to request a certain burst rate for the circuit. Although it is specified in bits, an implicit time factor is the sampling interval *Tc* on the switch, which is defined as the burst size divided by the committed information rate (CIR).

Examples

In the following example, the serial interface already has a basic configuration, and a map group called "bermuda" has already been defined. The example shows a map-list configuration that defines the source and destination addresses for bermuda, provides IP and IPX addresses, and ties the map list definition to the map class called "jamaica". Then traffic-shaping parameters are defined for the map class.

```
map-list bermuda local-addr X121 31383040703500 dest-addr X121 31383040709000
 ip 172.21.177.26 class jamaica ietf
 ipx 123.0000.0c07.d530 class jamaica ietf

map-class frame-relay jamaica
 frame-relay cir in 2000000
 frame-relay mincir in 1000000
 frame-relay cir out 15000
 frame-relay mincir out 10000
 frame-relay bc in 15000
 frame-relay bc out 9600
 frame-relay be in 10000
 frame-relay be out 10000
 frame-relay idle-timer 30
```

Related Commands

Command	Description
frame-relay be	Sets the incoming or outgoing excess burst size (Be) for a Frame Relay VC.
frame-relay cir	Specifies the incoming or outgoing CIR for a Frame Relay VC.

frame-relay be

To set the incoming or outgoing excess burst size (Be) for a Frame Relay virtual circuit, use the **frame-relay be** map-class configuration command. To reset the excess burst size to the default, use the **no** form of this command.

frame-relay be {**in** | **out**} *bits*

no frame-relay be {**in** | **out**} *bits*

Syntax Description

in | **out**	Incoming or outgoing.
bits	Excess burst size, in bits.

Defaults

7000 bits

Command Modes

Map-class configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

The Frame Relay excess burst size is specified within a map class to request a certain burst rate for the circuit. Although it is specified in bits, an implicit time factor is the sampling interval *Tc* on the switch, which is defined as the burst size divided by the committed information rate (CIR).

Examples

In the following example, the serial interface already has a basic configuration, and a map group called "bermuda" has already been defined. The example shows a map-list configuration that defines the source and destination addresses for bermuda, provides IP and IPX addresses, and ties the map list definition to the map class called "jamaica". Then traffic-shaping parameters are defined for the map class.

```
map-list bermuda local-addr X121 31383040703500 dest-addr X121 31383040709000
 ip 172.21.177.26 class jamaica ietf
 ipx 123.0000.0c07.d530 class jamaica ietf

map-class frame-relay jamaica
 frame-relay cir in 2000000
 frame-relay mincir in 1000000
 frame-relay cir out 15000
 frame-relay mincir out 10000
 frame-relay bc in 15000
 frame-relay bc out 9600
 frame-relay be in 10000
 frame-relay be out 10000
 frame-relay idle-timer 30
```

Related Commands

Command	Description
frame-relay bc	Specifies the incoming or outgoing committed burst size (Bc) for a Frame Relay VC.
frame-relay cir	Specifies the incoming or outgoing CIR for a Frame Relay VC.

frame-relay becn-response-enable

This **frame-relay becn-response-enable** command has been replaced by the **frame-relay adaptive-shaping** command. See the description of the **frame-relay adaptive-shaping** command for more information.

frame-relay broadcast-queue

To create a special queue for a specified interface to hold broadcast traffic that has been replicated for transmission on multiple data-link connection identifiers (DLCIs), use the **frame-relay broadcast-queue** interface configuration command.

frame-relay broadcast-queue *size byte-rate packet-rate*

Syntax Description

size	Number of packets to hold in the broadcast queue.
byte-rate	Maximum number of bytes to be sent per second.
packet-rate	Maximum number of packets to be sent per second.

Defaults

size—64 packets

byte-rate—256000 bytes per second

packet-rate—36 packets per second

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

For purposes of the Frame Relay broadcast queue, *broadcast traffic* is defined as packets that have been replicated for transmission on multiple DLCIs. However, the broadcast traffic does not include the original routing packet or service access point (SAP) packet, which passes through the normal queue. Because of timing sensitivity, bridged broadcasts and spanning-tree packets are also sent through the normal queue. The Frame Relay broadcast queue is managed independently of the normal interface queue. It has its own buffers and a configurable service rate.

A broadcast queue is given a maximum transmission rate (throughput) limit measured in bytes per second and packets per second. The queue is serviced to ensure that only this maximum is provided. The broadcast queue has priority when transmitting at a rate below the configured maximum, and hence has a guaranteed minimum bandwidth allocation. The two transmission rate limits are intended to avoid flooding the interface with broadcasts. The actual limit in any second is the first rate limit that is reached.

Given the transmission rate restriction, additional buffering is required to store broadcast packets. The broadcast queue is configurable to store large numbers of broadcast packets.

The queue size should be set to avoid loss of broadcast routing update packets. The exact size will depend on the protocol being used and the number of packets required for each update. To be safe, set the queue size so that one complete routing update from each protocol and for each DLCI can be stored. As a general rule, start with 20 packets per DLCI. Typically, the byte rate should be less than both of the following:

- *N/4* times the minimum remote access rate (measured in *bytes* per second), where *N* is the number of DLCIs to which the broadcast must be replicated.
- 1/4 the local access rate (measured in *bytes* per second).

The packet rate is not critical if you set the byte rate conservatively. Set the packet rate at 250-byte packets.

Examples

The following example specifies a broadcast queue to hold 80 packets, to have a maximum byte transmission rate of 240,000 bytes per second, and to have a maximum packet transmission rate of 160 packets per second:

```
frame-relay broadcast-queue 80 240000 160
```

frame-relay cir

To specify the incoming or outgoing committed information rate (CIR) for a Frame Relay virtual circuit, use the **frame-relay cir** map-class configuration command. To reset the CIR to the default, use the **no** form of this command.

frame-relay cir {**in** | **out**} *bps*

no frame-relay cir {**in** | **out**} *bps*

Syntax Description

in | **out**	Incoming or outgoing.
bps	CIR in bits per second.

Defaults

56000 bits per second

Command Modes

Map-class configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Use this command to specify a CIR for an SVC. The specified CIR value is sent through the SETUP message to the switch, which then attempts to provision network resources to support this value.

Examples

The following example sets a higher committed information rate for incoming traffic than for outgoing traffic (which is going out on a slow WAN line):

```
frame-relay cir in 2000000
frame-relay cir out 9600
```

Related Commands

Command	Description
frame-relay bc	Specifies the incoming or outgoing committed burst size (Bc) for a Frame Relay VC.
frame-relay be	Sets the incoming or outgoing excess burst size (Be) for a Frame Relay VC.

frame-relay class

To associate a map class with an interface or subinterface, use the **frame-relay class** interface configuration command. To remove the association between the interface or subinterface and the named map class, use the **no** form of this command.

frame-relay class *name*

no frame-relay class *name*

Syntax Description

name	Name of the map class to associate with this interface or subinterface.

Defaults

No map class is defined.

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command can apply to interfaces or subinterfaces.

All relevant parameters defined in the *name* map class are inherited by each virtual circuit created on the interface or subinterface. For each virtual circuit, the precedence rules are as follows:

1. Use the map class associated with the virtual circuit if it exists.
2. If not, use the map class associated with the subinterface if the map class exists.
3. If not, use map class associated with interface if the map class exists.
4. If not, use the interface default parameters.

Examples

The following example associates the slow_vcs map class with the serial 0.1 subinterface and the slow_vcs map class is defined to have an outbound CIR value of 9600:

```
interface serial 0.1
 frame-relay class slow_vcs

map-class frame-relay slow_vcs
 frame-relay cir out 9600
```

If a virtual circuit exists on the serial 0.1 interface and is associated with some other map class, the parameter values of the second map class override those defined in the slow_vc map class for that virtual circuit.

Related Commands

Command	Description
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay congestion-management

To enable Frame Relay congestion management functions on all switched permanent virtual circuits (PVCs) on an interface, and to enter Frame Relay congestion management configuration mode, use the **frame-relay congestion-management** interface configuration command. To disable Frame Relay congestion management, use the **no** form of this command.

frame-relay congestion-management

no frame-relay congestion-management

Syntax Description

This command has no arguments or keywords.

Defaults

Frame Relay congestion management is not enabled on switched PVCs.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You must enable Frame Relay switching, using the **frame-relay switching** global command, before you can configure Frame Relay congestion management.

Frame Relay congestion management is supported only when the interface is configured with FIFO queueing, weighted fair queueing (WFQ), or PVC interface priority queueing (PIPQ).

Examples

In the following example, the **frame-relay congestion-management** command enables Frame Relay congestion management on serial interface 1. The command also enters Frame Relay congestion management configuration mode so that congestion threshold parameters can be configured.

```
interface serial1
 encapsulation frame-relay
 frame-relay intf-type dce
 frame-relay congestion-management
  threshold ecn be 0
  threshold ecn bc 20
  threshold de 40
```

Related Commands

Command	Description
frame-relay congestion threshold de	Configures the threshold at which DE-marked packets are discarded from the traffic-shaping queue of a switched PVC.
frame-relay congestion threshold ecn	Configures the threshold at which ECN bits are set on packets in the traffic-shaping queue of a switched PVC.
threshold de	Configures the threshold at which DE-marked packets are discarded from switched PVCs on the output interface.
threshold ecn	Configures the threshold at which ECN bits are set on packets in switched PVCs on the output interface.

frame-relay congestion threshold de

To configure the threshold at which discard-eligible (DE)-marked packets will be discarded from the traffic-shaping queue of a switched permanent virtual circuit (PVC), use the **frame-relay congestion threshold de** map-class configuration command. To reconfigure the threshold, use the **no** form of this command.

frame-relay congestion threshold de *percentage*

no frame-relay congestion threshold de *percentage*

Syntax Description

percentage	Threshold at which DE-marked packets will be discarded, specified as a percentage of the maximum queue size.

Defaults

100%

Command Modes

Map-class configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

The **frame-relay congestion threshold de** command applies only to default FIFO traffic-shaping queues.

You must enable Frame Relay switching, using the **frame-relay switching** global command, before Frame Relay congestion management parameters will be effective on switched PVCs.

Examples

The following example illustrates the configuration of the DE congestion threshold in the Frame Relay map class called perpvc_congestion:

```
map-class frame-relay perpvc_congestion
 frame-relay congestion threshold de 50
```

Related Commands

Command	Description
frame-relay congestion-management	Enables Frame Relay congestion management functions on all switched PVCs on an interface, and enters congestion management configuration mode.
frame-relay congestion threshold ecn	Configures the threshold at which ECN bits are set on packets in the traffic-shaping queue of a switched PVC.

Command	Description
threshold de	Configures the threshold at which DE-marked packets are discarded from switched PVCs on the output interface.
threshold ecn	Configures the threshold at which ECN bits are set on packets in switched PVCs on the output interface.

frame-relay congestion threshold ecn

To configure the threshold at which explicit congestion notice (ECN) bits will be set on packets in the traffic-shaping queue of a switched permanent virtual circuit (PVC), use the **frame-relay congestion threshold ecn** map-class configuration command. To reconfigure the threshold, use the **no** form of this command.

frame-relay congestion threshold ecn *percentage*

no frame-relay congestion threshold ecn *percentage*

Syntax Description

percentage	Threshold at which ECN bits will be set on packets, specified as a percentage of the maximum queue size.

Defaults

100%

Command Modes

Map-class configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

The **frame-relay congestion threshold ecn** command applies only to default FIFO traffic-shaping queues.

One ECN threshold applies to all traffic on a traffic-shaping queue. You cannot configure separate thresholds for committed and excess traffic.

You must enable Frame Relay switching, using the **frame-relay switching** global command, before the **frame-relay congestion threshold ecn** command will be effective on switched PVCs.

Examples

The following example illustrates the configuration of the ECN congestion threshold in the Frame Relay map class called perpvc_congestion:

```
map-class frame-relay perpvc_congestion
 frame-relay congestion threshold ecn 50
```

Related Commands

Command	Description
frame-relay congestion-management	Enables Frame Relay congestion management functions on all switched PVCs on an interface, and enters congestion management configuration mode.
frame-relay congestion threshold de	Configures the threshold at which DE-marked packets are discarded from the traffic-shaping queue of a switched PVC.

Command	Description
threshold de	Configures the threshold at which DE-marked packets are discarded from switched PVCs on the output interface.
threshold ecn	Configures the threshold at which ECN bits are set on packets in switched PVCs on the output interface.

frame-relay custom-queue-list

To specify a custom queue to be used for the virtual circuit queueing associated with a specified map class, use the **frame-relay custom-queue-list** map-class configuration command. To remove the specified queueing from the virtual circuit and cause it to revert to the default first-come, first-served queueing, use the **no** form of this command.

frame-relay custom-queue-list *list-number*

no frame-relay custom-queue-list *list-number*

Syntax Description

list-number	Custom queue list number.

Defaults

If this command is not entered, the default queueing is first come, first served.

Command Modes

Map-class configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Definition of the custom queue takes place in the existing manner (through **queue-list** commands).

Only one form of queueing can be associated with a particular map class; subsequent definitions overwrite previous ones.

Examples

The following example configures a custom queue list for the fast_vcs map class:

```
map-class frame-relay fast_vcs
 frame-relay custom-queue-list 1

queue-list 1 queue 4 byte-count 100
```

Related Commands

Command	Description
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay de-group

To specify the discard eligibility (DE) group number to be used for a specified data-link connection identifier (DLCI), use the **frame-relay de-group** interface configuration command. To disable a previously defined group number assigned to a specified DLCI, use the **no** form of the command with the relevant keyword and arguments.

frame-relay de-group *group-number dlci*

no frame-relay de-group [*group-number*] [*dlci*]

Syntax Description

group-number	DE group number to apply to the specified DLCI number, between 1 and 10.
dlci	DLCI number.

Defaults

No DE group is defined.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

To disable all previously defined group numbers, use the **no** form of this command with no arguments.

This command requires that Frame Relay be enabled.

Frame Relay DE group functionality works on process-switched packets only.

The DE bit is not set or recognized by the Frame Relay switching code, but must be recognized and interpreted by the Frame Relay network.

Examples

The following example specifies that group number 3 will be used for DLCI 170:

```
frame-relay de-group 3 170
```

Related Commands

Command	Description
frame-relay de-list	Defines a DE list specifying the packets that have the DE bit set and thus are eligible for discarding during congestion on the Frame Relay switch.

frame-relay de-list

To define a discard eligibility (DE) list specifying the packets that have the DE bit set and thus are eligible for discarding when congestion is experienced on the Frame Relay switch, use the **frame-relay de-list** global configuration command. To delete a portion of a previously defined DE list, use the **no** form of this command.

frame-relay de-list *list-number* {**protocol** *protocol* | **interface** *type number*} *characteristic*

no frame-relay de-list *list-number* {**protocol** *protocol* | **interface** *type number*} *characteristic*

Syntax Description

list-number	Number of the DE list.
protocol *protocol*	One of the following keywords corresponding to a supported protocol or device: **arp**—Address Resolution Protocol **apollo**—Apollo Domain **appletalk**—AppleTalk **bridge**—bridging device **clns**—ISO Connectionless Network Service **clns_es**—CLNS end systems **clns_is**—CLNS intermediate systems. **compressedtcp**—Compressed Transmission Control Protocol (TCP) **decnet**—DECnet **decnet_node**—DECnet end node **decnet_router-L1**—DECnet Level 1 (intra-area) router **decnet_router-L2**—DECnet Level 2 (interarea) router **ip**—Internet Protocol **ipx**—Novell Internet Packet Exchange Protocol **vines**—Banyan VINES **xns**—Xerox Network Systems
interface *type*	One of the following interface types: **serial**, **null**, or **ethernet**.
number	Interface number.
characteristic	One of the following: **fragments**—Fragmented IP packets **gt** *bytes*—Sets the DE bit for packets larger than the specified number of bytes (including the 4 byte Frame Relay Encapsulation) **list** *access-list-number*—Previously defined access list number **lt** *bytes*—Sets the DE bit for packets smaller than the specified number of bytes (including the 4 byte Frame Relay Encapsulation) **tcp** *port*—TCP packets to or from a specified port **udp** *port*—User Datagram Protocol (UDP) packets to or from a specified port

Defaults

Discard eligibility is not defined.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

To remove an entire DE list, use the **no** form of this command with no options and arguments.

This prioritizing feature requires that the Frame Relay network be able to interpret the DE bit as indicating which packets can be dropped first in case of congestion, or which packets are less time sensitive, or both.

When you calculate packet size, include the data packet size, the ICMP header, the IP header, and the Frame Relay encapsulation bytes. For example, count 92 bytes of data, 8 bytes for the ICMP header, 20 bytes for the IP header, and 4 bytes for the Frame Relay encapsulation, which equals 124 bytes.

Examples

The following example specifies that IP packets larger than 512 bytes (including the 4-byte Frame Relay Encapsulation) will have the DE bit set:

```
frame-relay de-list 1 protocol ip gt 512
```

frame-relay end-to-end keepalive error-threshold

To modify the keepalive error threshold value, use the **frame-relay end-to-end keepalive error-threshold** map-class configuration command. To reset the error threshold value to its default, use the **no** form of this command.

frame-relay end-to-end keepalive error-threshold {**send** | **receive**} *count*

no frame-relay end-to-end keepalive error-threshold {**send** | **receive**}

Syntax Description

send	Number of send-side errors in the event window before keepalive status goes from up to down.
receive	Number of receive-side errors in the event window before keepalive status goes from up to down.
count	Number of errors required. The maximum value is 32.

Defaults

The default value for both the send and receive error threshold is 2.

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

The send-side value can only be configured in bidirectional and request modes. The receive-side value can only be configured in bidirectional and reply modes. See the **frame-relay end-to-end keepalive mode** command. When you configure the error threshold, you will also want to configure the event window. See the **frame-relay end-to-end keepalive event-window** command.

Examples

The following example shows increasing the receive-side error threshold to 4 and changing the event window to 7:

```
map-class frame-relay olga
  frame-relay end-to-end keepalive reply
  frame-relay end-to-end keepalive error-threshold receive 4
  frame-relay end-to-end keepalive event-window receive 7
```

Related Commands

Command	Description
frame-relay end-to-end keepalive event-window	Modifies the keepalive event window value.
frame-relay end-to-end keepalive mode	Enables Frame Relay end-to-end keepalives.
frame-relay end-to-end keepalive success-events	Modifies the keepalive success events value.
frame-relay end-to-end keepalive timer	Modifies the keepalive timer.

Command	Description
map-class frame-relay	Specifies a map class to define QoS values for an SVC.
show frame-relay end-to-end keepalive	Displays statistics about Frame Relay end-to-end keepalive.

frame-relay end-to-end keepalive event-window

To modify the keepalive event window value, use the **frame-relay end-to-end keepalive event-window** map-class configuration command. To reset the default event window size, use the **no** form of this command.

frame-relay end-to-end keepalive event-window {**send** | **receive**} *size*

no frame-relay end-to-end keepalive event-window {**send** | **receive**}

Syntax Description

send	The size of the send-side event window.
receive	The size of the receive-side event window.
size	Number of events in the event window. The maximum value is 32.

Defaults

The default value for both the send and receive event windows is 3.

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

The send-side value can only be configured in bidirectional and request modes. The receive-side value can only be configured in bidirectional and reply modes. See the **frame-relay end-to-end keepalive mode** command. When you configure the event window, you will also want to configure the error-threshold. See the **frame-relay end-to-end keepalive error-threshold** command.

Examples

The following example shows increasing the receive-side error threshold to 4 and changing the event window to 7:

```
map-class frame-relay olga
  frame-relay end-to-end keepalive reply
  frame-relay end-to-end keepalive error-threshold receive 4
  frame-relay end-to-end keepalive event-window receive 7
```

Related Commands

Command	Description
frame-relay end-to-end keepalive error-threshold	Modifies the keepalive error threshold value.
frame-relay end-to-end keepalive mode	Enables Frame Relay end-to-end keepalives.
frame-relay end-to-end keepalive success-events	Modifies the keepalive success events value.
frame-relay end-to-end keepalive timer	Modifies the keepalive timer.

Command	Description
map-class frame-relay	Specifies a map class to define QoS values for an SVC.
show frame-relay end-to-end keepalive	Displays statistics about Frame Relay end-to-end keepalive.

frame-relay end-to-end keepalive mode

To enable Frame Relay end-to-end keepalives, use the **frame-relay end-to-end keepalive mode** map-class configuration command. To disable Frame Relay end-to-end keepalives, use the **no** form of this command.

frame-relay end-to-end keepalive mode {**bidirectional** | **request** | **reply** | **passive-reply**}

no frame-relay end-to-end keepalive mode

Syntax Description

bidirectional	Enables bidirectional mode.
request	Enables request mode.
reply	Enables reply mode.
passive-reply	Enables passive reply mode.

Defaults

When a Frame Relay end-to-end keepalive mode is enabled, default values depend on which mode is selected. For the meaning of the parameters, see the **frame-relay end-to-end keepalive timer**, **frame-relay end-to-end keepalive event-window**, **frame-relay end-to-end keepalive error-threshold**, and **frame-relay end-to-end keepalive success-events** commands.

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

To enable Frame Relay end-to-end keepalives, Frame Relay must be configured. In addition, a map-class must be associated and a DLCI assigned to an interface, subinterface, VC or PVC. For more information on associating a frame-relay class with an interface, subinterface, VC or PVC, see the **frame-relay class** command. For more information on assigning a DLCI to an interface, subinterface, VC or PVC, see the **frame-relay interface-dlci** command.

In bidirectional mode, both ends of a virtual circuit (VC) send keepalive requests and respond to keepalive requests. If one end of the VC is configured in the bidirectional mode, the other end must also be configured in the bidirectional mode.

In request mode, the router sends keepalive requests and expects replies from the other end of the VC. If one end of a VC is configured in the request mode, the other end must be configured in the reply or passive-reply mode.

In reply mode, the router does not send keepalive requests, but waits for keepalive requests from the other end of the VC and replies to them. If no keepalive request has arrived within the timer interval, the router times out and increments the error counter by 1. If one end of a VC is configured in the reply mode, the other end must be configured in the request mode.

In passive-reply mode, the router does not send keepalive requests, but waits for keepalive requests from the other end of the VC and replies to them. No timer is set when in this mode, and the error counter is not incremented. If one end of a VC is configured in the passive-reply mode, the other end must be configured in the request mode.

Table 23 displays parameter values for send- and receive-sides in bidirectional mode

Table 23 Bidirectional Mode

Parameter	Send-Side	Receive-Side
Timer	10 seconds	15 seconds
Event window	3	3
Error threshold	2	2
Success events	2	2

Table 24 displays parameter values for send- and receive-sides in request mode.

Table 24 Request Mode

Parameter	Send-Side	Receive-Side
Timer	10 seconds	no value set
Event window	3	no value set
Error threshold	2	no value set
Success events	2	no value set

Table 25 displays parameter values for send- and receive-sides in reply mode.

Table 25 Reply Mode

Parameter	Send-Side	Receive-Side
Timer	no value set	15 seconds
Event window	no value set	3
Error threshold	no value set	2
Success events	no value set	2

Passive-Reply Mode

In passive-reply mode, no values are set.

Examples

The following example configures one end of a VC so that a DLCI is assigned to a Frame Relay serial interface, a map class is associated with the interface, and Frame Relay end-to-end keepalive is configured in bidirectional mode using default values:

```
router1(config) interface serial 0/0.1 point-to-point
router1(config-if) ip address 10.1.1.1 255.255.255.0
router1(config-if) frame-relay interface-dlci 16
router1(config-if) frame-relay class vcgrp1
router1(config-if) exit
!
```

```
router1(config)# map-class frame-relay vcgrp1
router1(config-map-class)# frame-relay end-to-end keepalive mode bidirectional
```

The following example configures one end of a VC to reply to keepalive requests and to increment its error counter if no keepalive requests are received 30 seconds after the latest request:

```
router1(config)# map-class frame-relay oro34
router1(config-map-class)# frame-relay end-to-end keepalive reply
router1(config-map-class)# frame-relay end-to-end keepalive timer receive 30
```

Related Commands

Command	Description
frame-relay end-to-end keepalive error-threshold	Modifies the keepalive error threshold value.
frame-relay end-to-end keepalive event-window	Modifies the keepalive event window value.
frame-relay end-to-end keepalive success-events	Modifies the keepalive success events value.
frame-relay end-to-end keepalive timer	Modifies the keepalive timer.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.
show frame-relay end-to-end keepalive	Displays statistics about Frame Relay end-to-end keepalive.

frame-relay end-to-end keepalive success-events

To modify the keepalive success events value, use the **frame-relay end-to-end keepalive success-events** map-class configuration command. To reset the success events value to its default, use the **no** form of this command.

frame-relay end-to-end keepalive success-events {**send** | **receive**} *count*

no frame-relay end-to-end keepalive success-events {**send** | **receive**}

Syntax Description

send	The number of consecutive send-side success events required to change the keepalive state from down to up.
receive	The number of consecutive receive-side success events required to change the keepalive state from down to up.
count	Number of consecutive success events required. The maximum value is 32.

Defaults

The default value for both the send and receive success events is 2.

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

The send-side value can only be configured in bidirectional and request modes. The receive-side value can only be configured in the bidirectional and reply modes. See the **frame-relay end-to-end keepalive mode** command.

If the success events value is set to a low value at the same time that a low value is set for the error threshold value of the **frame-relay end-to-end keepalive error-threshold** command, the keepalive state of the VC may flap from state to state.

Examples

The following example shows how to increase the success events value:

```
map-class frame-relay vcgrp4
 frame-relay end-to-end keepalive request
 frame-relay end-to-end keepalive success-events send 4
```

Related Commands

Command	Description
frame-relay end-to-end keepalive error-threshold	Modifies the keepalive error threshold value.
frame-relay end-to-end keepalive event-window	Modifies the keepalive event window value.
frame-relay end-to-end keepalive mode	Enables Frame Relay end-to-end keepalives.

Command	Description
frame-relay end-to-end keepalive timer	Modifies the keepalive timer.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.
show frame-relay end-to-end keepalive	Displays statistics about Frame Relay end-to-end keepalive.

frame-relay end-to-end keepalive timer

To modify the keepalive timer value, use the **frame-relay end-to-end keepalive timer** map-class configuration command. To reset the timer value to its default, use the **no** form of this command.

frame-relay end-to-end keepalive timer {**send** | **receive**} *interval*

no frame-relay end-to-end keepalive timer {**send** | **receive**}

Syntax Description

send	How frequently to send a keepalive request.
receive	How long before the receive-side error counter is incremented if no request is received.
interval	Time in seconds for the timer to expire.

Defaults

The default value for the send timer is 10 seconds. The default value for the receive timer is 15 seconds.

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

The send-side value can only be configured in bidirectional and request modes. The receive-side value can only be configured in the bidirectional and reply modes. See the **frame-relay end-to-end keepalive mode** command.

The send-side timer expires if a reply has not been received *interval* seconds after a request is sent. The receive-side timer expires if a request has not been received *interval* seconds after the previous request.

Examples

The following example shows how to set up one end of a virtual circuit (VC) to send a keepalive request every 15 seconds and increment the error counter if more than 22 seconds elapse between receiving keepalive responses:

```
map-class frame-relay vcgrp1
  frame-relay end-to-end keepalive bidirectional
  frame-relay end-to-end keepalive timer send 15
  frame-relay end-to-end keepalive timer receive 22
```

Related Commands

Command	Description
frame-relay end-to-end keepalive error-threshold	Modifies the keepalive error threshold value.
frame-relay end-to-end keepalive event-window	Modifies the keepalive event window value.
frame-relay end-to-end keepalive mode	Enables Frame Relay end-to-end keepalives.
frame-relay end-to-end keepalive success-events	Modifies the keepalive success events value.

Command	Description
map-class frame-relay	Specifies a map class to define QoS values for an SVC.
show frame-relay end-to-end keepalive	Displays statistics about Frame Relay end-to-end keepalive.

frame-relay fair-queue

To enable weighted fair queueing for one or more Frame Relay permanent virtual circuits (PVCs), use the **frame-relay fair-queue** map-class configuration command in conjunction with the **map-class frame-relay** command. To disable weighted fair queueing for a Frame Relay map class, use the **no** form of this command.

frame-relay fair-queue [*congestive_discard_threshold* [*number_dynamic_conversation_queues* [*number_reservable_conversation_queues* [*max_buffer_size_for_fair_queues*]]]]

no frame-relay fair-queue [*congestive_discard_threshold* [*number_dynamic_conversation_queues* [*number_reservable_conversation_queues* [*max_buffer_size_for_fair_queues*]]]]

Syntax Description

congestive_discard_threshold	(Optional) Specifies the number of messages allowed in each queue. The range is from 1 to 4096 messages; the default is 64.
number_dynamic_conversation_ queues	(Optional) Specifies the number of dynamic queues to be used for best-effort conversations—normal conversations not requiring any special network services. Valid values are 16, 32, 64, 128, 256, 512, 1024, 2048, and 4096; the default is 16.
number_reservable_conversation_queues	(Optional) Specifies the number of reserved queues to be used for carrying voice traffic. The range is from 0 to 100; the default is 0. (The command-line interface (CLI) will not allow a value of less than 2 if fragmentation is configured for the Frame Relay map-class.)
max_buffer_size_for_fair_queues	(Optional) Specifies the maximum buffer size in bytes for all of the fair queues. The range is from 0 to 4096 bytes; the default is 600.

Defaults

Disabled

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(3)XG	This command was introduced.
12.0(4)T	This command was implemented in Cisco IOS Release 12.0 T.

Usage Guidelines

To use this command, you must first associate a Frame Relay map class with a specific data-link connection identifier (DLCI), and then enter map-class configuration mode and enable or disable weighted fair queueing for that map class.

When Frame Relay fragmentation is enabled, weighted fair queueing is the only queueing strategy allowed.

If this command is entered without any accompanying numbers, the default values for each of the four parameters will be set. If you desire to alter only the value of the first parameter (*congestive_discard_threshold*), you only need to enter the desired value for that parameter. If you desire to alter only the value of the second, third, or fourth parameters, you must enter values for the preceding parameters as well as for the parameter you wish to change.

Examples

The following example shows how to enable weighted fair queueing and set the default parameter values for the "vofr" Frame Relay map class on a Cisco 2600 series, 3600 series, or 7200 series router or on a Cisco MC3810:

```
interface serial 1/1
 frame-relay interface-dlci 100
  class vofr
  exit
map-class frame-relay vofr
 frame-relay fair-queue
```

The following example shows how to enable weighted fair queueing and set the *congestive_discard_threshold* parameter to a value other than the default value for the "vofr" Frame Relay map class on a Cisco 2600 series, 3600 series, or 7200 series router or on an MC3810 concentrator:

```
interface serial 1/1
 frame-relay interface-dlci 100
  class vofr
  exit
map-class frame-relay vofr
 frame-relay fair-queue 255
```

The following example shows how to enable weighted fair queueing and set the*number_reservable_conversation_queues* to a value of 25 for the "vofr" Frame Relay map class on a Cisco 2600 series, 3600 series, or 7200 series router or on a Cisco MC3810:

```
interface serial 1/1
 frame-relay interface-dlci 100
  class vofr
  exit
map-class frame-relay vofr
 frame-relay fair-queue 64 256 25
```

Related Commands

Command	Description
class (virtual circuit)	Associates a map class with a specified DLCI.
frame-relay fragment	Enables fragmentation for a Frame Relay map class.
frame-relay interface-dlci	Assigns a DLCI to a specified Frame Relay subinterface on the router or access server.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay fragment

To enable fragmentation of Frame Relay frames for a Frame Relay map class, use the **frame-relay fragment** map-class configuration command. To disable Frame Relay fragmentation, use the **no** form of this command.

frame-relay fragment *fragment_size* [**switched**]

no frame-relay fragment

Syntax Description

fragment_size	Specifies the number of payload bytes from the original Frame Relay frame that will go into each fragment. This number excludes the Frame Relay header of the original frame. All the fragments of a Frame Relay frame except the last will have a payload size equal to *fragment_size*; the last fragment will have a payload less than or equal to *fragment_size*. Valid values are from 16 to 1600 bytes; the default is 53.
switched	(Optional) Specifies that fragmentation will be enabled on a switched permanent virtual circuit (PVC).

Defaults

Fragmentation is disabled.

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(3)XG	This command was introduced.
12.0(4)T	This command was implemented in Cisco IOS Release 12.0 T.
12.1(2)T	This command was modified to extend end-to-end FRF.12 fragmentation support to additional platforms and to switched Frame Relay PVCs.
12.1(2)E	This command was introduced for Cisco 7500 series routers with a Versatile Interface Processor.
12.1(5)T	This command was introduced for Cisco 7500 series routers with a Versatile Interface Processor running Cisco IOS Release 12.1(5)T.

Usage Guidelines

You should enable fragmentation for low-speed links (meaning those operating at less than 768 kbps).

Frame Relay fragmentation is enabled on a per-PVC basis. Before enabling Frame Relay fragmentation, you must first associate a Frame Relay map class with a specific data-link connection identifier (DLCI), and then enter map-class configuration mode and enable or disable fragmentation for that map class. In addition, you must enable Frame Relay traffic shaping on the interface in order for fragmentation to work.

Selecting a Fragmentation Format

Frame Relay frames are fragmented using one of the following formats, depending on how the PVC is configured:

- Pure end-to-end FRF.12 format
- FRF.11 Annex C format
- Cisco proprietary format

Only pure end-to-end FRF.12 fragmentation can be configured on switched PVCs.

Cisco recommends pure end-to-end FRF.12 fragmentation on PVCs that are carrying VoIP packets and on PVCs that are sharing the link with other PVCs carrying Voice over Frame Relay (VoFR) traffic.

In pure end-to-end FRF.12 fragmentation, Frame Relay frames having a payload less than the fragment size configured for that PVC are transmitted without the fragmentation header.

FRF.11 Annex C and Cisco proprietary fragmentation are used when VoFR frames are transmitted on a PVC. When fragmentation is enabled on a PVC, FRF.11 Annex C format is implemented when **vofr** is configured on that PVC; Cisco proprietary format is implemented when **vofr cisco** is configured.

In FRF.11 Annex C and Cisco proprietary fragmentation, VoFR frames are never fragmented, and all data packets (including VoIP packets) contain the fragmentation header regardless of the payload size.

Selecting a Fragment Size

You should set the fragment size based on the lowest port speed between the routers. For example, for a hub-and-spoke Frame Relay topology where the hub has a T1 speed and the remote routers have 64 kbps port speeds, the fragmentation size must be set for the 64 kbps speed on both routers. Any other PVCs that share the same physical interface must use the same fragmentation size used by the voice PVC.

With pure end-to-end FRF.12 fragmentation, you should select a fragment size that is larger than the voice packet size.

Table 26 shows the recommended fragmentation sizes for a serialization delay of 10 ms.

Table 26 Recommended Fragment Size for 10 ms Serialization Delay

Lowest Link Speed in Path	Recommended Fragment Size
56 kbps	70 bytes
64 kbps	80 bytes
128 kbps	160 bytes
256 kbps	320 bytes
512 kbps	640 bytes
768 kbps	1000 bytes
1536 kbps	1600 bytes

Examples

FRF.12 Fragmentation on a Switched PVC Example

The following example shows how to configure pure end-to-end FRF.12 fragmentation in the map class "data." The map class is associated with switched PVC 20 on serial interface 3/3.

```
Router(config)# frame-relay switching
!
Router(config)# interface Serial3/2
Router(config-if)# encapsulation frame-relay
```

```
Router(config-if)# frame-relay intf-type dce
!
Router(config)# interface Serial3/3
Router(config-if)# encapsulation frame-relay
Router(config-if)# frame-relay traffic-shaping
Router(config-if)# frame-relay interface-dlci 20 switched
Router(config-fr-dlci)# class data
Router(config-if)# frame-relay intf-type dce
!
Router(config)# map-class frame-relay data
Router(config-map-class)# frame-relay fragment 80 switched
Router(config-map-class)# frame-relay cir 64000
Router(config-map-class)# frame-relay bc 640
!
Router(config)# connect data Serial3/2 16 Serial3/3 20
```

End-to-End FRF.12 Fragmentation Examples

The following example shows how to enable pure end-to-end FRF.12 fragmentation for the "frag" map class. The fragment payload size is set to 40 bytes. Frame Relay traffic shaping is required on the PVC; the only queueing type supported on the PVC when fragmentation is configured is weighted fair queueing (WFQ).

```
Router(config)# interface serial 1/0/0
Router(config-if)# frame-relay traffic-shaping
Router(config-if)# frame-relay interface-dlci 100
Router(config-fr-dlci)# class frag
Router(config-fr-dlci)# exit

Router(config)# map-class frame-relay frag
Router(config-map-class)# frame-relay cir 128000
Router(config-map-class)# frame-relay bc 1280
Router(config-map-class)# frame-relay fragment 160
Router(config-map-class)# frame-relay fair-queue
```

The following example is for the same configuration on a VIP-enabled Cisco 7500 series router:

```
Router(config)# class-map frf
Router(config-cmap)# match protocol vofr
Router(config-cmap)# exit
Router(config)# policy-map llq
Router(config-pmap)# class frf
Router(config-pmap-c)# priority 2000
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# policy-map llq-shape
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 1000 128000
Router(config-pmap-c)# service-policy llq
Router(config-pmap-c)# exit
Router(config-pmap)# exit

Router(config)# interface serial 1/0/0.1
Router(config-if)# frame-relay interface-dlci 100
Router(config-fr-dlci)# class frag
Router(config-fr-dlci)# exit

Router(config)# map-class frame-relay frag
Router(config-map-class)# frame-relay fragment 40
Router(config-map-class)# service-policy llq-shape
Router(config-map-class)#
```

FRF.11 Annex C Fragmentation Configuration Examples

The following example shows how to enable FRF.11 Annex C fragmentation for data on a Cisco MC3810 PVC configured for VoFR. Note that fragmentation must be configured if a VoFR PVC is to carry data. The fragment payload size is set to 40 bytes. Frame Relay traffic shaping is required on the PVC; the only queueing type supported on the PVC when fragmentation is configured is weighted fair queueing (WFQ).

```
Router(config)# interface serial 1/1
Router(config-if)# frame-relay traffic-shaping
Router(config-if)# frame-relay interface-dlci 101
Router(config-fr-dlci)# vofr
Router(config-fr-dlci)# class frag
Router(config-fr-dlci)# exit

Router(config)# map-class frame-relay frag
Router(config-map-class)# frame-relay cir 128000
Router(config-map-class)# frame-relay bc 1280
Router(config-map-class)# frame-relay fragment 160
Router(config-map-class)# frame-relay fair-queue
Router(config-map-class)#
```

The following example is for the same configuration on a VIP-enabled Cisco 7500 series router:

```
Router(config)# class-map frf
Router(config-cmap)# match protocol vofr
Router(config-cmap)# exit
Router(config)# policy-map llq
Router(config-pmap)# class frf
Router(config-pmap-c)# priority 2000
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# policy-map llq-shape
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 1000 128000
Router(config-pmap-c)# service-policy llq
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface serial 1/1/0.1
Router(config-if)# frame-relay interface-dlci 101
Router(config-fr-dlci)# class frag
Router(config-fr-dlci)# exit

Router(config)# map-class frame-relay frag
Router(config-map-class)# frame-relay fragment 40
Router(config-map-class)# service-policy llq-shape
Router(config-map-class)#
```

Cisco-Proprietary Fragmentation Examples

The following example shows how to enable Cisco-proprietary Frame Relay fragmentation for the "frag" Frame Relay map class on a Cisco 2600 series, 3600 series, or 7200 series router, starting from global configuration mode. The fragment payload size is set to 40 bytes. Frame Relay traffic shaping is required on the PVC; the only queueing type supported on the PVC when fragmentation is configured is weighted fair queueing (WFQ).

```
Router(config)# interface serial 2/0/0
Router(config-if)# frame-relay traffic-shaping
Router(config-if)# frame-relay interface-dlci 102
Router(config-fr-dlci)# vofr cisco
Router(config-fr-dlci)# class frag
Router(config-fr-dlci)# exit
```

```
Router(config)# map-class frame-relay frag
Router(config-map-class)# frame-relay cir 128000
Router(config-map-class)# frame-relay bc 1280
Router(config-map-class)# frame-relay fragment 160
Router(config-map-class)# frame-relay fair-queue
```

The following example is for the same configuration on a VIP-enabled Cisco 7500 series router:

```
Router(config)# class-map frf
Router(config-cmap)# match protocol vofr
Router(config-cmap)# exit
Router(config)# policy-map llq
Router(config-pmap)# class frf
Router(config-pmap-c)# priority 2000
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# policy-map llq-shape
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 1000 128000
Router(config-pmap-c)# service-policy llq
Router(config-pmap-c)# exit
Router(config-pmap)# exit

Router(config)# interface serial 2/0/0.1
Router(config-if)# frame-relay interface-dlci 102
Router(config-fr-dlci)# class frag
Router(config-fr-dlci)# exit

Router(config)# map-class frame-relay frag
Router(config-map-class)# frame-relay fragment 40
Router(config-map-class)# service-policy llq-shape
```

Related Commands

Command	Description
class (virtual circuit)	Associates a map class with a specified DLCI.
debug frame-relay fragment	Displays information related to Frame Relay fragmentation on a PVC.
frame-relay fair-queue	Enables weighted fair queueing for one or more Frame Relay PVCs.
frame-relay interface-dlci	Assigns a DLCI to a specified Frame Relay subinterface on the router or access server.
frame-relay traffic-shaping	Enables traffic shaping and per-virtual circuit queueing for all PVCs and SVCs on a Frame Relay interface.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay holdq

To configure the maximum size of a traffic-shaping queue on a switched PVC, use the **frame-relay holdq** map-class configuration command. To reconfigure the size of the queue, use the **no** form of this command.

frame-relay holdq *queue-size*

no frame-relay holdq *queue-size*

Syntax Description

queue-size	Size of the traffic-shaping queue, as specified in maximum number of packets. The range is from 1 to 512.

Defaults

40 packets

Command Modes

Map-class configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You must enable Frame Relay traffic shaping, using the **frame-relay traffic-shaping** interface command, before **frame-relay holdq** and other traffic-shaping map-class commands will be effective.

You must enable Frame Relay switching, using the **frame-relay switching** global command, before the **frame-relay holdq** command will be effective on switched PVCs.

The **frame-relay holdq** command can be applied to switched PVCs that use FIFO default queueing.

Examples

The following example illustrates the configuration of the maximum size of the traffic-shaping queue on a switched PVC. The queue size is configured in a map class called perpvc_congestion:

```
map-class frame-relay perpvc_congestion
 frame-relay holdq 100
```

Related Commands

Command	Description
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
frame-relay traffic-shaping	Enables both traffic shaping and per-PVC queueing for all PVCs and SVCs on a Frame Relay interface.

frame-relay idle-timer

To specify the idle timeout interval for a switched virtual circuit (SVC), use the **frame-relay idle-timer** map-class configuration command. To reset the idle timer to its default interval, use the **no** form of this command.

frame-relay idle-timer [**in** | **out**] *seconds*

no frame-relay idle-timer *seconds*

Syntax Description

in	(Optional) timeout interval applies to inbound packet activity.
out	(Optional) timeout interval applies to outbound packet activity.
seconds	Time interval, in seconds, with no frames exchanged on a switched virtual circuit, after which the SVC is released.

Defaults

120 seconds

Command Modes

Map-class configuration

Command History

Release	Modification
11.2	This command was introduced.
11.3	The following keywords were added: • **in** • **out**

Usage Guidelines

The **frame-relay idle-timer** command applies to switched virtual circuits that are associated with the map class where the idle-timer is defined.

The idle timer must be tuned for each application. Routing protocols such as Routing Information Protocol (RIP) might keep the SVC up indefinitely because updates go out every 10 seconds.

Beginning in Release 11.3, if **in** and **out** are not specified in the command, the timeout interval applies to both timers. In Release 11.2, the timeout interval applies to the outbound timer.

Examples

The following example defines the traffic rate and idle timer for the fast_vcs map class and applies those values to DLCI 100, which is associated with that map class:

```
interface serial 0
 frame-relay interface-dlci 100
  class fast_vc

map-class frame-relay fast_vcs
 frame-relay traffic-rate 56000 128000
 frame-relay idle-timer 30
```

Related Commands

Command	Description
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay interface-dlci

To assign a data-link connection identifier (DLCI) to a specified Frame Relay subinterface on the router or access server, or to assign a specific permanent virtual circuit (PVC) to a DLCI, or to apply a virtual template configuration for a PPP session, use the **frame-relay interface-dlci** interface configuration command. To remove this assignment, use the **no** form of this command.

frame-relay interface-dlci *dlci* [**ietf** | **cisco**] [**voice-cir** *cir*] [**ppp** *virtual-template-name*]

no frame-relay interface-dlci *dlci* [**ietf** | **cisco**] [**voice-cir** *cir*] [**ppp** *virtual-template-name*]

BOOTP server only

frame-relay interface-dlci *dlci* [**protocol ip** *ip-address*]

Syntax Description

dlci	DLCI number to be used on the specified subinterface.
ietf | **cisco**	(Optional) Encapsulation type: Internet Engineering Task Force (IETF) Frame Relay encapsulation or Cisco Frame Relay encapsulation.
voice-cir *cir*	(Optional; supported on the Cisco MC3810 only.) Specifies the upper limit on the voice bandwidth that may be reserved for this DLCI. The default is the committed information rate (CIR) configured for the Frame Relay map class. For more information, see the "Usage Guidelines" section.
ppp	(Optional) Enables the circuit to use the PPP in Frame Relay encapsulation.
virtual-template-name	(Optional) Specifies which virtual template interface to apply the PPP connection to.
protocol ip *ip-address*	(Optional) Indicates the IP address of the main interface of a new router or access server onto which a router configuration file is to be automatically installed over a Frame Relay network. Use this option only when this device will act as the BOOTP server for automatic installation over Frame Relay.

Defaults

No DLCI is assigned.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3(1)MA	The **voice-encap** option was added for the Cisco MC3810.
12.0(1)T	The **ppp** keyword and *virtual-template-name* argument were introduced.
12.0(2)T	The **voice-cir** option was added for the Cisco MC3810.
12.0(3)T	The keyword **x25 profile** was introduced.

Release	Modification
12.0(4)T	Usage guidelines for the Cisco MC3810 were added.
12.0(7)XK	The **voice-encap** keyword for the Cisco MC3810 was removed. This keyword is no longer supported.
12.1(2)T	The **voice-encap** keyword for the Cisco MC3810 was removed. This keyword is no longer supported.

Usage Guidelines

This command is typically used for subinterfaces; however, it can also be used on main interfaces. Using the **frame-relay interface-dlci** command on main interfaces will enable the use of routing protocols on interfaces that use Inverse ARP. The **frame-relay interface-dlci** command on a main interface is also valuable for assigning a specific class to a single PVC where special characteristics are desired. Subinterfaces are logical interfaces associated with a physical interface. You must specify the interface and subinterface before you can use this command to assign any DLCIs and any encapsulation or broadcast options. See the "Examples" section for the sequence of commands.

This command is required for all point-to-point subinterfaces; it is also required for multipoint subinterfaces for which dynamic address resolution is enabled. It is not required for multipoint subinterfaces configured with static address mappings.

Use the **protocol ip** *ip-address* option only when this router or access server will act as the BOOTP server for autoinstallation over Frame Relay.

By issuing the **frame-relay interface-dlci** interface configuration command, you enter Frame Relay DLCI interface configuration mode (see the first example below). This gives you the following command options, which must be used with the relevant class or X.25-profile names you previously assigned:

- **class** *name*—Assigns a mapclass to a DLCI.
- **default**—Sets a command to its defaults.
- **no** {**class** *name* | **x25-profile** *name*}—Cancels the relevant class or X.25 profile.
- **x25-profile** *name*—Assigns an X.25 profile to a DLCI. (Annex G).

A Frame Relay DLCI configured for Annex G can be thought of as a single logical X.25/LAPB interface. Therefore, any number of X.25 routes may be configured to route X.25 calls to that logical interface.

The **voice-cir** option on the Cisco MC3810 provides call admission control; it does not provide traffic shaping. A call setup will be refused if the unallocated bandwidth available at the time of the request is not at least equal to the value of the **voice-cir** option.

When configuring the **voice-cir** option on the Cisco MC3810 for Voice over Frame Relay, do not set the value of this option to be higher than the physical link speed. If Frame Relay traffic shaping is enabled for a PVC sharing voice and data, do not configure the **voice-cir** option to be higher than the value set with the **frame-relay mincir** command.

Note On the Cisco MC3810 only, the **voice-cir** option performs the same function as the **frame-relay voice bandwidth** map-class configuration command introduced in Cisco IOS Release 12.0(3)XG.

For more information about automatically installing router configuration files over a Frame Relay network, see the "Loading and Maintaining System Images" chapter in the *Cisco IOS Configuration Fundamentals Configuration Guide*.

Examples

The following example assigns DLCI 100 to serial subinterface 5.17:

```
! Enter interface configuration and begin assignments on interface serial 5
interface serial 5
! Enter subinterface configuration by assigning subinterface 17
interface serial 5.17
! Now assign a DLCI number to subinterface 5.17
frame-relay interface-dlci 100
```

The following example specifies DLCI 26 over subinterface serial 1.1 and assigns the characteristics under virtual-template 2 to this PPP connection:

```
Router(config)# interface serial1.1 point-to-point
Router(config-if)# frame-relay interface-dlci 26 ppp virtual-template2
```

The following example shows an Annex G connection being created by assigning the X.25 profile "NetworkNodeA" to the Frame Relay DLCI interface 20 on interface serial 1 (having enabled Frame Relay encapsulation on that interface):

```
Router(config)# interface serial1
Router(config-if)# encapsulation frame-relay
Router(config-if)# frame-relay interface-dlci 20
Router(config-fr-dlci)# x25-profile NetworkNodeA
```

The following example assigns DLCI 100 to serial subinterface 5.17:

```
Router(config)# interface serial 5
Router(config-if)# interface serial 5.17
Router(config-if)# frame-relay interface-dlci 100
```

The following example assigns DLCI 100 to a serial interface, starting from global configuration mode:

```
router(config)# interface serial 1/1
router(config-if)# frame-relay interface-dlci 100
router(config-fr-dlci)#
```

Related Commands

Command	Description
frame-relay class	Associates a map class with an interface or subinterface.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.
show interface	Displays P1024B/C information.
vofr	Configures subchannels and enables Voice over Frame Relay for a specific DLCI.

frame-relay interface-dlci switched

To indicate that a Frame Relay data-link connection identifier (DLCI) is switched, use the **frame-relay interface-dlci switched** interface configuration command. To remove this assignment, use the **no** form of this command.

frame-relay interface-dlci *dlci* **switched**

no frame-relay interface-dlci *dlci* **switched**

Syntax Description

dlci	DLCI number to be used on the specified interface or subinterface.

Defaults

No DLCI is assigned.

The default PVC type is terminated.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

Use the **frame-relay interface-dlci switched** command to allow a map class to be associated with a switched permanent virtual circuit (PVC).

You cannot change an existing PVC from terminated to switched or vice versa. You must delete the PVC and recreate it in order to change the type.

Use the **frame-relay interface-dlci switched** command to create switched PVCs for configuring Frame Relay-ATM network interworking (FRF.5) and Frame Relay-ATM service interworking (FRF.8).

By issuing the **frame-relay interface-dlci switched** interface configuration command, you enter Frame Relay DLCI interface configuration mode (see the example below).

Examples

In the following example, DLCI 16 on serial interface 0 is identified as a switched PVC and is associated with a map class called “shape256K.”

```
Router(config) # interface serial0
Router(config-if) # encapsulation frame-relay
Router(config-if) # frame-relay interface-dlci 16 switched
Router(config-fr-dlci) #  class shape256K
```

Related Commands

Command	Description
connect (Frame Relay)	Defines connections between Frame Relay PVCs.
frame-relay class	Associates a map class with an interface or subinterface.
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.

frame-relay intf-type

To configure a Frame Relay switch type, use the **frame-relay intf-type** interface configuration command. To disable the switch, use the **no** form of this command.

frame-relay intf-type [**dce** | **dte** | **nni**]

no frame-relay intf-type [**dce** | **dte** | **nni**]

Syntax Description

dce	(Optional) Router or access server functions as a switch connected to a router.
dte	(Optional) Router or access server is connected to a Frame Relay network.
nni	(Optional) Router or access server functions as a switch connected to a switch—supports Network-to-Network Interface (NNI) connections.

Defaults

dte

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command can be used only if Frame Relay switching has previously been enabled globally by means of the **frame-relay switching** command.

Examples

The following example configures a DTE switch type:

```
frame-relay switching
!
interface serial 2
 frame-relay intf-type dte
```

frame-relay inverse-arp

To reenable Inverse Address Resolution Protocol (Inverse ARP) on a specified interface or subinterface if the Inverse ARP was previously disabled on a router or access server configured for Frame Relay, use the **frame-relay inverse-arp** interface configuration command. To disable this feature, use the **no** form of this command.

frame-relay inverse-arp [*protocol*] [*dlci*]

no frame-relay inverse-arp [*protocol*] [*dlci*]

Syntax Description

protocol	(Optional) Supported protocols: **appletalk**, **decnet**, **ip**, **ipx**, **vines**, and **xns**.
dlci	(Optional) One of the DLCI numbers used on the interface. Acceptable numbers are integers in the range from 16 through 1007.

Defaults

Enabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

To enable Inverse ARP for all protocols that were enabled before the prior **no frame-relay inverse-arp** command was issued, use the **frame-relay inverse-arp** command without arguments. To disable Inverse ARP for all protocols of an interface, use the **no frame-relay inverse-arp** command without arguments.

To enable or disable Inverse ARP for a specific protocol and DLCI pair, use both the *protocol* and *dlci* arguments. To enable or disable Inverse ARP for all protocols on a DLCI, use only the *dlci* argument. To enable or disable Inverse ARP for a protocol for all DLCIs on the specified interface or subinterface, use only the *protocol* argument.

This implementation of Inverse ARP is based on RFC 1293. It allows a router or access server running Frame Relay to discover the protocol address of a device associated with the virtual circuit.

In Frame Relay, permanent virtual circuits (PVCs) are identified by a DLCI, which is the equivalent of a hardware address. By exchanging signaling messages, a network announces a new virtual circuit, and with Inverse ARP, the protocol address at the other side of the circuit can be discovered.

The **show frame-relay map** command displays the word “dynamic” to flag virtual circuits that are created dynamically by Inverse ARP.

Examples

The following example sets Inverse ARP on an interface running AppleTalk:

```
interface serial 0
 frame-relay inverse-arp appletalk 100
```

Related Commands

Command	Description
clear frame-relay-inarp	Clears dynamically created Frame Relay maps, which are created by the use of Inverse ARP.
show frame-relay map	Displays the current map entries and information about the connections.

frame-relay ip tcp compression-connections

To specify the maximum number of TCP header compression connections that can exist on a Frame Relay interface, use the **frame-relay ip tcp compression-connections** interface configuration command. To restore the default, use the **no** form of this command.

frame-relay ip tcp compression-connections *number*

no frame-relay ip tcp compression-connections

Syntax Description

number	Maximum number of TCP header compression connections. The range is from 3 to 256.

Defaults

No default behavior or values.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

Before you can configure the maximum number of connections, TCP header compression must be configured on the interface using the **frame-relay ip tcp header-compression** command.

The number of TCP header compression connections must be set to the same value at each end of the connection.

Examples

The following example shows the configuration of a maximum of 150 TCP header compression connections on serial interface 0:

```
interface serial 0
 encapsulation frame-relay
 frame-relay ip tcp header-compression
 frame-relay ip tcp compression-connections 150
```

Related Commands

Command	Description
frame-relay ip tcp header-compression	Enables TCP header compression for all Frame Relay maps on a physical interface.
frame-relay map ip compress	Enables both RTP and TCP header compression on a link.
frame-relay map ip tcp header-compression	Assigns header compression characteristics to an IP map that differ from the compression characteristics of the interface with which the IP map is associated.
show frame-relay ip tcp header-compression	Displays statistics and TCP/IP header compression information for the interface.

frame-relay ip tcp header-compression

To configure an interface to ensure that the associated permanent virtual circuit (PVC) will always carry outgoing TCP/IP headers in compressed form, use the **frame-relay ip tcp header-compression** interface configuration command. To disable compression of TCP/IP packet headers on the interface, use the **no** form of this command.

frame-relay ip tcp header-compression [**passive**]

no frame-relay ip tcp header-compression

Syntax Description

passive	(Optional) Compresses the outgoing TCP/IP packet header only if an incoming packet had a compressed header.

Defaults

Active TCP/IP header compression; all outgoing TCP/IP packets are subjected to header compression.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command applies to interfaces that support Frame Relay encapsulation, specifically serial ports and High-Speed Serial Interface (HSSI).

Frame Relay must be configured on the interface before this command can be used.

TCP/IP header compression and Internet Engineering Task Force (IETF) encapsulation are mutually exclusive. If an interface is changed to IETF encapsulation, all encapsulation and compression characteristics are lost.

When you use this command to enable TCP/IP header compression, every IP map inherits the compression characteristics of the interface, unless header compression is explicitly rejected or modified by use of the **frame-relay map ip tcp header compression** command.

We recommend that you shut down the interface prior to changing encapsulation types. Although this is not required, shutting down the interface ensures the interface is reset for the new type.

Examples

The following example configures serial interface 1 to use the default encapsulation (cisco) and passive TCP header compression:

```
interface serial 1
 encapsulation frame-relay
 frame-relay ip tcp header-compression passive
```

Related Commands

Command	Description
frame-relay map ip tcp header-compression	Assigns header compression characteristics to an IP map different from the compression characteristics of the interface with which the IP map is associated.

frame-relay lapf frmr

To resume the default setting of sending the Frame Reject (FRMR) frame at the Link Access Procedure for Frame Relay (LAPF) Frame Reject procedure after having set the option of not sending the frame, use the **frame-relay lapf frmr** command. To set the option of *not* sending the Frame Reject (FRMR) frame at the LAPF Frame Reject procedure, use the **no** form of this command.

frame-relay lapf frmr

no frame-relay lapf frmr

Syntax Description

This command has no arguments or keywords.

Defaults

Send FRMR during the Frame Reject procedure.

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

If the Frame Relay switch does not support FRMR, use the **no** form of this command to suppress the transmission of FRMR frames.

Examples

The following example suppresses the transmission of FRMR frames:

```
no frame-relay lapf frmr
```

frame-relay lapf k

To set the Link Access Procedure for Frame Relay (LAPF) window size *k*, use the **frame-relay lapf k** interface configuration command. To reset the maximum window size *k* to the default value, use the **no** form of this command.

frame-relay lapf k *number*

no frame-relay lapf k [*number*]

Syntax Description

number	Maximum number of Information frames that either are outstanding for transmission or are transmitted but unacknowledged, in the range from 1 through 127.

Defaults

7 frames

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command is used to tune Layer 2 system parameters to work well with the Frame Relay switch. Normally, you do not need to change the default setting.

Manipulation of Layer 2 parameters is not recommended if you do not know well the resulting functional change. For more information, refer to the ITU-T Q.922 specification for LAPF.

Examples

The following example resets the LAPF window size *k* to the default value:

```
no frame-relay lapf k
```

Related Commands

Command	Description
frame-relay lapf t203	Sets the LAPF link idle timer value T203 of DLCI 0.

frame-relay lapf n200

To set the Link Access Procedure for Frame Relay (LAPF) maximum retransmission count *N200*, use the **frame-relay lapf n200** interface configuration command. To reset the maximum retransmission count to the default of 3, use the **no** form of this command.

frame-relay lapf n200 *retries*

no frame-relay lapf n200 [*retries*]

Syntax Description

retries	Maximum number of retransmissions of a frame.

Defaults

3 retransmissions

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command is used to tune Layer 2 system parameters to work well with the Frame Relay switch. Normally, you do not need to change the default setting.

Manipulation of Layer 2 parameters is not recommended if you do not know well the resulting functional change. For more information, refer to the ITU-T Q.922 specification for LAPF.

Examples

The following example resets the N200 maximum retransmission count to the default value:

```
no frame-relay lapf n200
```

frame-relay lapf n201

To set the Link Access Procedure for Frame Relay (LAPF) N201 value (the maximum length of the Information field of the LAPF I frame), use the **frame-relay lapf n201** interface configuration command. To reset the maximum length of the Information field to the default of 260 bytes (octets), use the **no** form of this command.

frame-relay lapf n201 *bytes*

no frame-relay lapf n201 [*bytes*]

Syntax Description

bytes	Maximum number of bytes in the Information field of the LAPF I frame, between 1 and 16384.

Defaults

260 bytes

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command is used to tune Layer 2 system parameters to work well with the Frame Relay switch. Normally, you do not need to change the default setting.

Manipulation of Layer 2 parameters is not recommended if you do not know well the resulting functional change. For more information, refer to the ITU-T Q.922 specification for LAPF.

Examples

The following example resets the N201 maximum information field length to the default value:

```
no frame-relay lapf n201
```

frame-relay lapf t200

To set the Link Access Procedure for Frame Relay (LAPF) retransmission timer value T200, use the **frame-relay lapf t200** interface configuration command. To reset the T200 timer to the default value of 15, use the **no** form of this command.

frame-relay lapf t200 *tenths-of-a-second*

no frame-relay lapf t200

Syntax Description

tenths-of-a-second	Time, in tenths of a second, in the range from 1 through 100.

Defaults

15 tenths of a second (1.5 seconds)

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

The retransmission timer value T200 should be less than the link idle timer value T203 (using the same time unit).

This command is used to tune Layer 2 system parameters to work well with the Frame Relay switch. Normally, you do not need to change the default setting.

Manipulation of Layer 2 parameters is not recommended if you do not know well the resulting functional change. For more information, refer to the ITU-T Q.922 specification for LAPF.

Examples

The following example resets the T200 timer to the default value:

```
no frame-relay lapf t200
```

Related Commands

Command	Description
frame-relay lapf t203	Sets the LAPF link idle timer value T203 of DLCI 0.

frame-relay lapf t203

To set the Link Access Procedure for Frame Relay (LAPF) link idle timer value T203 of data-link connection identifier (DLCI) 0, use the **frame-relay lapf t203** interface configuration command. To reset the link idle timer to the default value, use the **no** form of this command.

frame-relay lapf t203 *seconds*

no frame-relay lapf t203

Syntax Description

seconds	Maximum time allowed with no frames exchanged, in the range from 1 through 65535 seconds.

Defaults

30 seconds

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

The **frame-relay lapf t203** command applies to the link; that is, it applies to DLCI 0. Circuits other than DLCI 0 are not affected.

The link idle timer value T203 should be greater than the retransmission timer value T200 (using the same time unit).

This command is used to tune Layer 2 system parameters to work well with the Frame Relay switch. Normally, you do not need to change the default setting.

Manipulation of Layer 2 parameters is not recommended if you do not know well the resulting functional change. For more information, refer to the ITU-T Q.922 specification for LAPF.

Examples

The following example resets the T203 idle link timer to the default value:

```
no frame-relay lapf t203
```

frame-relay lmi-n391dte

To set a full status polling interval, use the **frame-relay lmi-n391dte** interface configuration command. To restore the default interval value, assuming that a Local Management Interface (LMI) has been configured, use the **no** form of this command.

frame-relay lmi-n391dte *keep-exchanges*

no frame-relay lmi-n391dte *keep-exchanges*

Syntax Description

keep-exchanges	Number of keep exchanges to be done before requesting a full status message. Acceptable value is a positive integer in the range from 1 through 255.

Defaults

6 keep exchanges

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Use this command when the interface is configured as data terminal equipment (DTE) or a Network-to-Network Interface (NNI) as a means of setting the full status message polling interval.

Examples

In the following example, one out of every four status inquiries generated will request a full status response from the switch. The other three status inquiries will request keepalive exchanges only.

```
interface serial 0
 frame-relay intf-type DTE
 frame-relay lmi-n391dte 4
```

frame-relay lmi-n392dce

To set the data communications equipment (DCE) and the Network-to-Network Interface (NNI) error threshold, use the **frame-relay lmi-n392dce** interface configuration command. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n392dce *threshold*

no frame-relay lmi-n392dce *threshold*

Syntax Description

threshold	Error threshold value. Acceptable value is a positive integer in the range from 1 through 10.

Defaults

2 errors

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

In Cisco's implementation, N392 errors must occur within the number defined by the N393 event count in order for the link to be declared down. Therefore, the threshold value for this command must be less than the count value defined in the **frame-relay lmi-n393dce** command.

Examples

The following example sets the LMI failure threshold to 3. The router acts as a Frame Relay DCE or NNI switch.

```
interface serial 0
 frame-relay intf-type DCE
 frame-relay lmi-n392dce 3
```

Related Commands

Command	Description
frame-relay lmi-n393dce	Sets the DCE and NNI monitored events count.

frame-relay lmi-n392dte

To set the error threshold on a data terminal equipment (DTE) or network-to-network interface (NNI) interface, use the **frame-relay lmi-n392dte** interface configuration command. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n392dte *threshold*

no frame-relay lmi-n392dte *threshold*

Syntax Description

threshold	Error threshold value. Acceptable value is a positive integer in the range from 1 through 10.

Defaults

3 errors

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the Loca Management Interface (LMI) failure threshold to 3. The router acts as a Frame Relay DTE or NNI switch.

```
interface serial 0
 frame-relay intf-type DTE
 frame-relay lmi-n392dte 3
```

frame-relay lmi-n393dce

To set the data communications equipment (DCE) and Network-to-Network Interface (NNI) monitored events count, use the **frame-relay lmi-n393dce** interface configuration command. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n393dce *events*

no frame-relay lmi-n393dce *events*

Syntax Description

events	Value of monitored events count. Acceptable value is a positive integer in the range from 1 through 10.

Defaults

2 events

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command and the **frame-relay lmi-n392dce** command define the condition that causes the link to be declared down. In Cisco's implementation, N392 errors must occur within the *events* argument count in order for the link to be declared down. Therefore, the *events* value defined in this command must be greater than the threshold value defined in the **frame-relay lmi-n392dce** command.

Examples

The following example sets the Local Management Interface (LMI) monitored events count to 3. The router acts as a Frame Relay DCE or NNI switch.

```
interface serial 0
 frame-relay intf-type DCE
 frame-relay lmi-n393dce 3
```

Related Commands

Command	Description
frame-relay lmi-n392dce	Sets the DCE and the NNI error threshold.

frame-relay lmi-n393dte

To set the monitored event count on a data terminal equipment (DTE) or Network-to-Network Interface (NNI) interface, use the **frame-relay lmi-n393dte** interface configuration command. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n393dte *events*

no frame-relay lmi-n393dte *events*

Syntax Description

events	Value of monitored events count. Acceptable value is a positive integer in the range from 1 through 10.

Defaults

4 events

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the Local Management Interface (LMI) monitored events count to 3. The router acts as a Frame Relay DTE or NNI switch.

```
interface serial 0
 frame-relay intf-type DTE
 frame-relay lmi-n393dte 3
```

frame-relay lmi-t392dce

To set the polling verification timer on a data communications equipment (DCE) or Network-to-Network Interface (NNI) interface, use the **frame-relay lmi-t392dce** interface configuration command. To remove the current setting, use the **no** form of this command.

frame-relay lmi-t392dce *seconds*

no frame-relay lmi-t392dce *seconds*

Syntax Description

seconds	Polling verification timer value from 5 to 30 seconds.

Defaults

15 seconds

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The value for the timer must be greater than the DTE or NNI keepalive timer.

Examples

The following example indicates a polling verification timer on a DCE or NNI interface set to 20 seconds:

```
interface serial 3
 frame-relay intf-type DCE
 frame-relay lmi-t392dce 20
```

Related Commands

Command	Description
keepalive (LMI)	Enables the LMI mechanism for serial lines using Frame Relay encapsulation.

frame-relay lmi-type

To select the Local Management Interface (LMI) type, use the **frame-relay lmi-type** interface configuration command. To return to the default LMI type, use the **no** form of this command.

frame-relay lmi-type {**ansi** | **cisco** | **q933a**}

no frame-relay lmi-type {**ansi** | **q933a**}

Syntax Description

ansi	Annex D defined by American National Standards Institute (ANSI) standard T1.617.
cisco	LMI type defined jointly by Cisco and three other companies.
q933a	ITU-T Q.933 Annex A.

Defaults

LMI autosense is active and determines the LMI type by communicating with the switch.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Cisco's implementation of Frame Relay supports three LMI types: Cisco, ANSI Annex D, and ITU-T Q.933 Annex A.

The LMI type is set on a per-interface basis and is shown in the output of the **show interfaces** EXEC command.

If you want to deactivate LMI autosense, use this command and the **keepalive** command to configure the LMI. For more information about LMI autosense and configuring the LMI, refer to the chapter "Configuring Frame Relay" in the *Cisco IOS Wide-Area Networking Configuration Guide*.

Examples

The following is an example of the commands you might enter to configure an interface for the ANSI Annex D LMI type:

```
interface Serial1
 encapsulation frame-relay
 frame-relay lmi-type ansi
 keepalive 15
```

frame-relay local-dlci

To set the source data-link connection identifier (DLCI) for use when the Local Management Interface (LMI) is not supported, use the **frame-relay local-dlci** interface configuration command. To remove the DLCI number, use the **no** form of this command.

frame-relay local-dlci *number*

no frame-relay local-dlci

Syntax Description

number	Local (source) DLCI number to be used.

Defaults

No source DLCI is set.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

If LMI is supported and the multicast information element is present, the network server sets its local DLCI based on information provided via the LMI.

Note The **frame-relay local-dlci** command is provided mainly to allow testing of the Frame Relay encapsulation in a setting where two servers are connected back-to-back. This command is not required in a live Frame Relay network.

Examples

The following example specifies 100 as the local DLCI:

```
interface serial 4
 frame-relay local-dlci 100
```

frame-relay map

To define the mapping between a destination protocol address and the data-link connection identifier (DLCI) used to connect to the destination address, use the **frame-relay map** interface configuration command. To delete the map entry, use the **no** form of this command.

frame-relay map *protocol protocol-address dlci* [**broadcast**] [**ietf** | **cisco**] [**payload-compress** {**packet-by-packet** | **frf9 stac** [*hardware-options*] | **data-stream stac** [*hardware-options*]}]

no frame-relay map *protocol protocol-address*

Syntax Description

protocol	Supported protocol, bridging, or logical link control keywords: **appletalk**, **decnet**, **dlsw, ip**, **ipx**, **llc2**, **rsrb**, **vines,** and **xns**.
protocol-address	Destination protocol address.
dlci	DLCI number used to connect to the specified protocol address on the interface.
broadcast	(Optional) Forwards broadcasts to this address when multicast is not enabled (see the **frame-relay multicast-dlci** command for more information about multicasts). This keyword also simplifies the configuration of Open Shortest Path First (OSPF) (see the "Usage Guidelines" section for more detail).
ietf	(Optional) Internet Engineering Task Force (IETF) form of Frame Relay encapsulation. Used when the router or access server is connected to the equipment of another vendor across a Frame Relay network.
cisco	(Optional) Cisco encapsulation method.
payload-compress	(Optional) Enables payload compression.
packet-by-packet	(Optional) Packet-by-packet payload compression using the Stacker method.
frf9 stac	(Optional) FRF.9 compression using the Stacker method: • If the router contains a compression service adapter (CSA), compression is performed in the CSA hardware (hardware compression). • If the CSA is not available, compression is performed in the software installed on the VIP2 (distributed compression). • If the second-generation Versatile Interface Processor (VIP2) is not available, compression is performed in the main processor of the router (software compression).
data-stream stac	(Optional) Data-stream compression using the Stacker method: • If the router contains a CSA, compression is performed in the CSA hardware (hardware compression). • If the CSA is not available, compression is performed in the main processor of the router (software compression).

hardware-options	Choose one of the following hardware options: • (Optional) **distributed**. Specifies that compression is implemented in the software that is installed in a VIP2. If the VIP2 is not available, compression is performed in the main processor of the router (software compression). This option applies only to the Cisco 7500 series routers. This option is not supported with data-stream compression. • (Optional) **software**. Specifies that compression is implemented in the Cisco IOS software installed in the main processor of the router. • (Optional) **csa** *csa_number*. Specifies the CSA to use for a particular interface. This option applies only to Cisco 7200 series routers.

Defaults

No mapping is defined.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3	The **payload-compress frf9 stac** keyword was added.
12.1(5)T	The **payload-compress data-stream stac** keyword was added.

Usage Guidelines

Many DLCIs can be known by a router or access server and can send data to many different places, but they are all multiplexed over one physical link. The Frame Relay map defines the logical connection between a specific protocol and address pair and the correct DLCI.

The optional **ietf** and **cisco** keywords allow flexibility in the configuration. If no keywords are specified, the map inherits the attributes set with the **encapsulation frame-relay** command. You can also use the encapsulation options to specify that, for example, all interfaces use IETF encapsulation except one, which needs the original Cisco encapsulation method and can be configured through use of the **cisco** keyword with the **frame-relay map** command.

Data-stream compression is supported on interfaces and virtual circuits (VCs) using Cisco proprietary encapsulation. When the **data-stream stac** keyword is specified, Cisco encapsulation is automatically enabled. FRF.9 compression is supported on IETF-encapsulated VCs and interfaces. When the **frf9 stac** keyword is specified, IETF encapsulation is automatically enabled.

Packet-by-packet compression is Cisco-proprietary and will not interoperate with routers of other manufacturers.

You can disable payload compression by entering the **no frame-relay map payload** command and then entering the **frame-relay map** command again with one of the other encapsulation keywords (**ietf** or **cisco**).

Use the **frame-relay map** command to enable or disable payload compression on multipoint interfaces. Use the **frame-relay payload-compress** command to enable or disable payload compression on point-to-point interfaces.

We recommend that you shut down the interface before changing encapsulation types. Although shutting down the interface is not required, it ensures that the interface is reset for the new encapsulation.

The **broadcast** keyword provides two functions: it forwards broadcasts when multicasting is not enabled, and it simplifies the configuration of OSPF for nonbroadcast networks that will use Frame Relay.

The **broadcast** keyword might also be required for some routing protocols—for example, AppleTalk—that depend on regular routing table updates, especially when the router at the remote end is waiting for a routing update packet to arrive before adding the route.

By requiring selection of a designated router, OSPF treats a nonbroadcast, multiaccess network such as Frame Relay in much the same way as it treats a broadcast network. In previous releases, selection of a designated router required manual assignment in the OSPF configuration using the **neighbor interface** router command. When the **frame-relay map** command (with the **broadcast** keyword) and the **ip ospf network** command (with the **broadcast** keyword) are configured, there is no need to configure any neighbors manually. OSPF will now automatically run over the Frame Relay network as a broadcast network. (See the **ip ospf network** interface command for more detail.)

Note The OSPF broadcast mechanism assumes that IP class D addresses are never used for regular traffic over Frame Relay.

Examples

IP Address Mapping Example

The following example maps the destination IP address 172.16.123.1 to DLCI 100:

```
interface serial 0
 frame-relay map ip 172.16.123.1 100 broadcast
```

OSPF will use DLCI 100 to broadcast updates.

FRF.9 Compression Example

The following example shows FRF.9 compression configuration using the **frame-relay map** command:

```
interface serial2/0/1
 ip address 172.16.1.4 255.255.255.0
 no ip route-cache
 encapsulation frame-relay ietf
 no keepalive
 shutdown
 frame-relay map ip 172.16.1.1 105 ietf payload-compress frf9 stac
```

Data-Stream Compression Example

The following example shows data-stream compression configuration using the **frame-relay map** command:

```
interface serial0/0
 frame-relay map ip 10.0.0.1 100 payload-compress data-stream stac
```

Related Commands

Command	Description
encapsulation frame-relay	Enables Frame Relay encapsulation.
frame-relay payload-compress	Enables Stacker payload compression on a specified point-to-point interface or subinterface.
ip ospf network	Configures the OSPF network type to a type other than the default for a given medium.

frame-relay map bridge

To specify that broadcasts are to be forwarded during bridging, use the **frame-relay map bridge** interface configuration command. To delete the map entry, use the **no** form of this command.

frame-relay map bridge *dlci* [**broadcast**] [**ietf**]

no frame-relay map bridge *dlci*

Syntax Description

dlci	DLCI number to be used for bridging on the specified interface or subinterface.
broadcast	(Optional) Broadcasts are forwarded when multicast is not enabled.
ietf	(Optional) IETF form of Frame Relay encapsulation. Use when the router or access server is connected to another vendor's equipment across a Frame Relay network.

Defaults

No broadcasts are forwarded.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example uses DLCI 144 for bridging:

```
interface serial 0
 frame-relay map bridge 144 broadcast
```

The following example sets up separate point-to-point links over a subinterface and runs transparent bridging over it:

```
interface serial 0
 bridge-group 1
 encapsulation frame-relay
interface serial 0.1
 bridge-group 1
 frame-relay map bridge 42 broadcast
interface serial 0.2
 bridge-group 1
 frame-relay map bridge 64 broadcast
interface serial 0.3
 bridge-group 1
 frame-relay map bridge 73 broadcast
```

DLCI 42 is used as the link; refer to the section “Frame Relay Configuration Examples” in the *Cisco IOS Wide-Area Networking Configuration Guide* for more examples of subinterfaces.

frame-relay map clns

To forward broadcasts when Connectionless Network Service (CLNS) is used for routing, use the **frame-relay map clns** interface configuration command. To delete the map entry, use the **no** form of this interface configuration command.

frame-relay map clns *dlci* [**broadcast**]

no frame-relay map clns *dlci*

Syntax Description

dlci	DLCI number to which CLNS broadcasts are forwarded on the specified interface.
broadcast	(Optional) Broadcasts are forwarded when multicast is not enabled.

Defaults

No broadcasts are forwarded.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example uses DLCI 125 for CLNS routing:

```
interface serial 0
 frame-relay map clns 125 broadcast
```

frame-relay map ip tcp header-compression

To assign to an IP map header compression characteristics that differ from the compression characteristics of the interface with which the IP map is associated, use the **frame-relay map ip tcp header-compression** interface configuration command.

frame-relay map ip *ip-address dlci* [**broadcast**] **tcp header-compression** [**active** | **passive**] [**connections** *number*]

Syntax Description

ip-address	IP address of the destination or next hop.
dlci	Data-link connection identifier (DLCI) number.
broadcast	(Optional) Forwards broadcasts to the specified IP address.
active	(Optional) Compresses the header of every outgoing TCP/IP packet.
passive	(Optional) Compresses the header of an outgoing TCP/IP packet only if an incoming TCP/IP packet had a compressed header.
connections *number*	(Optional) Specifies the maximum number of TCP header compression connections. The range is from 3 to 256.

Defaults

The default maximum number of TCP header compression connections is 256.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.1(2)T	This command was modified to enable the configuration of the maximum number of header compression connections.

Usage Guidelines

If you do not specify the number of TCP header compression connections, the map will inherit the current value from the interface.

IP maps inherit the compression characteristics of the associated interface unless this command is used to provide different characteristics. This command can also reconfigure an IP map that existed before TCP header compression was configured on the associated interface.

When IP maps at both ends of a connection inherit passive compression, the connection will never transfer compressed traffic because neither side will generate a packet that has a compressed header.

If you change the encapsulation characteristics of the interface to Internet Engineering Task Force (IETF) encapsulation, you lose the TCP header compression configuration of the associated IP map.

The **frame-relay map ip** *ip-address dlci* **tcp header-compression active** command can also be entered as **frame-relay map ip** *ip-address dlci* **active tcp header-compression**.

We recommend that you shut down the interface before changing encapsulation types. Although shutting down the interface is not required, it ensures that the interface is reset for the new encapsulation.

Examples

The following example illustrates a command sequence for configuring an IP map associated with serial interface 1 to enable active TCP/IP header compression:

```
interface serial 1
 encapsulation frame-relay
 ip address 10.108.177.170 255.255.255.0
 frame-relay map ip 10.108.177.180 190 tcp header-compression active
```

Related Commands

Command	Description
frame-relay ip tcp compression-connections	Specifies the maximum number of TCP header compression connections that can exist on a Frame Relay interface.
frame-relay ip tcp header-compression	Enables TCP header compression for all Frame Relay maps on a physical interface.
frame-relay map ip compress	Enables both RTP and TCP header compression on a link.
show frame-relay ip tcp header-compression	Displays statistics and TCP/IP header compression information for the interface.

frame-relay mincir

To specify the minimum acceptable incoming or outgoing committed information rate (CIR) for a Frame Relay virtual circuit, use the **frame-relay mincir** map-class configuration command. To reset the minimum acceptable CIR to the default, use the **no** form of this command.

frame-relay mincir {**in** | **out**} *bps*

no frame-relay mincir

Syntax Description

in | **out**	Incoming or outgoing.
bps	Committed information rate, in bits per second.

Defaults

56000 bps

Command Modes

Map-class configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Rate values greater than 2048 must be entered with trailing zeros. For example, 2048000 and 5120000.

The network uses the **mincir** value when allocating resources for the SVC. If the **mincir** value cannot be supported, the call is cleared.

Examples

The following example defines the peak and average traffic rate, the minimum CIR, and the idle timer for the fast_vcs map class and applies those values to DLCI 100, which is associated with that map class:

```
interface serial 0
 frame-relay interface-dlci 100
  class fast_vc

map-class frame-relay fast_vc
 frame-relay traffic-rate 56000 128000
 frame-relay idle-timer 30
 frame-relay mincir out 48000
```

Related Commands

Command	Description
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay multicast-dlci

To define the data-link connection identifier (DLCI) to be used for multicasts, use the **frame-relay multicast-dlci** interface configuration command. To remove the multicast group, use the **no** form of this command.

frame-relay multicast-dlci *number*

no frame-relay multicast-dlci

Syntax Description

number	Multicast DLCI.

Defaults

No DLCI is defined.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Use this command when the multicast facility is not supported. Network transmissions (packets) sent to a multicast DLCI are delivered to all network servers defined as members of the multicast group.

Note The **frame-relay multicast-dlci** command is provided mainly to allow testing of the Frame Relay encapsulation in a setting where two servers are connected back-to-back. This command is not required in a live Frame Relay network.

Examples

The following example specifies 1022 as the multicast DLCI:

```
interface serial 0
 frame-relay multicast-dlci 1022
```

frame-relay payload-compress

To enable Stacker payload compression on a specified point-to-point interface or subinterface, use the **frame-relay payload-compress** interface configuration command. To disable payload compression on a specified point-to-point interface or subinterface, use the **no** form of this command.

frame-relay payload-compress {**packet-by-packet** | **frf9 stac** [*hardware-options*] | **data-stream stac** [*hardware-options*]}

no frame-relay payload-compress {**packet-by-packet** | **frf9 stac** | **data-stream stac**}

Syntax Description

packet-by-packet	Packet-by-packet payload compression using the Stacker method.
frf9 stac	Enables FRF.9 compression using the Stacker method. • If the router contains a CSA[1], compression is performed in the CSA hardware (hardware compression). • If the CSA is not available, compression is performed in the software installed on the VIP2[2] (distributed compression). • If the VIP2 is not available, compression is performed in the main processor of the router (software compression).
hardware-options	Choose one of the following hardware options: • (Optional) **distributed**. Specifies that compression is implemented in the software that is installed in a VIP2. If the VIP2 is not available, compression is performed in the main processor of the router (software compression). This option applies only to the Cisco 7500 series routers. This option is not supported with data-stream compression. • (Optional) **software**. Specifies that compression is implemented in the Cisco IOS software installed in the main processor of the router. • (Optional) **csa** *csa_number*. Specifies the CSA to use for a particular interface. This option applies only to Cisco 7200 series routers.
data-stream stac	Enables data-stream compression using the Stacker method. • If the router contains a CSA, compression is performed in the CSA hardware (hardware compression). • If the CSA is not available, compression is performed in the main processor of the router (software compression).

1. CSA = compression service adapter
2. VIP2 = second-generation Versatile Interface Processor

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.
11.2	The **packet-by-packet** keyword was added.
11.3	The **frf9 stac** keyword was added.
12.1(5)T	The **data-stream stac** keyword was added.

Usage Guidelines

Use the **frame-relay payload-compress** command to enable or disable payload compression on a point-to-point interface or subinterface. Use the **frame-relay map** command to enable or disable payload compression on a multipoint interface or subinterface.

We recommend that you shut down the interface before changing encapsulation types. Although shutting down the interface is not required, it ensures that the interface is reset for the new encapsulation.

Data-stream hardware compression is supported on interfaces and virtual circuits (VCs) using Cisco proprietary encapsulation. When the **data-stream stac** keyword is specified, Cisco encapsulation is automatically enabled. FRF.9 compression is supported on VCs and interfaces that using Internet Engineering Task Force (IETF) encapsulation type. When the **frf9 stac** keyword is specified, IETF encapsulation is automatically enabled.

Examples

FRF.9 Compression Example

The following example configures FRF.9 compression for subinterfaces:

```
interface serial2/0/0
 no ip address
 no ip route-cache
 encapsulation frame-relay
 ip route-cache distributed
 no keepalive
 shutdown
!
interface serial2/0/0.500 point-to-point
 ip address 172.16.1.4 255.255.255.0
 no cdp enable
 frame-relay interface-dlci 500 ietf
 frame-relay payload-compress frf9 stac
```

Data-Stream Compression Example

The following example shows the configuration of data-stream compression using the **frame-relay payload-compress** command:

```
 interface serial1/0
  encapsulation frame-relay
  frame-relay traffic-shaping
 !
 interface serial1/0.1 point-to-point
  ip address 10.0.0.1 255.0.0.0
  frame-relay interface-dlci 100
  frame-relay payload-compress data-stream stac
```

Related Commands

Command	Description
frame-relay map	Defines mapping between a destination protocol address and the DLCI used to connect to the destination address.

frame-relay policing

To enable Frame Relay policing on all switched PVCs on the interface, use the **frame-relay policing** interface configuration command. To disable Frame Relay policing, use the **no** form of this command.

frame-relay policing

no frame-relay policing

Syntax Description

This command has no arguments or keywords.

Defaults

Frame Relay policing is not enabled on switched PVCs.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You must enable Frame Relay policing on the incoming interface before you can configure traffic-policing parameters.

You must enable Frame Relay switching, using the **frame-relay switching** global command, before the **frame-relay policing** command will be effective on switched PVCs.

Examples

The following example shows the configuration of Frame Relay policing on serial interface 0:

```
interface serial0
 frame-relay policing
```

Related Commands

Command	Description
frame-relay bc	Specifies the incoming or outgoing Bc for a Frame Relay virtual circuit.
frame-relay be	Specifies the incoming or outgoing Be for a Frame Relay virtual circuit.
frame-relay cir	Specifies the incoming or outgoing CIR for a Frame Relay virtual circuit.
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
frame-relay tc	Specifies the measurement interval for policing incoming traffic when the CIR is zero.

frame-relay priority-dlci-group

To prioritize multiple data-link connection identifiers (DLCIs) according to the type of Frame Relay traffic, use the **frame-relay priority-dlci-group** interface configuration command.

frame-relay priority-dlci-group *group-number high-dlci medium-dlci normal-dlci low-dlci*

Syntax Description

group-number	Specific group number.
high-dlci	DLCI that is to have highest priority level.
medium-dlci	DLCI that is to have medium priority level.
normal-dlci	DLCI that is to have normal priority level.
low-dlci	DLCI that is to have lowest priority level.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.0	This command was introduced.

Usage Guidelines

This command is applied at the interface or subinterface level. Levels in descending order are high, medium, normal, and low.

This command allows you to define different DLCIs for different categories of traffic based on traffic priorities. This command does not itself define priority queueing, but it can be used in conjunction with priority queueing.

A global priority list must be defined, and the associated DLCIs must already be applied to the configuration before you enable this command.

Associate the DLCIs to their prospective groups and define their priority levels. This command is used for multiple DLCIs, where the source and destination endpoints are the same (parallel paths). This command should not be used on a main interface, or point-to-point subinterface, where only a single DLCI is configured.

A DLCI can only be affiliated with a single priority-group; however, there can be multiple groups per interface or subinterface.

You must configure the *high-priority* and *medium-priority* DLCI values. If you do not explicitly associate a DLCI for the *normal-dlci* and *low-dlci* priority levels, the last DLCI specified in the command line is used as the value of the remaining arguments. For example, the following two commands are equivalent:

```
frame-relay priority-dlci-group 1 40 50
frame-relay priority-dlci-group 1 40 50 50 50
```

When you configure static map entries using **frame-relay map** commands or use Inverse Address Resolution Protocol (ARP), the high-level DLCI is the only DLCI that is mapped. In the example, DLCI 40 is defined as having the highest priority. Therefore, DLCI 40 is the only DLCI that should be included in the **frame-relay map** command. DLCI 50 should not be included in a **frame-relay map** command.

Examples

The following example shows the **frame-relay priority-dlci-group** command configured on a main interface with a static Frame Relay map entry. Note that DLCI 40 is the high-priority DLCI as defined in the **frame-relay priority-dlci-group** command and the only DLCI included in the **frame-relay map** command.

```
interface serial 1
 ip address 172.21.177.1 255.255.255.0
 encapsulation frame-relay
 frame-relay priority-dlci-group 1 40
 frame-relay map ip 172.21.177.2 40 broadcast
```

The following example shows the **frame-relay priority-dlci-group** command configured on subinterfaces where multiple priority groups are defined. DLCI 40 is the high-priority DLCI in group 1, and DLCI 80 is the high-priority DLCI in group 2.

```
interface Serial3
 no ip address
 encapsulation frame-relay
!
interface Serial3.2 multipoint
 ip address 172.21.177.1 255.255.255.0
 frame-relay interface-dlci 40
 frame-relay priority-dlci-group 1 40

!
interface Serial3.3 multipoint
 ip address 131.108.177.180 255.255.255.0
 frame-relay priority-dlci-group 2 80 90 100 100
 frame-relay interface-dlci 80
!
interface Serial 4
 no ip address
 encapsulation frame-relay
!
interface serial4.1 multipoint
 ip address 172.16.1.1 255.255.255.0
 frame-relay priority-dlci-group 3 200 210 300 300
 frame-relay priority-dlci-group 4 400 410 410 410
 frame-relay interface-dlci 200
 frame-relay interface-dlci 400
```

Related Commands

Command	Description
frame-relay map	Defines mapping between a destination protocol address and the DLCI used to connect to the destination address.

frame-relay priority-group

To assign a priority queue to virtual circuits associated with a map class, use the **frame-relay priority-group** map-class configuration command. To remove the specified queueing from the virtual circuit and cause it to revert to the default first-come, first-served queueing, use the **no** form of this command.

frame-relay priority-group *list-number*

no frame-relay priority-group *list-number*

Syntax Description

list-number	Priority-list number to be associated with the specified map class.

Defaults

If this command is not entered, the default is first-come, first-served queueing.

Command Modes

Map-class configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Definition of the priority queue takes place in the existing manner (through **priority-list** commands). Because only one form of queueing can be associated with a particular map class, subsequent definitions overwrite previous ones.

Examples

The following example configures a map class for a specified DLCI, specifies a priority list for the map class, and then defines the priority list:

```
interface serial 0
 encapsulation frame-relay
 frame-relay interface-dlci 100
 class pri_vc

 map-class frame-relay pri_vc
 frame-relay priority-group 1

priority-list 1 protocol ip high
```

Related Commands

Command	Description
class (virtual circuit)	Associates a map class with a specified DLCI.
frame-relay interface-dlci	Assigns a DLCI to a specified Frame Relay subinterface on the router or access server.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay pvc

To configure Frame Relay permanent virtual circuits (PVCs) for FRF.8 Frame Relay-ATM Service Interworking, use the **frame-relay pvc** interface configuration command. To remove the PVC, use the **no** form of the command.

frame-relay pvc *dlci* **service** {**transparent** | **translation**} [**clp-bit** {**0** | **1** | **map-de**}][**de-bit** {**0** | **1** | **map-clp**}][**efci-bit** {**0** | **1** | **map-fecn**}] **interface atm0** {*vpi*/*vci* | *vcd*}

no frame-relay pvc *dlci* **service** {**transparent** | **translation**} [**clp-bit** {**0** | **1** | **map-de**}][**de-bit** {**0** | **1** | **map-clp**}][**efci-bit** {**0** | **1** | **map-fecn**}] **interface atm0** {*vpi*/*vci* | *vcd*}

Syntax Description

dlci	A value ranging from 16 to 1007 for the PVC's data-link connection identifier (DLCI). Use this label when you associate a Frame Relay PVC with an ATM PVC.
service {**transparent** | **translation**}	In the **transparent** mode of Service Interworking, encapsulations are sent unaltered. In **translatio**n mode, mapping and translation take place. There is no default.
clp-bit {**0** | **1** | **map-de**}	(Optional) Sets the mode of DE/CLP mapping in Frame Relay to the ATM direction. The default is **map-de**. • **map-de**—Specifies Mode 1 (see section 4.2.1 of FRF.8) • **0** or **1**—Specifies Mode 2 (see section 4.2.1 of FRF.8)
de-bit {**0** | **1** | **map-clp**}	(Optional) Sets the mode of DE/CLP mapping in the ATM-to-Frame Relay direction. The default is **map-clp**. • **map-clp**—Specifies Mode 1 (see section 4.2.1 of FRF.8) • **0** or **1**—Specifies Mode 2 (see section 4.2.1 of FRF.8)
efci-bit {**0** | **1** | **map-fecn**}	(Optional) Sets FECN and the ATM EFCI in the Frame Relay-to-ATM direction. **map-fecn** is the default. • **0**—Sets a constant value rather than mapping. • **1**—Sets a constant value rather than mapping. • **map-fecn**—Adheres to Mode 1 and maps the FECN indicators to EFCI indicators.
interface atm0 {*vpi*/*vci* | *vcd*}	Maps the Frame Relay PVC to an ATM PVC specified by slot number (0 is the only option for ATM on the Cisco MC3810) and either one of the following labels: • *vpi*/*vci*—The virtual path identifier-virtual channel identifier (VPI-VCI) pair for the ATM PVC • *vcd*—The ATM virtual circuit descriptor (VCD) for the ATM PVC

Defaults

See the defaults listed in the "Syntax Description" section.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(7)T	This command was introduced.

Usage Guidelines

This command applies only to Frame Relay-ATM Service Interworking (FRF.8) on the Cisco MC3810. Use this command to create Frame Relay PVCs for association with ATM PVCs when you are configuring FRF.8 Frame Relay-ATM Service Interworking on the Cisco MC3810 multiservice access concentrator.

Examples

The following example shows two Frame Relay PVCs configured on a serial interface of a Cisco MC3810:

```
frame-relay pvc 222 service translation clp-bit map-de de-bit map-clp efci-bit map-fecn
interface ATM0 222/222
frame-relay pvc 925 service transparent clp-bit map-de de-bit map-clp efci-bit map-fecn
interface ATM0 92/92
```

Related Commands

Command	Description
pvc	Creates an ATM PVC on a main interface or subinterface; assigns a name to an ATM PVC; specifies ILMI, QSAAL, or SMDS as the encapsulation type on an ATM PVC; or enters interface-ATM-VC configuration mode.

frame-relay qos-autosense

To enable Enhanced Local Management Interface on the Cisco router, use the **frame-relay qos-autosense** interface configuration command. To disable Enhanced Local Management Interface on the Cisco router, use the **no** form of this command.

frame-relay qos-autosense

no frame-relay qos-autosense

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Enhanced Local Management Interface must be configured on both the Cisco router and the Cisco switch.

Traffic shaping is optional with Enhanced Local Management Interface. Configure traffic shaping on the interface if you want QoS information to be used by the router for traffic rate enforcement.

Examples

This configuration example shows a Frame Relay interface enabled to receive Enhanced Local Management Interface messages from the Cisco switch that is also configured with Enhanced Local Management Interface enabled. Traffic shaping is also configured on the interface for traffic rate enforcement and dynamic rate throttling. This allows the router to adjust its output rate based on congestion information it receives from the switch.

```
interface serial0
  no ip address
  encapsulation frame-relay
  frame-relay lmi-type ansi
  frame-relay traffic-shaping
  frame-relay qos-autosense

interface serial0.1 point-to-point
  no ip address
  frame-relay interface-dlci 101
```

Related Commands

Command	Description
encapsulation frame-relay	Enables Frame Relay encapsulation.
frame-relay adaptive-shaping	Selects the type of backward notification you want to use.
frame-relay traffic-shaping	Enables both traffic shaping and per-VC queueing for all PVCs and SVCs on a Frame Relay interface.
show frame-relay qos-autosense	Displays the QoS values sensed from the switch.

frame-relay route

To specify the static route for permanent virtual circuit (PVC) switching, use the **frame-relay route** interface configuration command. To remove a static route, use the **no** form of this command.

frame-relay route *in-dlci* **interface** *out-interface-type out-interface-number out-dlci* [**voice-encap** *size*]

no frame-relay route *in-dlci* **interface** *out-interface-type out-interface-number out-dlci* [**voice-encap** *size*]

Syntax Description

in-dlci	DLCI on which the packet is received on the interface.
interface *out-interface-type out-interface-number*	Interface that the router or access server uses to transmit the packet.
out-dlci	DLCI that the router or access server uses to transmit the packet over the interface specified by the *out-interface* argument.
voice encap *size*	(Optional) (Supported on the Cisco MC3810 only.) Specifies that data segmentation will be used to support Voice over Frame Relay. Note that the voice encapsulation applies only to the input DLCI side. The valid range is from 8 to 1600.

Defaults

No static route is specified.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

When used with voice, the **frame-relay route** command is applied on both interfaces. If the voice-encap option is specified on one interface, then the incoming frames on that interface are defragmented before being routed to the other interface. The outgoing frames on that interface are then fragmented after being routed from the other interface, and before transmission out the interface.

Note Static routes cannot be configured over tunnel interfaces on the Cisco 800 series, 1600 series, and 1700 series platforms. Static routes can only be configured over tunnel interfaces on platforms that have the Enterprise feature set.

Examples

The following example configures a static route that allows packets in DLCI 100 and sends packets out over DLCI 200 on interface serial 2:

```
frame-relay route 100 interface Serial2 200
```

The following example illustrates the commands you enter for a complete configuration that includes two static routes for PVC switching between interface serial 1 and interface serial 2:

```
interface Serial1
 no ip address
 encapsulation frame-relay
 keepalive 15
 frame-relay lmi-type ansi
 frame-relay intf-type dce
 frame-relay route 100 interface Serial2 200
 frame-relay route 101 interface Serial2 201
 clockrate 2000000
```

frame-relay svc

To enable Frame Relay switched virtual circuit (SVC) operation on the specified interface, use the **frame-relay svc** interface configuration command. To disable SVC operation on the specified interface, use the **no** form of this command.

frame-relay svc

no frame-relay svc

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

SVC operation can be enabled at the interface level only. Once it is enabled at the interface level, it is enabled on all subinterfaces on the interface. One signalling channel, DLCI 0, is set up for the interface, and all SVCs are controlled from the physical interface.

The first use of this command on the router starts all SVC-related processes on the router. If they are already up and running because SVCs are enabled on another interface, no additional action is taken. These processes are not removed once they are created.

Examples

The following example enables Frame Relay SVC operation on serial interface 0 and starts SVC-related processes on the router:

```
interface serial 0
 ip address 172.68.3.5 255.255.255.0
 encapsulation frame-relay
 frame-relay lmi-type q933a
 frame-relay svc
```

Related Commands

Command	Description
encapsulation frame-relay	Enables Frame Relay encapsulation.
frame-relay lmi-type	Selects the LMI type.
interface serial	Specifies a serial interface created on a channelized E1 or channelized T1 controller (for ISDN PRI, CAS, or robbed bit signalling).
ip address	Sets a primary or secondary IP address for an interface.

frame-relay switching

To enable permanent virtual switching (PVC) switching on a Frame Relay DCE device or a Network-to-Network Interface (NNI), use the **frame-relay switching** global configuration command. To disable switching, use the **no** form of this command.

frame-relay switching

no frame-relay switching

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

You must add this command to the configuration file before configuring the routes.

Examples

The following example shows the simple command that is entered in the configuration file before the Frame Relay configuration commands to enable switching:

```
frame-relay switching
```

frame-relay tc

To set the measurement interval for policing incoming traffic when the committed information rate (CIR) is zero, use the **frame-relay tc** map-class configuration command. To reset the measurement interval for policing, use the **no** form of this command.

frame-relay tc *milliseconds*

no frame-relay tc *milliseconds*

Syntax Description

milliseconds	Time interval from 10 ms to 10,000 ms, during which incoming traffic cannot exceed committed burst size (Bc) plus excess burst size (Be).

Defaults

1000 ms

Command Modes

Map-class configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You must enable Frame Relay policing on the incoming interface, using the **frame-relay policing** interface command, before you can configure traffic-policing parameters.

You must enable Frame Relay switching, using the **frame-relay switching** global command, before the **frame-relay tc** command will be effective on switched PVCs.

When the CIR is greater than 0, Tc is equal to Bc divided by the CIR.

Examples

The following example shows how to configure a policing measurement interval of 800 milliseconds within a map class called “police”:

```
map-class frame-relay police
 frame-relay tc 800
```

Related Commands

Command	Description
frame-relay bc	Specifies the incoming or outgoing Bc for a Frame Relay virtual circuit.
frame-relay be	Specifies the incoming or outgoing Be for a Frame Relay virtual circuit.
frame-relay cir	Specifies the incoming or outgoing CIR for a Frame Relay virtual circuit.
frame-relay policing	Enables Frame Relay policing on all switched PVCs on an interface.
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.

frame-relay traffic-rate

To configure all the traffic-shaping characteristics of a virtual circuit (VC) in a single command, use the **frame-relay traffic-rate** command in map-class configuration mode. To remove the specified traffic shaping from the map class, use the **no** form of this command.

frame-relay traffic-rate *average* [*peak*]

no frame-relay traffic-rate *average* [*peak*]

Syntax Description

average	Average rate, in bits per second; equivalent to specifying the contracted committed information rate (CIR).
peak	(Optional) Peak rate, in bits per second; equivalent to CIR + Be/Tc = CIR (1 + Be/Bc) = CIR + EIR. If the *peak* value is not configured, the peak rate will default to the configured *average* value.

Defaults

If the peak rate is omitted, the default value used is the average rate configured.

Command Modes

Map-class configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

The configured *peak* and *average* rates are converted to the equivalent CIR, excess burst size (Be), and committed burst size (Bc) values for use by the VC. When the values are translated, the *average* rate is used as the CIR. This value is assumed to be for one second. The generated Bc value is 1/8 the CIR value with an interval of 125 milliseconds.

The Be value is derived from the *peak* rate by subtracting by the *average* rate. The value of the *peak* rate minus *average* rate is assumed to be for one second. The generated Be value is 1/8 the *peak* rate minus the *average* rate with an interval of 125 milliseconds. If the *peak* value is not configured, the peak rate will default to the configured *average* value, and the Be value will equal 0.

For example, entering the **frame-relay traffic-rate 64000 96000** command will result in a CIR of 64000 bps. Assuming 8 intervals of 125 milliseconds, the Bc is 64000/8 or 8000 bits. The Be value is calculated by subtracting 64000 from 96000, so the one-second value is 32000 bits. For each 125-millisecond interval, the Be value is 4000 bits.

Note that the **show frame-relay pvc** command displays Be and Bc values based on an interval of one second. Internally the values being used are based on an interval of 125 milliseconds. The configuration examples below include the **frame-relay traffic-rate** command and corresponding **show frame-relay pvc** command output.

The **frame-relay traffic-rate** command lets you configure all the traffic-shaping characteristics of a virtual circuit in a single command. Using it is simpler than the alternative of entering the three commands **frame-relay cir out**, **frame-relay be out** and **frame-relay bc out**, but offers slightly less flexibility.

Examples

The following example associates a map class with specified data-link connection identifier (DLCI) and then sets a traffic rate for the map class (and thus for the DLCI):

```
interface serial 0
 frame-relay interface-dlci 100
  class fast_vc

map-class frame-relay fast_vc
 frame-relay traffic-rate 64000 96000
```

The following sample output for the **show frame-relay pvc** command is for the PVC configured in the preceding example. Note that the display shows values for Be and Bc that are based on an interval of one second. Internally the values being used are based on an interval of 125 milliseconds, which means that the actual Be value being used is 4000 bits and the actual Bc value being used is 8000 bits.

```
Router# show frame-relay pvc 100

PVC Statistics for interface Serial0 (Frame Relay DTE)

DLCI = 100, DLCI USAGE = LOCAL, PVC STATUS = STATIC, INTERFACE = Serial0.100

  input pkts 0             output pkts 2314         in bytes 0
  out bytes 748080         dropped pkts 0           in pkts dropped 0
  out pkts dropped 0                 out bytes dropped 0
  in FECN pkts 0           in BECN pkts 0           out FECN pkts 0
  out BECN pkts 0          in DE pkts 0             out DE pkts 0
  out bcast pkts 2308      out bcast bytes 747792
  pvc create time 1d16h, last time pvc status changed 1d16h
  cir 64000     bc 64000     be 32000     byte limit 5000   interval 125
  mincir 32000     byte increment 1000  Adaptive Shaping none
  pkts 12        bytes 3888      pkts delayed 0         bytes delayed 0
  shaping inactive
  traffic shaping drops 0
  Queueing strategy:fifo
  Output queue 0/40, 0 drop, 0 dequeued
```

Related Commands

Command	Description
frame-relay bc	Specifies the incoming or outgoing Bc for a Frame Relay VC.
frame-relay be	Sets the incoming or outgoing Be for a Frame Relay VC.
frame-relay cir	Specifies the incoming or outgoing CIR for a Frame Relay VC.

frame-relay traffic-shaping

To enable both traffic shaping and per-virtual circuit queueing for all permanent virtual circuits (PVCs) and switched virtual circuits (SVCs) on a Frame Relay interface, use the **frame-relay traffic-shaping** interface configuration command. To disable traffic shaping and per-virtual circuit queueing, use the **no** form of this command.

frame-relay traffic-shaping

no frame-relay traffic-shaping

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

For virtual circuits (VCs) for which no specific traffic-shaping or queueing parameters are specified, a set of default values are used. The default queueing is performed on a first-come, first-served basis.

The default committed information rate (CIR) of 56K will apply in the following situations:

- When traffic shaping is enabled (by using the **frame-relay traffic-shaping** command), but a map class is not assigned to the VC
- When traffic shaping is enabled (by using the **frame-relay traffic-shaping** command) and a map class is assigned to the VC, but traffic-shaping parameters have not been defined in the map class

Frame Relay traffic shaping is not effective for Layer 2 PVC switching using the **frame-relay route** command.

Examples

The following example enables both traffic shaping and per-virtual circuit queueing:

```
frame-relay traffic-shaping
```

Related Commands

Command	Description
frame-relay class	Associates a map class with an interface or subinterface.
frame-relay custom-queue-list	Specifies a custom queue to be used for the VC queueing associated with a specified map class.
frame-relay priority-group	Assigns a priority queue to VCs associated with a map class, rather than the default first-come-first-served queueing.

Command	Description
frame-relay traffic-rate	Configures all the traffic shaping characteristics of a VC in a single command.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

interface fr-atm

To create a Frame Relay-ATM Interworking interface on the Cisco MC3810 and to enter Frame Relay-ATM Interworking configuration mode, use the **interface fr-atm** global configuration command. To delete the Frame Relay-ATM Interworking interface, use the **no** form of this command.

interface fr-atm *number*

no interface fr-atm *number*

Syntax Description

number	The Frame Relay-ATM Interworking interface number. Valid range is from 0 to 20.

Defaults

Frame Relay-ATM Interworking interface 20 is configured by default.

Command Modes

Global configuration

Command History

Release	Modification
11.3 MA	This command was introduced.

Usage Guidelines

This command applies to Frame Relay-ATM Interworking on the Cisco MC3810 only.

Use the **interface fr-atm** command to enter Frame Relay-ATM interworking interface configuration mode. When you issue this command for the first time, an interface number is created dynamically. You can configure up to 21 Frame Relay-ATM interworking interfaces.

Note The Cisco MC3810 provides only *network interworking* (FRF.5). The Cisco MC3810 can be used with *service interworking* (FRF.8), which is provided by the carrier's ATM network equipment.

Examples

The following example configures Frame Relay-ATM Interworking interface number 20:

```
interface fr-atm 20
```

Related Commands

Command	Description
fr-atm connect dlci	Maps a Frame Relay DLCI to an ATM virtual circuit descriptor for FRF.5 Frame Relay-ATM internetworking.

keepalive (LMI)

To enable the Local Management Interface (LMI) mechanism for serial lines using Frame Relay encapsulation, use the **keepalive** interface configuration command. To disable this capability, use the **no** form of this command.

keepalive *number*

no keepalive

Syntax Description

number	Number of seconds that defines the keepalive interval. The interval must be set as a positive integer that is less than the interval set on the switch; see the **frame-relay lmi-t392dce** command description earlier in this chapter.

Defaults

10 seconds

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

The **keepalive** command enables the keepalive sequence, which is part of the LMI protocol.

Note When booting from a network server over Frame Relay, you might need to disable keepalives.

Examples

The following example sets the keepalive timer on the server for a period that is two or three seconds faster (has a shorter interval) than the interval set on the keepalive timer of the Frame Relay switch. The difference in keepalive intervals ensures proper synchronization between the Cisco server and the Frame Relay switch.

```
interface serial 3
 keepalive 8
```

Related Commands

Command	Description
frame-relay lmi-t392dce	Sets the polling verification timer on a DCE or NNI interface.

map-class frame-relay

To specify a map class to define quality of service (QoS) values for a switched virtual circuit (SVC), use the **map-class frame-relay** global configuration command.

map-class frame-relay *map-class-name*

Syntax Description

map-class-name	Name of this map class.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

After you specify the named map class, you can specify the QoS parameters—such as incoming and outgoing committed information rate (CIR), committed burst rate, excess burst rate, and the idle timer—for the map class.

To specify the protocol-and-address combination to which the QoS parameters are to be applied, associate this map class with the static maps under a map list.

Examples

The following example specifies a map class called “hawaii” and defines three QoS parameters for it. The “hawaii” map class is associated with a protocol-and-address static map defined under the **map-list** command.

```
map-list bermuda source-addr E164 123456 dest-addr E164 654321
 ip 10.108.177.100 class hawaii
 appletalk 1000.2 class hawaii

map-class frame-relay hawaii
 frame-relay cir in 2000000
 frame-relay cir out 56000
 frame-relay be out 9000
```

Related Commands

Command	Description
frame-relay bc	Specifies the incoming or outgoing Bc for a Frame Relay VC.
frame-relay be	Sets the incoming or outgoing Be for a Frame Relay VC.
frame-relay cir	Specifies the incoming or outgoing CIR for a Frame Relay VC.
frame-relay idle-timer	Specifies the idle timeout interval for an SVC.

map-group

To associate a map list with a specific interface, use the **map-group** interface configuration command.

map-group *group-name*

Syntax Description

group-name	Name used in a **map-list** command.

Defaults

Disabled. No map group name is defined.

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

A map-group association with an interface is required for switched virtual circuit (SVC) operation. In addition, a map list must be configured.

The **map-group** command applies to the interface or subinterface on which it is configured. The associated E.164 or X.121 address is defined by the **map-list** command, and the associated protocol addresses are defined by using the **class** command under the **map-list** command.

Examples

The following example configures a physical interface, applies a map group to the physical interface, and then defines the map group:

```
interface serial 0
 ip address 172.10.8.6
 encapsulation frame-relay
 map-group bermuda
 frame-relay lmi-type q933a
 frame-relay svc

map-list bermuda source-addr E164 123456 dest-addr E164 654321
 ip 131.108.177.100 class hawaii
 appletalk 1000.2 class rainbow
```

Related Commands

Command	Description
class (map-list)	Associates a map class with a protocol-and-address combination.
map-list	Specifies a map group and link it to a local E.164 or X.121 source address and a remote E.164 or X.121 destination address for Frame Relay SVCs.

map-list

To specify a map group and link it to a local E.164 or X.121 source address and a remote E.164 or X.121 destination address for Frame Relay switched virtual circuits (SVCs), use the **map-list** global configuration command. To delete a previous map-group link, use the **no** form of this command.

map-list *map-group-name* **source-addr** {**e164** | **x121**} *source-address* **dest-addr** {**e164** | **x121**} *destination-address*

no map-list *map-group-name* **source-addr** {**e164** | **x121**} *source-address* **dest-addr** {**e164** | **x121**} *destination-address*

Syntax Description

map-group-name	Name of the map group. This map group must be associated with a physical interface.
source-addr {**e164** | **x121**}	Type of source address.
source-address	Address of the type specified (E.164 or X.121).
dest-addr {**e164** | **x121**}	Type of destination address.
destination-address	Address of the type specified (E.164 or X.121).

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Use the **map-class** command and its subcommands to define quality of service (QoS) parameters—such as incoming and outgoing committed information rate (CIR), committed burst rate, excess burst rate, and the idle timer—for the static maps defined under a map list.

Each SVC needs to use a source and destination number, in much the same way that a public telephone network needs to use source and destination numbers. These numbers allow the network to route calls from a specific source to a specific destination. This specification is done through map lists.

Depending on switch configuration, addressing can take either of two forms: E.164 or X.121.

An X.121 address number is 14 digits long and has the following form:

```
Z CC P NNNNNNNNNN
```

Table 27 describes the codes in an X.121 address number form.

Table 27 X.121 Address Numbers

Code	Meaning	Value
Z	Zone code	3 for North America
C	Country code	10–16 for the United States
P	Public data network (PDN) code	Provided by the PDN
N	10-digit number	Set by the network for the specific destination

An E.164 number has a variable length; the maximum length is 15 digits. An E.164 number has the fields shown in Figure 2 and described in Table 28.

Figure 2 E.164 Address Format

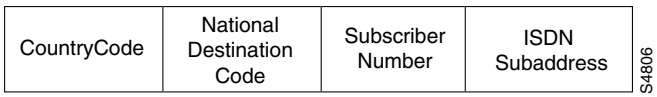


Table 28 E.164 Address Field Descriptions

Field	Description
Country code	Can be 1, 2, or 3 digits long. Some current values are the following: • Code 1—United States of America • Code 44—United Kingdom • Code 61—Australia
National destination code + subscriber number	Referred to as the National ISDN number; the maximum length is 12, 13, or 14 digits, based on the country code.
ISDN subaddress	Identifies one of many devices at the termination point. An ISDN subaddress is similar to an extension on a PBX.

Examples

In the following SVC example, if IP or AppleTalk triggers the call, the SVC is set up with the QoS parameters defined within the class “hawaii”. An SVC triggered by either protocol results in two SVC maps, one for IP and one for AppleTalk. Two maps are set up because these protocol-and-address combinations are heading for the same destination, as defined by the **dest-addr** keyword and the values following it in the **map-list** command.

```
map-list bermuda source-addr E164 123456 dest-addr E164 654321
 ip 131.108.177.100 class hawaii
 appletalk 1000.2 class hawaii
```

Related Commands

Command	Description
class (map-list)	Associates a map class with a protocol-and-address combination.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

show frame-relay end-to-end keepalive

To display statistics about Frame Relay end-to-end keepalive, use the **show frame-relay end-to-end keepalive** EXEC command.

show frame-relay end-to-end keepalive [*interface* [*DLCI*]]

Syntax Description

interface	(Optional) Interface to display.
DLCI	(Optional) DLCI to display.

Defaults

If no interface is specified, show all interfaces.

Command Modes

EXEC

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

Use this command to display the keepalive status of an interface.

Examples

The following example shows output from the **show frame-relay end-to-end keepalive** command:

```
Router# show frame-relay end-to-end keepalive interface s1

End-to-end Keepalive Statistics for Interface Serial1 (Frame Relay DTE)
DLCI = 100, DLCI USAGE = LOCAL, VC STATUS = STATIC (EEK UP)

SEND SIDE STATISTICS
Send Sequence Number: 86,       Receive Sequence Number: 87
Configured Event Window: 3,     Configured Error Threshold: 2
Total Observed Events: 90,      Total Observed Errors: 34
Monitored Events: 3,            Monitored Errors: 0
Successive Successes: 3,        End-to-end VC Status: UP

RECEIVE SIDE STATISTICS
Send Sequence Number: 88,       Receive Sequence Number: 87
Configured Event Window: 3,     Configured Error Threshold: 2
Total Observed Events: 90,      Total Observed Errors: 33
Monitored Events: 3,            Monitored Errors: 0
Successive Successes: 3,        End-to-end VC Status: UP
```

Related Commands

Command	Description
frame-relay end-to-end keepalive error-threshold	Modifies the keepalive error threshold value.
frame-relay end-to-end keepalive event-window	Modifies the keepalive event window value.
frame-relay end-to-end keepalive mode	Enables Frame Relay end-to-end keepalives.

Command	Description
frame-relay end-to-end keepalive success-events	Modifies the keepalive success events value.
frame-relay end-to-end keepalive timer	Modifies the keepalive timer.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

show frame-relay fragment

To display information about the Frame Relay fragmentation, use the **show frame-relay fragment** command in privileged EXEC mode.

show frame-relay fragment [**interface** *interface* [*DLCI*]]

Syntax Description

interface	(Optional) Indicates a specific interface for which Frame Relay fragmentation information will be displayed.
interface	(Optional) Interface number containing the DLCI(s) for which you wish to display fragmentation information.
DLCI	(Optional) Specific DLCI for which you wish to display fragmentation information.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(4)T	This command was introduced.
12.1(2)E	Support was added for Cisco 7500 series routers with Versatile Interface Processors.
12.1(5)T	Support was added for Cisco 7500 series routers with Versatile Interface Processors running 12.1(5)T.

Usage Guidelines

When no parameters are specified with this command, the output displays a summary of each data-link connection identifier (DLCI) configured for fragmentation. The information displayed includes the fragmentation type, the configured fragment size, and the number of fragments transmitted, received, and dropped.

When a specific interface and DLCI are specified, additional details are displayed.

Examples

The following is sample output for the **show frame-relay fragment** command without any parameters specified:

```
Router# show frame-relay fragment

interface         dlci  frag-type    frag-size  in-frag    out-frag   dropped-frag
Serial0           108   VoFR-cisco   100        1261       1298       0
Serial0           109   VoFR         100        0          243        0
Serial0           110   end-to-end   100        0          0          0
```

The following is sample output for the **show frame-relay fragment** command when an interface and DLCI are specified:

```
Router# show frame-relay fragment interface Serial1/0 16

  fragment-size 45                  fragment type end-to-end
  in fragmented pkts 0              out fragmented pkts 0
```

```
in fragmented bytes 0              out fragmented bytes 0
in un-fragmented pkts 0            out un-fragmented pkts 0
in un-fragmented bytes 0           out un-fragmented bytes 0
in assembled pkts 0                out pre-fragmented pkts 0
in assembled bytes 0               out pre-fragmented bytes
in dropped reassembling pkts 0     out dropped fragmenting pkts 0
in timeouts 0
in out-of-sequence fragments 0
in fragments with unexpected B bit set 0
out interleaved packets 0
```

Table 29 describes the fields shown in the display.

Table 29 show frame-relay fragment Field Descriptions

Field	Description
interface	Subinterface containing the DLCI for which the fragmentation information pertains.
dlci	Data-link connection identifier for which the displayed fragmentation information applies.
frag-type	Type of fragmentation configured on the designated DLCI. Supported types are end-to-end, VoFR, and VoFR-cisco.
frag-size	Configured fragment size in bytes.
in-frag	Total number of fragments received by the designated DLCI.
out-frag	Total number of fragments sent by the designated DLCI.
dropped-frag	Total number of fragments dropped by the designated DLCI.
in/out fragmented pkts	Total number of frames received/sent by this DLCI that have a fragmentation header.
in/out fragmented bytes	Total number of bytes, including those in the Frame Relay headers, that have been received/sent by this DLCI.
in/out un-fragmented pkts	Number of frames received/sent by this DLCI that do not require reassembly, and therefore do not contain the FRF.12 header. These counters can be incremented only when the end-to-end fragmentation type is set.
in/out un-fragmented bytes	Number of bytes received/sent by this DLCI that do not require reassembly, and therefore do not contain the FRF.12 header. These counters can be incremented only when the end-to-end fragmentation type is set.
in assembled pkts	Total number of fully reassembled frames received by this DLCI, including the frames received without a Frame Relay fragmentation header (in unfragmented packets). This counter corresponds to the frames viewed by the upper-layer protocols.
out pre-fragmented pkts	Total number of fully reassembled frames transmitted by this DLCI, including the frames transmitted without a Frame Relay fragmentation header (out un-fragmented pkts).

Table 29 show frame-relay fragment Field Descriptions (continued)

Field	Description
in assembled bytes	Number of bytes in the fully reassembled frames received by this DLCI, including the frames received without a Frame Relay fragmentation header (in un-fragmented bytes). This counter corresponds to the total number of bytes viewed by the upper-layer protocols.
out pre-fragmented bytes	Number of bytes in the fully reassembled frames transmitted by this DLCI, including the frames sent without a Frame Relay fragmentation header (out un-fragmented bytes). This counter corresponds to the total number of bytes viewed by the upper-layer protocols.
in dropped reassembling pkts	Number of fragments received by this DLCI that are dropped for reasons such as running out of memory, receiving segments out of sequence, receiving an unexpected frame with a B bit set, or timing out on a reassembling frame.
out dropped fragmenting pkts	Number of fragments that are dropped by this DLCI during transmission because of running out of memory.
in timeouts	Number of reassembly timeouts that have occurred on incoming frames to this DLCI. (A frame that does not fully reassemble within two minutes is dropped, and the timeout counter is incremented.)
in out-of-sequence fragments	Number of fragments received by this DLCI that have an unexpected sequence number.
in fragments with unexpected B bit set	Number of fragments received by this DLCI that have an unexpected B bit set. When this occurs, all fragments being reassembled are dropped and a new frame is begun with this fragment.
out interleaved packets	Number of packets leaving this DLCI that have been interleaved between segments.

Related Commands

Command	Description
frame-relay fragment	Enables fragmentation of Frame Relay frames for a Frame Relay map class.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.
show frame-relay vofr	Displays details about FRF.11 subchannels being used on Voice over Frame Relay DLCIs.
show interfaces serial	Displays information about a serial interface.
show traffic-shape queue	Displays information about the elements queued at a particular time at the VC level.

show frame-relay ip tcp header-compression

To display statistics and TCP/IP header compression information for the interface, use the **show frame-relay ip tcp header-compression** EXEC command.

show frame-relay ip tcp header-compression

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.3	This command was introduced.

Examples

The following is sample output from the **show frame-relay ip tcp header-compression** command:

```
Router# show frame-relay ip tcp header-compression

DLCI 200          Link/Destination info: ip 10.108.177.200
Interface Serial0:
Rcvd:     40 total, 36 compressed, 0 errors
          0 dropped, 0 buffer copies, 0 buffer failures
Sent:     0 total, 0 compressed
          0 bytes saved, 0 bytes sent
Connect:  16 rx slots, 16 tx slots, 0 long searches, 0 misses, 0% hit ratio
          Five minute miss rate 0 misses/sec, 0 max misses/sec
```

Table 30 describes the fields shown in the display.

Table 30 show frame-relay ip tcp header-compression Field Descriptions

Field	Description
Rcvd:	Table of details concerning received packets.
total	Sum of compressed and uncompressed packets received.
compressed	Number of compressed packets received.
errors	Number of errors caused by errors in the header fields (version, total length, or IP checksum).
dropped	Number of packets discarded. Seen only after line errors.
buffer copies	Number of times that a new buffer was needed to put the uncompressed packet in.
buffer failures	Number of times that a new buffer was needed but was not obtained.

Table 30 show frame-relay ip tcp header-compression Field Descriptions (continued)

Field	Description
Sent:	Table of details concerning sent packets.
total	Sum of compressed and uncompressed packets sent.
compressed	Number of compressed packets sent.
bytes saved	Number of bytes reduced because of the compression.
bytes sent	Actual number of bytes transmitted.
Connect:	Table of details about the connections.
rx slots, tx slots	Number of states allowed over one TCP connection. A state is recognized by a source address, a destination address, and an IP header length.
long searches	Number of times that the connection ID in the incoming packet was not the same as the previous one that was processed.
misses	Number of times that a matching entry was not found within the connection table and a new entry had to be entered.
hit ratio	Percentage of times that a matching entry was found in the compression tables and the header was compressed.
Five minute miss rate	Miss rate computed over the most recent 5 minutes and the maximum per-second miss rate during that period.

show frame-relay lapf

To display information about the status of the internals of Frame Relay Layer 2 (LAPF) if switched virtual circuits (SVCs) are configured, use the **show frame-relay lapf** EXEC command.

show frame-relay lapf

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Examples

The following is sample output from the **show frame-relay lapf** command.

```
Router# show frame-relay lapf

Interface = Serial1 (up),  LAPF state = TEI_ASSIGNED (down)
SVC disabled, link down cause = LMI down,  #link-reset = 0
T200 = 1.5 sec.,  T203 = 30 sec.,  N200 = 3,  k = 7,  N201 = 260
I xmt = 0, I rcv = 0, I reXmt = 0, I queued = 0
I xmt dropped = 0,  I rcv dropped = 0,  Rcv pak dropped = 0
RR xmt = 0,  RR rcv = 0,  RNR xmt = 0,  RNR rcv = 0
REJ xmt = 0,  REJ rcv = 0,  FRMR xmt = 0,  FRMR rcv = 0
DM xmt = 0,  DM rcv = 0,  DISC xmt = 0,  DISC rcv = 0
SABME xmt = 0,  SABME rcv = 0,  UA xmt = 0,  UA rcv = 0
V(S) = 0,  V(A) = 0,  V(R) = 0,  N(S) = 0,  N(R) = 0
Xmt FRMR at Frame Reject
```

Table 31 describes significant fields in this output.

Table 31 show frame-relay lapf Field Descriptions

Field	Description
Interface	Identifies the interface and indicates the line status (up, down, administratively down).
LAPF state	A LAPF state of MULTIPLE FRAME ESTABLISHED or RIMER_RECOVERY indicates that Layer 2 is functional. Others, including TEI_ASSIGNED, AWAITING_ESTABLISHMENT, and AWAITING_RELEASE, indicate that Layer 2 is not functional.
SVC disabled	Indicates whether SVCs are enabled or disabled.
link down cause	Indicates the reason that the link is down. For example, N200 error, memory out, peer disconnect, LMI down, line down, and SVC disabled. Many other causes are described in the Q.922 specification.
#link-reset	Number of times the Layer 2 link has been reset.
T200, T203, N200, k, N201	Values of Layer 2 parameters.

Table 31 show frame-relay lapf Field Descriptions (continued)

Field	Description
I xmt, I rcv, I reXmt, I queued	Number of I frames sent, received, retransmitted, and queued for transmission, respectively.
I xmt dropped	Number of sent I frames that were dropped.
I rcv dropped	Number of I frames received over DLCI 0 that were dropped.
Rcv pak dropped	Number of received packets that were dropped.
RR xmt, RR rcv	Number of RR frames sent; number of RR frames received.
RNR xmt, RNR rcv	Number of RNR frames sent; number of RNR frames received.
REJ xmt, REJ rcv	Number of REJ frames sent; number of REJ frames received.
FRMR xmt, FRMR rcv	Number of FRMR frames sent; number of FRMR frames received.
DM xmt, DM rcv	Number of DM frames sent; number of DM frames received.
DISC xmt, DISC rcv	Number of DISC frames sent; number of DISC frames received.
SABME xmt, SABME rcv	Number of SABME frames sent; number of SABME frames received.
UA xmt, UA rcv	Number of UA frames sent; number of UA frames received.
V(S) 0, V(A) 0, V(R) 0, N(S) 0, N(R) 0	Layer 2 sequence numbers.
Xmt FRMR at Frame Reject	Indicates whether the FRMR frame is sent at Frame Reject.

show frame-relay lmi

To display statistics about the Local Management Interface (LMI), use the **show frame-relay lmi** EXEC command.

show frame-relay lmi [*type number*]

Syntax Description

type	(Optional) Interface type; it must be serial.
number	(Optional) Interface number.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Enter the command without arguments to obtain statistics about all Frame Relay interfaces.

Examples

The following is sample output from the **show frame-relay lmi** command when the interface is a data terminal equipment (DTE) device:

```
Router# show frame-relay lmi

LMI Statistics for interface Serial1 (Frame Relay DTE) LMI TYPE = ANSI
  Invalid Unnumbered info 0             Invalid Prot Disc 0
  Invalid dummy Call Ref 0              Invalid Msg Type 0
  Invalid Status Message 0              Invalid Lock Shift 0
  Invalid Information ID 0              Invalid Report IE Len 0
  Invalid Report Request 0              Invalid Keep IE Len 0
  Num Status Enq. Sent 9                Num Status msgs Rcvd 0
  Num Update Status Rcvd 0              Num Status Timeouts 9
```

The following is sample output from the **show frame-relay lmi** command when the interface is a Network-to-Network Interface (NNI):

```
Router# show frame-relay lmi

LMI Statistics for interface Serial3 (Frame Relay NNI) LMI TYPE = CISCO
  Invalid Unnumbered info 0             Invalid Prot Disc 0
  Invalid dummy Call Ref 0              Invalid Msg Type 0
  Invalid Status Message 0              Invalid Lock Shift 0
  Invalid Information ID 0              Invalid Report IE Len 0
  Invalid Report Request 0              Invalid Keep IE Len 0
  Num Status Enq. Rcvd 11               Num Status msgs Sent 11
  Num Update Status Rcvd 0              Num St Enq. Timeouts 0
  Num Status Enq. Sent 10               Num Status msgs Rcvd 10
  Num Update Status Sent 0              Num Status Timeouts 0
```

Table 32 describes significant fields shown in the output.

Table 32 show frame-relay lmi Field Descriptions

Field	Description
LMI Statistics	Signalling or LMI specification: CISCO, ANSI, or ITU-T.
Invalid Unnumbered info	Number of received LMI messages with invalid unnumbered information field.
Invalid Prot Disc	Number of received LMI messages with invalid protocol discriminator.
Invalid dummy Call Ref	Number of received LMI messages with invalid dummy call references.
Invalid Msg Type	Number of received LMI messages with invalid message type.
Invalid Status Message	Number of received LMI messages with invalid status message.
Invalid Lock Shift	Number of received LMI messages with invalid lock shift type.
Invalid Information ID	Number of received LMI messages with invalid information identifier.
Invalid Report IE Len	Number of received LMI messages with invalid Report IE Length.
Invalid Report Request	Number of received LMI messages with invalid Report Request.
Invalid Keep IE Len	Number of received LMI messages with invalid Keep IE Length.
Num Status Enq. Sent	Number of LMI status inquiry messages sent.
Num Status Msgs Rcvd	Number of LMI status messages received.
Num Update Status Rcvd	Number of LMI asynchronous update status messages received.
Num Status Timeouts	Number of times the status message was not received within the keepalive time value.
Num Status Enq. Rcvd	Number of LMI status enquiry messages received.
Num Status Msgs Sent	Number of LMI status messages sent.
Num Status Enq. Timeouts	Number of times the status enquiry message was not received within the T392 DCE timer value.
Num Update Status Sent	Number of LMI asynchronous update status messages sent.

show frame-relay map

To display the current map entries and information about the connections, use the **show frame-relay map** EXEC command.

show frame-relay map

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show frame-relay map** command:

```
Router# show frame-relay map

Serial 1 (administratively down): ip 10.108.177.177
dlci 177 (0xB1,0x2C10), static,
broadcast,
CISCO
TCP/IP Header Compression (inherited), passive (inherited)
```

Table 33 describes significant fields shown in the display.

Table 33 show frame-relay map Field Descriptions

Field	Description
Serial 1 (administratively down)	Identifies a Frame Relay interface and its status (up or down).
ip 131.108.177.177	Destination IP address.
dlci 177 (0xB1,0x2C10)	DLCI that identifies the logical connection being used to reach this interface. This value is displayed in three ways: its decimal value (177), its hexadecimal value (0xB1), and its value as it would appear on the wire (0x2C10).
static	Indicates whether this is a static or dynamic entry.
CISCO	Indicates the encapsulation type for this map; either CISCO or IETF.
TCP/IP Header Compression (inherited), passive (inherited)	Indicates whether the TCP/IP header compression characteristics were inherited from the interface or were explicitly configured for the IP map.

Related Commands

Command	Description
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.

show frame-relay pvc

To display statistics about permanent virtual circuits (PVCs) for Frame Relay interfaces, use the **show frame-relay pvc** privileged EXEC command.

show frame-relay pvc [**interface** *interface*] [*dlci*]

Syntax Description

interface	(Optional) Indicates a specific interface for which PVC information will be displayed.
interface	(Optional) Interface number containing the data-link connection identifiers (DLCIs) for which you wish to display PVC information.
dlci	(Optional) A specific DLCI number used on the interface. Statistics for the specified PVC are displayed when a DLCI is also specified.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.0(1)T	This command was modified to display statistics about virtual access interfaces used for PPP connections over Frame Relay.
12.0(3)XG	This command was modified to include the fragmentation type and size associated with a particular PVC when fragmentation is enabled on the PVC.
12.0(4)T	This command was modified to include the fragmentation type and size associated with a particular PVC when fragmentation is enabled on the PVC.
12.0(5)T	This command was modified to include information on the special voice queue that is created using the **queue** keyword of the **frame-relay voice bandwidth** command.
12.1(2)T	This command was modified to display the following information: • Details about the policy map attached to a specific PVC. • The priority configured for PVCs within Frame Relay PIPQ. • Details about Frame Relay traffic shaping and policing on switched PVCs.
12.0(12)S	This command was modified to display reasons for packet drops and complete status information for switched NNI PVCs.
12.1(5)T	This command was modified to display the following information: • The number of packets in the post-hardware-compression queue. • The reasons for packet drops and complete status information for switched NNI PVCs.
12.0(17)S	This command was modified to display the number of outgoing packets dropped and the number of outgoing bytes dropped because of QoS policy.

Release	Modification
12.2 T	This command was modified to show that when payload compression is configured for a PVC, the throughput rate reported by the PVC is equal to the rate reported by the interface.
12.2(11)T	This command was modified to display the number of outgoing packets dropped and the number of outgoing bytes dropped because of QoS policy.

Usage Guidelines

Use this command to monitor the PPP link control protocol (LCP) state as being open with an "up" state, or closed with a "down" state.

When "vofr" or "vofr cisco" has been configured on the PVC, and a voice bandwidth has been allocated to the class associated with this PVC, configured voice bandwidth and used voice bandwidth are also displayed.

Statistics Reporting

To obtain statistics about PVCs on all Frame Relay interfaces, use this command with no arguments. When you use the show frame-relay pvc command with no arguments or with the *interface* argument, a table will display that shows the number of PVCs in the various states.

To obtain statistics about a PVC that include policy-map configuration or the priority configured for that PVC, use this command with the *dlci* argument.

Per-VC counters are not incremented at all when either autonomous or silicon switching engine (SSE) switching is configured; therefore, PVC values will be inaccurate if either switching method is used.

Traffic Shaping

Congestion control mechanisms are currently not supported on terminated PVCs nor on PVCs over ISDN. Where congestion control mechanisms are supported, the switch passes forward explicit congestion notification (FECN) bits, backward explicit congestion notification (BECN) bits, and discard eligible (DE) bits unchanged from entry to exit points in the network.

Examples

The displays in this section show sample output for a variety of PVCs. Some of the PVCs carry data only; some carry a combination of voice and data.

Frame Relay Generic Configuration Example

The following sample output shows a generic Frame Relay configuration on DLCI 100:

```
Router# show frame-relay pvc 100

PVC Statistics for interface Serial4/0/1:0 (Frame Relay DTE)

DLCI = 100, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE (EEK UP), INTERFACE = Serial4/0/1:0.1

  input pkts 4360          output pkts 4361         in bytes 146364
  out bytes 130252         dropped pkts 3735        in pkts dropped 0
  out pkts dropped 3735             out bytes dropped 1919790
  late-dropped out pkts 3735        late-dropped out bytes 1919790
  in FECN pkts 0           in BECN pkts 0           out FECN pkts 0
  out BECN pkts 0          in DE pkts 0             out DE pkts 0
  out bcast pkts 337       out bcast bytes 102084
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
  pvc create time 05:34:06, last time pvc status changed 05:33:38
```

Multiple Frame Relay PVCs Example

The following is sample output for the **show frame-relay pvc** command with no arguments. Statistics for all of the PVCs on all of the interfaces are displayed.

```
PVC Statistics for interface Serial2/1 (Frame Relay DTE)

               Active     Inactive      Deleted       Static
   Local        115           0            0            0
   Switched       0           0            0            0
   Unused         0           0            0            0

 DLCI = 100, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial2/1

   input pkts 12             output pkts 7             in bytes 4406
   out bytes 1366            dropped pkts 0            in FECN pkts 0
   in BECN pkts 0            out FECN pkts 0           out BECN pkts 0
   in DE pkts 0              out DE pkts 0
   out bcast pkts 7           out bcast bytes 1366
   pvc create time 1d04h, last time pvc status changed 00:30:32
  --More--
```

Frame Relay Fragmentation and Hardware Compression Example

The following is sample output for the **show frame-relay pvc** command for a PVC configured with Cisco-proprietary fragmentation and hardware compression:

```
Router# show frame-relay pvc 110

PVC Statistics for interface Serial0/0 (Frame Relay DTE)

DLCI = 110, DLCI USAGE = LOCAL, PVC STATUS = STATIC, INTERFACE = Serial0/0

  input pkts 409            output pkts 409           in bytes 3752
  out bytes 4560            dropped pkts 1            in FECN pkts 0
  in BECN pkts 0            out FECN pkts 0           out BECN pkts 0
  in DE pkts 0              out DE pkts 0
  out bcast pkts 0           out bcast bytes 0
  pvc create time 3d00h, last time pvc status changed 2d22h
  Service type VoFR-cisco
   Voice Queueing Stats: 0/100/0 (size/max/dropped)
  Post h/w compression queue: 0
  Current fair queue configuration:
   Discard     Dynamic      Reserved
   threshold   queue count  queue count
   64          16           2
  Output queue size 0/max total 600/drops 0
  configured voice bandwidth 16000, used voice bandwidth 0
  fragment type VoFR-cisco          fragment size 100
  cir 64000     bc   640       be 0          limit 80     interval 10
  mincir 32000     byte increment 80    BECN response no
  frags 428       bytes 4810      frags delayed 24        bytes delayed 770
  shaping inactive
  traffic shaping drops 0
  ip rtp priority parameters 16000 32000 20000
```

Switched PVC Example

The following is sample output from the **show frame-relay pvc** command for a switched Frame Relay PVC. This output displays detailed information about NNI status and why packets were dropped from switched PVCs.

```
Router# show frame-relay pvc

 PVC Statistics for interface Serial2/2 (Frame Relay NNI)
```

```
DLCI = 16, DLCI USAGE = SWITCHED, PVC STATUS = INACTIVE, INTERFACE = Serial2/2
LOCAL PVC STATUS = INACTIVE, NNI PVC STATUS = INACTIVE

  input pkts 0             output pkts 0            in bytes 0
  out bytes 0              dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  out bcast pkts 0         out bcast bytes 0
  switched pkts0
  Detailed packet drop counters:
  no out intf 0            out intf down 0          no out PVC 0
  in PVC down 0            out PVC down 0           pkt too big 0
  shaping Q full 0         pkt above DE 0           policing drop 0
  pvc create time 00:00:07, last time pvc status changed 00:00:07
```

Frame Relay Congestion Management on a Switched PVC Example

The following is sample output from the **show frame-relay pvc** command that shows the statistics for a switched PVC on which Frame Relay congestion management is configured:

```
Router# show frame-relay pvc 200

PVC Statistics for interface Serial3/0 (Frame Relay DTE)

DLCI = 200, DLCI USAGE = SWITCHED, PVC STATUS = ACTIVE, INTERFACE = Serial3/0

  input pkts 341           output pkts 390          in bytes 341000
  out bytes 390000         dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 390
  out bcast pkts 0          out bcast bytes 0            Num Pkts Switched 341

  pvc create time 00:10:35, last time pvc status changed 00:10:06
  Congestion DE threshold 50
  shaping active
  cir 56000     bc 7000      be 0         byte limit 875    interval 125
  mincir 28000     byte increment 875   BECN response no
  pkts 346       bytes 346000    pkts delayed 339       bytes delayed 339000
  traffic shaping drops 0
  Queueing strategy:fifo
  Output queue 48/100, 0 drop, 339 dequeued
```

Frame Relay Policing on a Switched PVC Example

The following is sample output from the **show frame-relay pvc** command that shows the statistics for a switched PVC on which Frame Relay policing is configured:

```
Router# show frame-relay pvc 100

PVC Statistics for interface Serial1/0 (Frame Relay DCE)

DLCI = 100, DLCI USAGE = SWITCHED, PVC STATUS = ACTIVE, INTERFACE = Serial1/0

  input pkts 1260          output pkts 0            in bytes 1260000
  out bytes 0              dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  out bcast pkts 0          out bcast bytes 0            Num Pkts Switched 1260

  pvc create time 00:03:57, last time pvc status changed 00:03:19
  policing enabled, 180 pkts marked DE
  policing Bc  6000        policing Be  6000        policing Tc  125 (msec)
```

```
  in Bc pkts   1080        in Be pkts   180         in xs pkts   0
  in Bc bytes  1080000     in Be bytes  180000      in xs bytes  0
```

Frame Relay PVC Priority Queueing Example

The following is sample output for a PVC that has been assigned high priority:

```
Router# show frame-relay pvc 100

PVC Statistics for interface Serial0 (Frame Relay DTE)

DLCI = 100, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0

  input pkts 0             output pkts 0            in bytes 0
  out bytes 0              dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  out bcast pkts 0          out bcast bytes 0
  pvc create time 00:00:59, last time pvc status changed 00:00:33
  priority high
```

Low Latency Queueing for Frame Relay Example

The following is sample output from the **show frame-relay pvc** command for a PVC shaped to a 64K committed information rate (CIR) with fragmentation. A policy map is attached to the PVC and is configured with a priority class for voice, two data classes for IP precedence traffic, and a default class for best-effort traffic. Weighted Random Early Detection (WRED) is used as the drop policy on one of the data classes.

```
Router# show frame-relay pvc 100

PVC Statistics for interface Serial1/0 (Frame Relay DTE)

DLCI = 100, DLCI USAGE = LOCAL, PVC STATUS = INACTIVE, INTERFACE = Serial1/0.1

  input pkts 0             output pkts 0            in bytes 0
  out bytes 0              dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  out bcast pkts 0          out bcast bytes 0
  pvc create time 00:00:42, last time pvc status changed 00:00:42
  service policy mypolicy
 Class voice
  Weighted Fair Queueing
      Strict Priority
      Output Queue: Conversation 72
        Bandwidth 16 (kbps) Packets Matched 0
        (pkts discards/bytes discards) 0/0
 Class immediate-data
  Weighted Fair Queueing
      Output Queue: Conversation 73
        Bandwidth 60 (%) Packets Matched 0
        (pkts discards/bytes discards/tail drops) 0/0/0
        mean queue depth: 0
        drops: class  random   tail     min-th   max-th   mark-prob
               0      0        0        64       128      1/10
               1      0        0        71       128      1/10
               2      0        0        78       128      1/10
               3      0        0        85       128      1/10
               4      0        0        92       128      1/10
               5      0        0        99       128      1/10
               6      0        0        106      128      1/10
               7      0        0        113      128      1/10
               rsvp   0        0        120      128      1/10
```

```
 Class priority-data
  Weighted Fair Queueing
      Output Queue: Conversation 74
        Bandwidth 40 (%) Packets Matched 0 Max Threshold 64 (packets)
        (pkts discards/bytes discards/tail drops) 0/0/0
 Class class-default
  Weighted Fair Queueing
      Flow Based Fair Queueing
      Maximum Number of Hashed Queues 64  Max Threshold 20 (packets)
  Output queue size 0/max total 600/drops 0
  fragment type end-to-end         fragment size 50
  cir 64000     bc   640       be 0         limit 80     interval 10
  mincir 64000     byte increment 80    BECN response no
  frags 0         bytes 0         frags delayed 0         bytes delayed 0
  shaping inactive
  traffic shaping drops 0
```

PPP over Frame Relay Example

The following is sample output from the **show frame-relay pvc** command that shows the PVC statistics for serial interface 5 (slot 1 and DLCI 55 are up) during a PPP session over Frame Relay:

```
Router# show frame-relay pvc 55

PVC Statistics for interface Serial5/1 (Frame Relay DTE)
DLCI = 55, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial5/1.1
     input pkts 9             output pkts 16           in bytes 154
     out bytes 338            dropped pkts 6           in FECN pkts 0
     in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
     in DE pkts 0             out DE pkts 0
     out bcast pkts 0         out bcast bytes 0
     pvc create time 00:35:11, last time pvc status changed 00:00:22
     Bound to Virtual-Access1 (up, cloned from Virtual-Template5)
```

Voice over Frame Relay Example

The following is sample output from the **show frame-relay pvc** command for a PVC carrying Voice over Frame Relay (VoFR) traffic configured via the **vofr cisco** command. The **frame-relay voice bandwidth** command has been configured on the class associated with this PVC, as has fragmentation. The fragmentation employed is proprietary to Cisco.

A sample configuration for this scenario is shown first, followed by the output for the **show frame-relay pvc** command.

```
interface serial 0
 encapsulation frame-relay
 frame-relay traffic-shaping
 frame-relay interface-dlci 108
  vofr cisco
  class vofr-class
map-class frame-relay vofr-class
 frame-relay fragment 100
 frame-relay fair-queue
 frame-relay cir 64000
 frame-relay voice bandwidth 25000
```

```
Router# show frame-relay pvc 108

PVC Statistics for interface Serial0 (Frame Relay DTE)
DLCI = 108, DLCI USAGE = LOCAL, PVC STATUS = STATIC, INTERFACE = Serial0
  input pkts 1260          output pkts 1271         in bytes 95671
  out bytes 98604          dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  out bcast pkts 1271       out bcast bytes 98604
  pvc create time 09:43:17, last time pvc status changed 09:43:17
  Service type VoFR-cisco
  configured voice bandwidth 25000, used voice bandwidth 0
  voice reserved queues 24, 25
  fragment type VoFR-cisco         fragment size 100
  cir 64000     bc 64000     be 0         limit 1000   interval 125
  mincir 32000     byte increment 1000  BECN response no
  pkts 2592      bytes 205140    pkts delayed 1296      bytes delayed 102570
  shaping inactive
  shaping drops 0
  Current fair queue configuration:
   Discard     Dynamic      Reserved
   threshold   queue count  queue count
    64          16           2
  Output queue size 0/max total 600/drops 0
```

FRF.12 Fragmentation Example

The following is sample output from the **show frame-relay pvc** command for an application employing pure FRF.12 fragmentation. A sample configuration for this scenario is shown first, followed by the output for the **show frame-relay pvc** command.

```
interface serial 0
 encapsulation frame-relay
 frame-relay traffic-shaping
 frame-relay interface-dlci 110
  class frag
map-class frame-relay frag
 frame-relay fragment 100
 frame-relay fair-queue
 frame-relay cir 64000

Router# show frame-relay pvc 110

PVC Statistics for interface Serial0 (Frame Relay DTE)
DLCI = 110, DLCI USAGE = LOCAL, PVC STATUS = STATIC, INTERFACE = Serial0
  input pkts 0             output pkts 243          in bytes 0
  out bytes 7290           dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  out bcast pkts 243        out bcast bytes 7290
  pvc create time 04:03:17, last time pvc status changed 04:03:18
  fragment type end-to-end         fragment size 100
  cir 64000     bc 64000     be 0         limit 1000   interval 125
  mincir 32000     byte increment 1000  BECN response no
  pkts 486       bytes 14580     pkts delayed 243       bytes delayed 7290
  shaping inactive
  shaping drops 0
  Current fair queue configuration:
   Discard     Dynamic      Reserved
   threshold   queue count  queue count
   64          16           2
  Output queue size 0/max total 600/drops 0
```

Note that when voice is not configured, voice bandwidth output is not displayed.

PVC Transporting Voice and Data

The following is sample output from the **show frame-relay pvc** command for a PVC carrying voice and data traffic, with a special queue specifically for voice traffic created using the **frame-relay voice bandwidth** command **queue** keyword:

```
Router# show frame-relay pvc interface serial 1 45

 PVC Statistics for interface Serial1 (Frame Relay DTE)

 DLCI = 45, DLCI USAGE = LOCAL, PVC STATUS = STATIC, INTERFACE = Serial1

   input pkts 85            output pkts 289          in bytes 1730
   out bytes 6580           dropped pkts 11          in FECN pkts 0
   in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
   in DE pkts 0             out DE pkts 0
   out bcast pkts 0          out bcast bytes 0
   pvc create time 00:02:09, last time pvc status changed 00:02:09
   Service type VoFR
   configured voice bandwidth 25000, used voice bandwidth 22000
   fragment type VoFR         fragment size 100
   cir 20000     bc   1000      be 0         limit 125    interval 50
   mincir 20000     byte increment 125   BECN response no
   fragments 290       bytes 6613      fragments delayed 1         bytes delayed 33
   shaping inactive
   traffic shaping drops 0
    Voice Queueing Stats: 0/100/0 (size/max/dropped)
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
   Current fair queue configuration:
    Discard     Dynamic      Reserved
    threshold   queue count  queue count
    64          16           2
   Output queue size 0/max total 600/drops 0
```

Table 34 describes the significant fields shown in the display.

Table 34 show frame-relay pvc Field Descriptions

Field	Description
DLCI	One of the DLCI numbers for the PVC.
DLCI USAGE	Lists SWITCHED when the router or access server is used as a switch, or LOCAL when the router or access server is used as a DTE device.

Table 34 show frame-relay pvc Field Descriptions (continued)

Field	Description
PVC STATUS	Status of the PVC. The DCE device reports the status, and the DTE device receives the status. When you disable the Local Management Interface (LMI) mechanism on the interface (by using the **no keepalive** command), the PVC status is STATIC. Otherwise, the PVC status is exchanged using the LMI protocol: • STATIC—LMI is disabled on the interface. • ACTIVE— The PVC is operational and can transmit packets. • INACTIVE—The PVC is configured, but down. • DELETED—The PVC is not present (DTE device only), which means that no status is received from the LMI protocol. If the **frame-relay end-to-end keepalive** command is used, the end-to-end keepalive (EEK) status is reported in addition to the LMI status. For example: • ACTIVE (EEK UP) —The PVC is operational according to LMI and end-to-end keepalives. • ACTIVE (EEK DOWN)—The PVC is operational according to LMI, but end-to-end keepalive has failed.
INTERFACE	Specific subinterface associated with this DLCI.
LOCAL PVC STATUS[1]	Status of PVC configured locally on the NNI interface.
NNI PVC STATUS[1]	Status of PVC learned over the NNI link.
input pkts	Number of packets received on this PVC.
output pkts	Number of packets sent on this PVC.
in bytes	Number of bytes received on this PVC.
out bytes	Number of bytes sent on this PVC.
dropped pkts	Number of incoming and outgoing packets dropped by the router at the Frame Relay level.
in pkts dropped	Number of incoming packets dropped. Incoming packets may be dropped for a number of reasons, including the following: • inactive PVC • policing • pkts received above DE discard level • dropped fragments • memory allocation failures • configuration problems
out pkts dropped	Number of outgoing packets dropped, including shaping drops and late drops.
out bytes dropped	Number of outgoing bytes dropped.
late-dropped out pkts	Number of outgoing packets dropped because of QoS policy (such as with VC queuing or Frame Relay traffic shaping). This field is not displayed when the value is zero.

Table 34 show frame-relay pvc Field Descriptions (continued)

Field	Description
late-dropped out bytes	Number of outgoing bytes dropped because of QoS policy (such with as VC queuing or Frame Relay traffic shaping). This field is not displayed when the value is zero.
in FECN pkts	Number of packets received with the FECN bit set.
in BECN pkts	Number of packets received with the BECN bit set.
out FECN pkts	Number of packets sent with the FECN bit set.
out BECN pkts	Number of packets sent with the BECN bit set.
in DE pkts	Number of DE packets received.
out DE pkts	Number of DE packets sent.
out bcast pkts	Number of output broadcast packets.
out bcast bytes	Number of output broadcast bytes.
switched pkts	Number of switched packets.
no out intf[2]	Number of packets dropped because there is no output interface.
out intf down[2]	Number of packets dropped because the output interface is down.
no out PVC[2]	Number of packets dropped because the outgoing PVC is not configured.
in PVC down[2]	Number of packets dropped because the incoming PVC is inactive.
out PVC down[2]	Number of packets dropped because the outgoing PVC is inactive.
pkt too big[2]	Number of packets dropped because the packet size is greater than media MTU[3].
shaping Q full[2]	Number of packets dropped because the Frame Relay traffic-shaping queue is full.
pkt above DE[2]	Number of packets dropped because they are above the DE level when Frame Relay congestion management is enabled.
policing drop[2]	Number of packets dropped because of Frame Relay traffic policing.
pvc create time	Time at which the PVC was created.
last time pvc status changed	Time at which the PVC changed status.
VC-Bundle	PVC bundle of which the PVC is a member.
priority	Priority assigned to the PVC.
pkts marked DE	Number of packets marked DE because they exceeded the Bc.
policing Bc	Committed burst size.
policing Be	Excess burst size.
policing Tc	Measurement interval for counting Bc and Be.
in Bc pkts	Number of packets received within the committed burst.
in Be pkts	Number of packets received within the excess burst.
in xs pkts	Number of packets dropped because they exceeded the combined burst.
in Bc bytes	Number of bytes received within the committed burst.
in Be bytes	Number of bytes received within the excess burst.

Table 34 show frame-relay pvc Field Descriptions (continued)

Field	Description
in xs bytes	Number of bytes dropped because they exceeded the combined burst.
Congestion DE threshold	PVC queue percentage at which packets with the DE bit are dropped.
Congestion ECN threshold	PVC queue percentage at which packets are set with the BECN and FECN bits.
Service type	Type of service performed by this PVC. Can be VoFR or VoFR-cisco.
Post h/w compression queue	Number of packets in the post-hardware-compression queue when hardware compression and Frame Relay fragmentation are configured.
configured voice bandwidth	Amount of bandwidth in bits per second (bps) reserved for voice traffic on this PVC.
used voice bandwidth	Amount of bandwidth in bps currently being used for voice traffic.
service policy	Name of the output service policy applied to the VC.
Class	Class of traffic being displayed. Output is displayed for each configured class in the policy.
Output Queue	The WFQ[4] conversation to which this class of traffic is allocated.
Bandwidth	Bandwidth in kbps or percentage configured for this class.
Packets Matched	Number of packets that matched this class.
Max Threshold	Maximum queue size for this class when WRED is not used.
pkts discards	Number of packets discarded for this class.
bytes discards	Number of bytes discarded for this class.
tail drops	Number of packets discarded for this class because the queue was full.
mean queue depth	Average queue depth, based on the actual queue depth on the interface and the exponential weighting constant. It is a moving average. The minimum and maximum thresholds are compared against this value to determine drop decisions.
drops:	WRED parameters.
class	IP precedence value.
random	Number of packets randomly dropped when the mean queue depth is between the minimum threshold value and the maximum threshold value for the specified IP precedence value.
tail	Number of packets dropped when the mean queue depth is greater than the maximum threshold value for the specified IP precedence value.
min-th	Minimum WRED threshold in number of packets.
max-th	Maximum WRED threshold in number of packets.
mark-prob	Fraction of packets dropped when the average queue depth is at the maximum threshold.
Maximum Number of Hashed Queues	(Applies to class default only) Number of queues available for unclassified flows.

Table 34 show frame-relay pvc Field Descriptions (continued)

Field	Description
fragment type	Type of fragmentation configured for this PVC. Possible types are as follows: • end-to-end—Fragmented packets contain the standard FRF.12 header • VoFR—Fragmented packets contain the FRF.11 Annex C header • VoFR-cisco—Fragmented packets contain the Cisco proprietary header
fragment size	Size of the fragment payload in bytes.
adaptive active/inactive	Indicates whether Frame Relay voice-adaptive fragmentation is active or inactive.
time left	Number of seconds left on the Frame Relay voice-adaptive fragmentation deactivation timer. When this timer expires, Frame Relay fragmentation turns off.
cir	Current CIR in bps.
bc	Current committed burst (Bc) size, in bits.
be	Current excess burst (Be) size, in bits.
limit	Maximum number of bytes sent per internal interval (excess plus sustained).
interval	Interval being used internally (may be smaller than the interval derived from Bc/CIR; this happens when the router determines that traffic flow will be more stable with a smaller configured interval).
mincir	Minimum CIR for the PVC.
byte increment	Number of bytes that will be sustained per internal interval.
BECN response	Indication that Frame Relay has BECN adaptation configured.
pkts	Number of packets associated with this PVC that have gone through the traffic-shaping system.
frags	Total number of fragments shaped on this VC.
bytes	Number of bytes associated with this PVC that have gone through the traffic-shaping system.
pkts delayed	Number of packets associated with this PVC that have been delayed by the traffic-shaping system.
frags delayed	Number of fragments delayed in the shaping queue before being sent.
bytes delayed	Number of bytes associated with this PVC that have been delayed by the traffic-shaping system.
shaping	Indication that shaping will be active for all PVCs that are fragmenting data; otherwise, shaping will be active if the traffic being sent exceeds the CIR for this circuit.
shaping drops	Number of packets dropped by the traffic-shaping process.
Queueing strategy	Per-VC queueing strategy.

Table 34 show frame-relay pvc Field Descriptions (continued)

Field	Description
Output queue	State of the per-VC queue.
48/100	• Number of packets enqueued/size of the queue
0 drop	• Number of packets dropped
300 dequeued	• Number of packets dequeued
Voice Queueing Stats	Statistics showing the size of packets, the maximum number of packets, and the number of packets dropped in the special voice queue created using the **frame-relay voice bandwidth** command **queue** keyword.
Discard threshold	Maximum number of packets that can be stored in each packet queue. Additional packets received after a queue is full will be discarded.
Dynamic queue count	Number of packet queues reserved for best-effort traffic.
Reserved queue count	Number of packet queues reserved for voice traffic.
Output queue size	Size in bytes of each output queue.
max total	Maximum number of packets of all types that can be queued in all queues.
drops	Number of frames dropped by all output queues.

1. The LOCAL PVC STATUS and NNI PVC STATUS fields are displayed only for PVCs configured on Frame Relay NNI interface types. These fields are not displayed if the PVC is configured on DCE or DTE interface types.
2. The detailed packet drop fields are displayed for switched Frame Relay PVCs only. These fields are not displayed for terminated PVCs.
3. MTU = maximum transmission unit
4. WFQ = weighted fair queueing

Related Commands

Command	Description
frame-relay accounting adjust	Enables byte count adjustment at the PVC level so that the number of bytes sent and received at the PVC corresponds to the actual number of bytes sent and received on the physical interface.
frame-relay interface-queue priority	Enables FR PIPQ on a Frame Relay interface and assigns priority to a PVC within a Frame Relay map class.
frame-relay pvc	Configures Frame Relay PVCs for FRF.8 Frame Relay-ATM Service Interworking.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
show dial-peer voice	Displays configuration information and call statistics for dial peers.
show frame-relay fragment	Displays Frame Relay fragmentation details.
show frame-relay vofr	Displays details about FRF.11 subchannels being used on VoFR DLCIs.
show interfaces serial	Displays information about a serial interface.
show policy-map interface	Displays the configuration of classes configured for service policies on the specified interface or PVC.
show traffic-shape queue	Displays information about the elements queued at a particular time at the VC (DLCI) level.

show frame-relay qos-autosense

To display the quality of service (QoS) values sensed from the switch, use the **show frame-relay qos-autosense** EXEC command.

show frame-relay qos-autosense [**interface** *number*]

Syntax Description

interface *number*	(Optional) Indicates the number of the physical interface for which you want to display QoS information.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.
12.1(3)T	This command was modified to display information about Enhanced Local Management Interface (ELMI) address registration.

Examples

The following is sample output from the **show frame-relay qos-autosense** command when ELMI and ELMI address registration are enabled.

```
Router# show frame-relay qos-autosense

ELMI information for interface Serial1
   IP Address used for Address Registration:9.2.7.9 My Ifindex:4
   ELMI AR status : Enabled.
   Connected to switch:hgw1 Platform:2611 Vendor:cisco
   Sw side ELMI AR status: Enabled
   IP Address used by switch for address registration :9.2.6.9 Ifindex:5
   ELMI AR status : Enabled.
                (Time elapsed since last update 00:00:40)
```

The following is sample output from the **show frame-relay qos-autosense** command when ELMI and traffic shaping are enabled:

```
Router# show frame-relay qos-autosense

ELMI information for interface Serial1
 Connected to switch:FRSM-4T1   Platform:AXIS   Vendor:cisco
              (Time elapsed since last update 00:00:30)

 DLCI = 100
 OUT:    CIR  64000       BC 50000        BE 25000        FMIF 4497
 IN:     CIR  32000       BC 25000        BE 12500        FMIF 4497
 Priority 0     (Time elapsed since last update 00:00:12)

 DLCI = 200
 OUT:    CIR 128000       BC 50000        BE 5100         FMIF 4497
 IN:     CIR Unknown      BC Unknown      BE Unknown      FMIF 4497
 Priority 0     (Time elapsed since last update 00:00:13)
```

Table 35 describes the significant fields in the output display.

Table 35 show frame-relay qos-autosense Field Descriptions

Field	Description
IP Address used for Address Registration	Management IP address of the data terminal equipment (DTE) interface.
My ifIndex	ifIndex of the DTE interface on which ELMI is running.
ELMI AR status	Indicates whether ELMI is enabled or disabled on the interface.
Connected to switch	Name of neighboring switch.
Platform	Platform information about neighboring switch.
Vendor	Vendor information about neighboring switch.
Sw side ELMI AR status	Indicates whether ELMI is enabled or disabled on the neighboring switch.
IP Address used by switch for address registration	IP address of DCE. If ELMI is not supported or is disabled, this value will be 0.0.0.0.
ifIndex	ifIndex of DCE.
DLCI	Value that indicates which PVC statistics are being reported.
Out:	Values reporting settings configured for the outgoing Committed Information Rate, Burst Size, Excess Burst Size, and FMIF.
In:	Values reporting settings configured for the incoming Committed Information Rate, Burst Size, Excess Burst Size, and FMIF.
Priority	Value indicating priority level (currently not used).

Related Commands

Command	Description
frame-relay qos-autosense	Enables ELMI on the Cisco router.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.

show frame-relay route

To display all configured Frame Relay routes, along with their status, use the **show frame-relay route** EXEC command.

show frame-relay route

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show frame-relay route** command:

```
Router# show frame-relay route

    Input Intf      Input Dlci      Output Intf     Output Dlci  Status
    Serial1         100             Serial2         200          active
    Serial1         101             Serial2         201          active
    Serial1         102             Serial2         202          active
    Serial1         103             Serial3         203          inactive
    Serial2         200             Serial1         100          active
    Serial2         201             Serial1         101          active
    Serial2         202             Serial1         102          active
    Serial3         203             Serial1         103          inactive
```

Table 36 describes significant fields shown in the output.

Table 36 show frame-relay route Field Descriptions

Field	Description
Input Intf	Input interface and unit.
Input Dlci	Input DLCI number.
Output Intf	Output interface and unit.
Output Dlci	Output DLCI number.
Status	Status of the connection: active or inactive.

show frame-relay svc maplist

To display all the switched virtual circuits (SVCs) under a specified map list, use the **show frame-relay svc maplist** EXEC command.

show frame-relay svc maplist *name*

Syntax Description

name	Name of the map list.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Examples

The following example shows, first, the configuration of the shank map list and, second, the corresponding output of the **show frame-relay svc maplist** command. The following lines show the configuration:

```
map-list shank local-addr X121 87654321 dest-addr X121 12345678
 ip 172.21.177.26 class shank ietf
 ipx 123.0000.0c07.d530 class shank ietf
!
map-class frame-relay shank
 frame-relay incir 192000
 frame-relay min-incir 19200
 frame-relay outcir 192000
 frame-relay min-outcir 19200
 frame-relay incbr(bytes) 15000
 frame-relay outcbr(bytes) 15000
```

The following lines show the output of the **show frame-relay svc maplist** command for the preceding configuration:

```
Router# show frame-relay svc maplist shank

Map List : shank
Local Address : 87654321            Type: X121
Destination Address: 12345678       Type: X121

Protocol : ip 172.21.177.26
Protocol : ipx 123.0000.0c07.d530
Encapsulation : IETF
Call Reference : 1              DLCI : 501

Configured Frame Mode Information Field Size :
Incoming : 1500         Outgoing : 1500
Frame Mode Information Field Size :
Incoming : 1500         Outgoing : 1500
Configured Committed Information Rate (CIR) :
Incoming : 192 * (10**3)                Outgoing : 192 * (10**3)
Committed Information Rate (CIR) :
Incoming : 192 * (10**3)                Outgoing : 192 * (10**3)
```

```
Configured Minimum Acceptable CIR :
Incoming : 192 * (10**2)                Outgoing : 192 * (10**2)
Minimum Acceptable CIR :
Incoming : 0 * (10**0)          Outgoing : 0 * (10**0)
Configured Committed Burst Rate (bytes) :
Incoming : 15000                Outgoing : 15000
Committed Burst Rate (bytes) :
Incoming : 15000                Outgoing : 15000
Configured Excess Burst Rate (bytes) :
Incoming : 16000                Outgoing : 1200
Excess Burst Rate (bytes) :
Incoming : 16000                Outgoing : 1200
```

Table 37 describes significant fields in the output.

Table 37 show frame-relay svc maplist Field Descriptions

Field	Description
Map List	Name of the configured map-list.
Local Address...Type	Configured source address type (E.164 or X.121) for the call.
Destination Address...Type	Configured destination address type (E.164 or X.121) for the call.
Protocol : ip ... Protocol: ipx ...	Destination protocol addresses configured for the map-list.
Encapsulation	Configured encapsulation type (CISCO or IETF) for the specified destination protocol address.
Call Reference	Call identifier.
DLCI: 501	Number assigned by the switch as the DLCI for the call.
Configured Frame Mode Information Field Size: Incoming: Outgoing: Frame Mode Information Field Size: Incoming: 1500 Outgoing: 1500	Lines that contrast the configured and actual frame mode information field size settings used for the calls.
Configured Committed Information Rate (CIR): Incoming: 192 * (10**3) Outgoing: 192 * (10**3) Committed Information Rate (CIR): Incoming: 192 * (10**3) Outgoing: 192 * (10**3)	Lines that contrast the configured and actual committed information rate (CIR) settings used for the calls.
Configured Minimum Acceptable CIR: Incoming: 192 * (10**2) Outgoing: 192 * (10**2) Minimum Acceptable CIR: Incoming: 0 * (10**0) Outgoing: 0 * (10**0)	Lines that contrast the configured and actual minimum acceptable CIR settings used for the calls.

Table 37 show frame-relay svc maplist Field Descriptions (continued)

Field	Description
Configured Committed Burst Rate (bytes): Incoming: 15000 Outgoing: 15000 Committed Burst Rate (bytes): Incoming: 15000 Outgoing: 15000	Lines that contrast the configured and actual committed burst rate (bytes) settings used for the calls.
Configured Excess Burst Rate (bytes): Incoming: 16000 Outgoing: 1200 Excess Burst Rate (bytes): Incoming: 16000 Outgoing: 1200	Lines that contrast the configured and actual excess burst rate (bytes) settings used for the calls.

Related Commands

Command	Description
class (map-list)	Associates a map class with a protocol-and-address combination.
frame-relay bc	Specifies the incoming or outgoing Bc for a Frame Relay VC.
frame-relay cir	Specifies the incoming or outgoing CIR for a Frame Relay VC.
frame-relay mincir	Specifies the minimum acceptable incoming or outgoing CIR for a Frame Relay VC.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.
map-list	Specifies a map group and link it to a local E.164 or X.121 source address and a remote E.164 or X.121 destination address for Frame Relay SVCs.

show frame-relay traffic

To display the global Frame Relay statistics since the last reload, use the **show frame-relay traffic** EXEC command.

show frame-relay traffic

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show frame-relay traffic** command:

```
Router# show frame-relay traffic

Frame Relay statistics:
ARP requests sent 14, ARP replies sent 0
ARP request recvd 0, ARP replies recvd 10
```

threshold de

To configure the threshold at which discard eligible (DE)-marked packets will be discarded from switched permanent virtual circuits (PVCs) on the output interface, use the **threshold de** Frame Relay congestion management configuration command. To remove the threshold configuration, use the **no** form of this command.

threshold de *percentage*

no threshold de *percentage*

Syntax Description

percentage	Threshold at which DE-marked packets will be discarded, specified as a percentage of maximum queue size.

Defaults

100%

Command Modes

Frame Relay congestion management configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You must enable Frame Relay congestion management on the interface before congestion management parameters will be effective. To enable Frame Relay congestion management and to enter Frame Relay congestion management configuration mode, use the **frame-relay congestion-management** interface command.

You must enable Frame Relay switching, using the **frame-relay switching** global command, before the **threshold de** command will be effective on switched PVCs.

Examples

The following example shows how to configure a DE threshold of 40% on serial interface 1.

```
interface serial1
 encapsulation frame-relay
 frame-relay congestion-management
  threshold de 40
```

Related Commands

Command	Description
frame-relay congestion-management	Enables Frame Relay congestion management functions on all switched PVCs on an interface, and enters congestion management configuration mode.
frame-relay congestion threshold de	Configures the threshold at which DE-marked packets will be discarded from the traffic-shaping queue of a switched PVC.

Command	Description
frame-relay congestion threshold ecn	Configures the threshold at which ECN bits will be set on packets in the traffic-shaping queue of a switched PVC.
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
threshold ecn	Configures the threshold at which ECN bits will be set on packets in switched PVCs on the output interface.

threshold ecn

To configure the threshold at which ECN bits will be set on packets in switched PVCs on the output interface, use the **threshold ecn** Frame Relay congestion management configuration command. To remove the threshold configuration, use the **no** form of this command.

threshold ecn {**bc** | **be**} *percentage*

no threshold ecn {**bc** | **be**} *percentage*

Syntax Description

bc	Specifies threshold for committed traffic.
be	Specifies threshold for excess traffic.
percentage	Threshold at which ECN bits will be set on packets, specified as a percentage of maximum queue size.

Defaults

100%

Command Modes

Frame Relay congestion management

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

You must enable Frame Relay congestion management on the interface before congestion management parameters will be effective. To enable Frame Relay congestion management and to enter Frame Relay congestion management configuration mode, use the **frame-relay congestion-management** interface command.

You must enable Frame Relay switching, using the **frame-relay switching** global command, before the **threshold ecn** command will be effective on switched PVCs.

You can configure separate queue thresholds for committed and excess traffic.

Configure the Be ECN threshold so that it is greater than or equal to zero and less than or equal to the Bc ECN threshold. Configure the Bc ECN threshold so that it is less than or equal to 100.

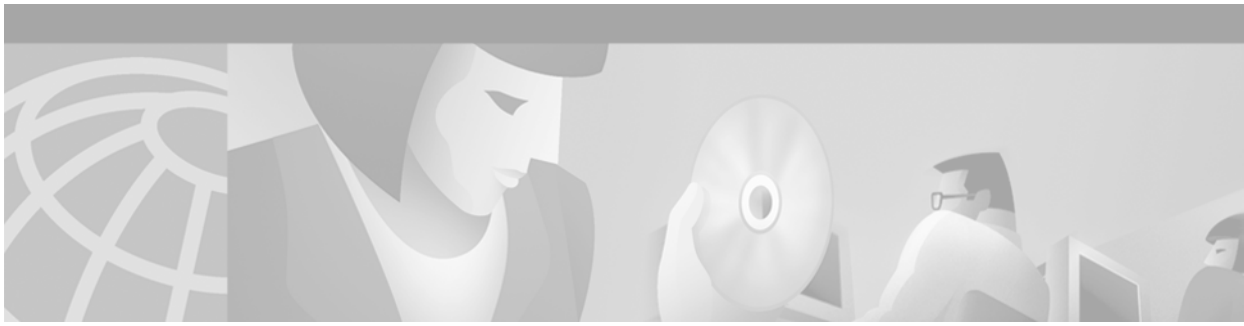
Examples

The following example shows how to configure a Be threshold of 0 and a Bc threshold of 20% on serial interface 1.

```
interface serial1
 encapsulation frame-relay
 frame-relay congestion-management
  threshold ecn be 0
  threshold ecn bc 20
```

Related Commands

Command	Description
frame-relay congestion-management	Enables Frame Relay congestion management functions on all switched PVCs on an interface, and enters congestion management configuration mode.
frame-relay congestion threshold de	Configures the threshold at which DE-marked packets will be discarded from the traffic-shaping queue of a switched PVC.
frame-relay congestion threshold ecn	Configures the threshold at which ECN bits will be set on packets in the traffic-shaping queue of a switched PVC.
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
threshold de	Configures the threshold at which DE-marked packets will be discarded from switched PVCs on the output interface.



Frame Relay-ATM Interworking Commands

Use the commands described in this chapter to configure FRF.5 Frame Relay-ATM Network Interworking and FRF.8 Frame Relay-ATM Service Interworking.

For Frame Relay-ATM configuration information and examples, refer to the "Configuring Frame Relay-ATM Interworking" chapter in the *Cisco IOS Wide-Area Networking Configuration Guide*.

clp-bit

To set the ATM cell loss priority (CLP) field in the ATM cell header, use the **clp-bit** connect submode command. To disable ATM CLP bit mapping, use the **no** form of this command.

clp-bit {**0** | **1** | **map-de**}

no clp-bit {**0** | **1** | **map-de**}

Syntax Description

0	The CLP field in the ATM cell header is always set to 0.
1	The CLP field in the ATM cell header is always set to 1.
map-de	The discard eligible (DE) field in the Frame Relay header is mapped to the CLP field in the ATM cell header.

Defaults

The default is set to **map-de**.

Command Modes

FRF.5 connect submode

FRF.8 connect submode

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

This command maps from Frame Relay to ATM.

Examples

FRF.5 Example

The following example sets the CLP field in the ATM header to 1 for FRF.5:

```
Router(config)# connect network-1 vc-group network-1 ATM3/0 1/35
Router(config-frf5)# clp-bit 1
```

FRF.8 Example

The following example sets the CLP field in the ATM header to 1 for FRF.8:

```
C3640(config)# connect service-1 Serial1/0 16 ATM3/0 1/32 service-interworking
C3640(config-frf8)# clp-bit 1
```

Related Commands

Command	Description
connect (FRF.5)	Connects a Frame Relay DLCI or VC group to an ATM PVC.
de-bit map-clp	Sets the Frame Relay DE bit field in the Frame Relay cell header.

connect (FRF.5)

To configure an FRF.5 one-to-one connection between two Frame Relay end users over an intermediate ATM network, or an FRF.5 many-to-one connection between two Frame Relay end users over an intermediate ATM network, use the **connect** global configuration command. To remove a connection, use the **no** form of this command.

connect *connection-name* {**vc-group** *group-name* | *FR-interface FR-DLCI*} *ATM-interface ATM-VPI/VCI* **network-interworking**

no connect *connection-name* {**vc-group** *group-name* | *FR-interface FR-DLCI*} *ATM-interface ATM-VPI/VCI* **network-interworking**

Syntax Description

connection-name	Specifies a connection name. Enter as a 15-character maximum string.
vc-group *group-name*	Specifies a VC group name for a many-to-one FRF.5 connection. Enter as an 11- character maximum string.
FR-interface	Specifies the Frame Relay interface type and number, for example, **serial1/0**.
FR-DLCI	Specifies the Frame Relay data-link connection identifier (DLCI) in the range from 16 to 1007.
ATM-interface	Specifies the ATM interface type and number, for example, **atm1/0**.
ATM-VPI/VCI	Specifies the ATM virtual path identifier/virtual channel identifier (VPI/VCI). If a VPI is not specified, the default VPI is 0.
network-interworking	Specifies FRF.5 network interworking. Not a valid keyword if the **vc-group** keyword is specified.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

Use the **connect** command to connect a group of Frame Relay DLCIs to an ATM PVC.

To disconnect the FRF.5 interworking connection, use the **shutdown** connect subcommand.

Examples

The following example shows how to create an FRF.5 one-to-one connection:

```
router(config)# interface serial0
router(config-if)# frame-relay interface-dlci 100 switched
router(config-if)# interface atm3/0
router(config-if)# pvc 0/32
```

```
router(config-if-atm-vc)# encapsulation aal5mux frame-relay
router(config)# connect serial0 100 atm3/0 0/32 network-interworking
router(config-frf5)# clp-bit 1
router(config-frf5)# de-bit map-clp
```

The following example shows how to create an FRF.5 many-to-one connection:

```
router(config)# interface serial0
router(config-if)# frame-relay interface-dlci 100 switched
router(config)# vc-group friends
router(config-vc-group)# serial0 16 16
router(config-vc-group)# serial0 17 17
router(config-vc-group)# serial0 18 18
router(config-vc-group)# serial0 19 19
router(config)# interface atm3/0
router(config-if)# pvc 0/32
router(config-if-atm-vc)# encapsulation aal5mux frame-relay
router(config)# connect vc-group friends atm3/0 0/32
router(config-frf5)# de-bit map-clp
```

Related Commands

Command	Description
encapsulation aal5	Configures the AAL and encapsulation type for an ATM PVC, SVC, or VC class.
pvc	Creates an ATM PVC on a main interface or subinterface; enters interface-ATM-VC configuration mode.
vc-group	Assigns multiple Frame Relay DLCIs to a VC group.

connect (FRF.8)

To configure an FRF.8 one-to-one mapping between a Frame Relay data-link connection identifier (DLCI) and an ATM permanent virtual circuit (PVC), use the **connect** global configuration command. To remove a connection, use the **no** form of this command.

connect *connection-name FR-interface FR-DLCI ATM-interface ATM-VPI/VCI* **service-interworking**

no connect *connection-name FR-interface FR-DLCI ATM-interface ATM-VPI/VCI* **service-interworking**

Syntax Description

connection-name	Specifies a connection name. Enter as a 15-character maximum string.
FR-interface	Specifies the Frame Relay interface type and number, for example, **serial1/0**.
FR-DLCI	Specifies the Frame Relay data-link connection identifier (DLCI) in the range 16 to 1007.
ATM-interface	Specifies the ATM interface type and number, for example **atm1/0**.
ATM-VPI/VCI	Specifies the ATM virtual path identifier/virtual channel identifier (VPI/VCI). If a VPI is not specified, the default VPI is 0.
service-interworking	Specifies FRF.8 service interworking.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

Use the **connect** command to connect a Frame Relay DLCI to an ATM PVC.

To disconnect the FRF.8 interworking connection, use the **shutdown** connect subcommand.

Examples

The following example shows how to create an FRF.8 connection:

```
router(config)# interface serial0
router(config-if)# frame-relay interface-dlci 100 switched
router(config-if)# interface atm1/0
router(config-if)# pvc 0/32
router(config-if-atm-vc)# encapsulation aal5mux fr-atm-srv
router(config)# connect service-1 Serial0 100 ATM1/0 0/32 service-interworking
router(config-frf8)# efci-bit map-fecn
```

Related Commands

Command	Description
clp-bit	Sets the ATM CLP field in the ATM cell header.
de-bit map-clp	Sets the EFCI bit field in the ATM cell header.
encapsulation aal5	Configures the AAL and encapsulation type for an ATM PVC, SVC, or VC class.
pvc	Creates an ATM PVC on a main interface or subinterface; enters interface-ATM-VC configuration mode.

de-bit

To set the Frame Relay discard eligible (DE) bit field in the Frame Relay cell header for FRF.8 service interworking, use the **de-bit** connect submode command. To disable or reset Frame Relay DE bit mapping, use the **no** form of this command.

de-bit {**0** | **1** | **map-clp**}

no de-bit {**0** | **1** | **map-clp**}

Syntax Description

0	The DE field in the Frame Relay header is always set to 0.
1	The DE field in the Frame Relay header is always set to 1.
map-clp	The DE field is set to 1 when one or more cells belonging to a frame has its cell loss priority (CLP) field set.

Defaults

The default is set to **map-clp**.

Command Modes

FRF.8 connect submode

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

This command maps from ATM to Frame Relay.

Examples

The following example sets the DE bit field in the Frame Relay cell header to 1:

```
Router(config)# connect service-1 serial1/0 16 atm3/0 1/32 service-interworking
Router(config-frf8)# de-bit 1
```

Related Commands

Command	Description
clp-bit	Sets the ATM CLP field in the ATM cell header.
connect (FRF.8)	Connects a Frame Relay DLCI to an ATM PVC.
de-bit map-clp	Sets the EFCI bit field in the ATM cell header.

de-bit map-clp

To set Frame Relay discard eligible (DE) bit mapping for FRF.5 network interworking, use the **de-bit map-clp** connect submode command. To disable or reset Frame Relay DE bit mapping, use the **no** form of this command.

de-bit map-clp

no de-bit map-clp

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

FRF.5 connect submode

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

In the default state, the DE bit in the Frame Relay header is set to 1 when one or more ATM cells belonging to a frame has its cell loss priority (CLP) field set to 1, or when the DE field of the Frame Relay service specific convergence sublayer (FR-SSCS) protocol data unit (PDU) is set to 1.

When the **no de-bit map-clp** command is entered, the FR-SSCS PDU DE field is copied unchanged to the Q.922 core frame DE field, independent of CLP indications received at the ATM layer.

Examples

The following example creates a connection that connects the virtual circuit (VC) group named friends to ATM PVC 0/32 and configures FR DE field mapping to match the ATM CLP field:

```
router(config)# vc-group friends
router(config-vc-group)# serial0 16 16
router(config-vc-group)# serial0 17 17
router(config-vc-group)# serial0 18 18
router(config-vc-group)# serial0 19 19
router(config)# interface atm3/0
router(config-if)# pvc 0/32
router(config-if-atm-vc)# encapsulation aal5mux frame-relay
router(config)# connect vc-group friends atm3/0 0/32
router(config-frf5)# de-bit map-clp
```

Related Commands

Command	Description
clp-bit	Sets the ATM CLP field in the ATM cell header.
connect (FRF.5)	Connects a Frame Relay DLCI or VC group to an ATM PVC.
vc-group	Assigns multiple Frame Relay DLCIs to a VC group.

efci-bit

To set the explicit forward congestion indication (EFCI) bit field in the ATM cell header for FRF.8 service interworking, use the **efci-bit** connect submode command. To disable or reset this bit, use the **no** form of this command.

efci-bit {**0** | **map-fecn**}

no efci-bit {**0** | **map-fecn**}

Syntax Description

0	The EFCI field in the ATM cell header is set to 0.
map-fecn	The EFCI field in the ATM cell header is set to 1 when the forward explicit congestion notification (FECN) field in the Frame Relay header is set.

Defaults

The default is **0**.

Command Modes

FRF.8 connect submode

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

This command maps from Frame Relay to ATM.

Examples

The following example creates a connection that connects Frame Relay DLCI 100 to ATM PVC 0/32, and sets the EFCI field in the ATM cell header to 1 when the FECN field in the Frame Relay header is set:

```
router(config)# interface atm1/0
router(config-if)# pvc 0/32
router(config-if)# encapsulation aal5mux fr-atm-srv
router(config)# connect serial0 100 atm1/0 0/32 service-interworking
router(config-frf8)# efci-bit map-fecn
```

Related Commands

Command	Description
clp-bit	Sets the ATM CLP field in the ATM cell header.
connect (FRF.8)	Connects a Frame Relay DLCI to an ATM PVC.
connect (FRF.5)	Sets the Frame Relay DE bit field in the Frame Relay cell header.
service translation	Allows mapping between encapsulated ATM PDUs and encapsulated Frame Relay PDUs.

service translation

To enable upper layer user protocol encapsulation for Frame Relay-to-ATM Service Interworking (FRF.8) feature, which allows mapping between encapsulated ATM protocol data units (PDUs) and encapsulated Frame Relay PDUs, use the **service translation** command in FRF.8 connection mode. To disable upper layer user protocol encapsulation, use the **no** form of this command.

service translation

no service translation

Syntax Description

This command has no arguments or keywords.

Defaults

The default state is **service translation**.

Command Modes

FRF.8 connect submode

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

The **no service translation** command disables mapping between encapsulated ATM PDUs and encapsulated Frame Relay PDUs.

Examples

The following example shows an FRF.8 configuration with service translation disabled:

```
Router# show running:configuration

Building configuration...

Current configuration:

connect service-1 Serial1/0 16 ATM3/0 1/32 service-interworking
 no service translation
 efci-bit map-fecn
```

The following example shows how to configure service translation on the connection named service-1:

```
Router(config)# connect service-1 serial1/0 16 ATM3/0 1/32 service-interworking
Router(config-frf8)# service translation
```

Related Commands

Command	Description
clp-bit	Sets the ATM CLP field in the ATM cell header.
connect (FRF.5)	Sets the Frame Relay DE bit field in the Frame Relay cell header.
de-bit map-clp	Sets the EFCI bit field in the ATM cell header.

show connect (FR-ATM)

To display statistics and other information about Frame-Relay-to-ATM Network Interworking (FRF.5) and Frame Relay-to-ATM Service Interworking (FRF.8) connections, use the **show connect** EXEC command.

show connect [**all** | *element* | **id** *ID* | *name* | **port** *port*]

Syntax Description

all	(Optional) Displays information about all Frame Relay-to-ATM connections.
element	(Optional) Displays information about the specified connection element.
id *ID*	(Optional) Displays information about the specified connection identifier.
name	(Optional) Displays information about the specified connection name.
port *port*	(Optional) Displays information about all connections on an interface.

Defaults

Default state is **show connect all**.

Command Modes

EXEC

Command History

Release	Modification
12.1(2)T	This command was introduced.

Examples

FRF.5 Examples

The following example displays information about all FRF.5 connections:

```
C3640# show connect all

ID   Name               Segment 1            Segment 2           State
========================================================================
5    network-1          VC-Group network-1   ATM3/0 1/34         UP
```

The following example displays information about the specified FRF.5 connection identifier:

```
C3640# show connect id 5

FR/ATM Network Interworking Connection: network-1
  Status    - UP
  Segment 1 - VC-Group network-1
  Segment 2 - ATM3/0 VPI 1 VCI 34
  Interworking Parameters -
    de-bit map-clp
    clp-bit map-de
```

FRF.8 Examples

The following example displays information about the specified FRF.8 connection identifier:

```
C3640# show connect id 10

FR/ATM Service Interworking Connection: service-1
  Status    - UP
  Segment 1 - Serial1/0 DLCI 16
  Segment 2 - ATM3/0 VPI 1 VCI 32
Interworking Parameters -
    service translation
    efci-bit 0
    de-bit map-clp
    clp-bit map-de
```

The following example displays information about the FRF.8 connection on an interface:

```
C3640# show connect port atm3/0

ID   Name               Segment 1            Segment 2           State
========================================================================
10   service-1         Serial1/0 16         ATM3/0 1/32          UP
```

Table 38 describes the fields seen in these displays.

Table 38 show connect Field Descriptions

Display	Description
ID	Arbitrary connection identifier assigned by the operating system.
Name	Assigned connection name.
Segment 1 or 2	Frame Relay or ATM interworking segments.
State or Status	Status of the connection, UP, DOWN, or ADMIN DOWN.

Related Commands

Command	Description
connect (FRF.8)	Connects a Frame Relay DLCI to an ATM PVC.
show atm pvc	Displays all ATM PVCs, SVCs, and traffic information.
show frame-relay pvc	Displays statistics about Frame Relay interfaces.

show vc-group

To display the names of all virtual circuit (VC) groups, use the **show vc-group** EXEC command.

show vc-group [*group-name*]

Syntax Description

group-name	(Optional) Name defined by the **vc-group** command. If this argument is not specified, the names of all VC groups in the system are displayed.

Defaults

The names of all VC groups in the system are displayed.

Command Modes

EXEC

Command History

Release	Modification
12.1(2)T	This command was introduced.

Examples

The following example shows the default display of the **show vc-group** EXEC command:

```
Router# show vc-group

Name of All VC Groups:
======================
network-1
```

Related Commands

Command	Description
show atm pvc	Displays all ATM PVCs, SVCs, and traffic information.
show frame-relay pvc	Displays statistics about Frame Relay interfaces.
vc-group	Assigns multiple Frame Relay DLCIs to a VC group.

shutdown (FR-ATM)

To shut down a Frame Relay-ATM Network Interworking (FRF.5) connection or a Frame Relay-ATM Service Interworking (FRF.8) connection, use the **shutdown** connect submode command. To disable disconnection, use the **no** form of this command.

shutdown

no shutdown

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

FRF.5 connect submode

FRF.8 connect submode

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

An FRF.5 or FRF.8 connection must be manually shut down once the interworking connection is created by use of the **shutdown** connect subcommand.

Examples

FRF.5 Shutdown Example

The following example shows how to shut down an FRF.5 connection:

```
Router(config)# connect network-2 interface serial0/1 16 atm3/0 0/32 network-interworking
. . .
Router(config-frf5)# shutdown
```

FRF.8 Shutdown Example

The following example shows how to shut down an FRF.8 connection:

```
Router(config)# connect serial0 100 atm3/0 1/35 service-interworking
. . .
Router(config-frf8)# shutdown
```

Related Commands

Command	Description
connect (FRF.5)	Connects a Frame Relay DLCI or VC group to an ATM PVC.

vc-group

To assign multiple Frame Relay data-link connection identifiers (DLCIs) to a virtual circuit (VC) group for Frame Relay-to-ATM Network Interworking (FRF.5), use the **vc-group** global configuration mode command. To disable the VC group assignments, use the **no** form of this command.

vc-group *group-name*

no vc-group *group-name*

The **vc-group** command requires the use of the following command in VC-group configuration mode to provide a map between Frame Relay DLCIs and Frame Relay-SSCS DLCIs:

FR-interface-name FR-DLCI [*FR-SSCS-DLCI*]

Syntax Description

group-name	A VC group name entered as an 11-character maximum string.

The following syntax description applies to the VC-group entries:

FR-interface-name	Frame Relay interface; for example, **serial0/0.**
FR-DLCI	Frame Relay DLCI number in the range 16 to 1007.
FR-SSCS-DLCI	(Optional) Frame Relay SSCS DLCI number in the range of 16 to 991. Default is 1022.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.

Usage Guidelines

This command specifies the Frame Relay DLCIs in the VC group and maps them to the Frame Relay-SSCS DLCIs. If the optional FR-SSCS DLCI value is not specified, its value is the same as the Frame Relay DLCI.

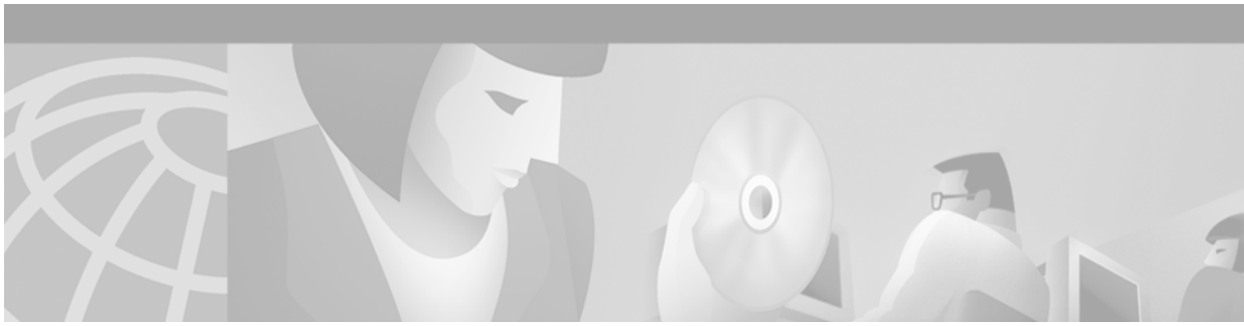
Examples

The following example shows how to configure an FRF.5 many-to-one connection. The **vc-group** command maps Frame Relay DLCI 16, 17, 18, and 19 to a VC group named “friends”:

```
Router(config)# vc-group friends
Router(config-vc-group)# serial0 16 16
Router(config-vc-group)# serial0 17 17
Router(config-vc-group)# serial0 18 18
Router(config-vc-group)# serial0 19 19
```

Related Commands

Command	Description
show vc-group	Displays the names of all VC groups.



SMDS Commands

Use the commands in this chapter to configure Switched Multimegabit Data Service (SMDS), a wide-area networking service offered by some regional Bell operating companies (RBOCs) and MCI.

For SMDS configuration information and examples, refer to the "Configuring SMDS" chapter in the *Cisco IOS Wide-Area Networking Configuration Guide*.

arp

To enable Address Resolution Protocol (ARP) entries for static routing over the Switched Multimegabit Data Service (SMDS) network, use the following variation of the **arp** global configuration command. To disable this capability, use the **no** form of this command.

arp *ip-address smds-address* **smds**

no arp *ip-address smds-address* **smds**

Syntax Description

ip-address	IP address of the remote router.
smds-address	12-digit SMDS address in the dotted notation *nnnn.nnnn.nnnn* (48 bits long).
smds	Enables ARP for SMDS.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

This command requires a 12-digit (48-bit) dotted-format SMDS address. It does not support 15-digit SMDS addresses.

Examples

The following example creates a static ARP entry that maps the IP address 172.20.173.28 to the SMDS address C141.5797.1313 on interface serial 0:

```
interface serial 0
 arp 172.20.173.28 C141.5797.1313 smds
```

Related Commands

Command	Description
smds enable-arp	Enables dynamic ARP. The multicast address for ARP must be set before this command is issued.
smds static-map	Configures a static map between an individual SMDS address and a higher-level protocol address.

encapsulation smds

To enable Switched Multimegabit Data Service (SMDS) on the desired interface, use the **encapsulation smds** interface configuration command.

encapsulation smds

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The interface to which this command applies must be a serial interface. All subsequent SMDS configuration commands apply only to an interface with encapsulation SMDS.

Note The maximum packet size allowed in the SMDS specifications (TA-772) is 9188. This is larger than the packet size used by servers with most media. The Cisco default maximum transmission unit (MTU) size is 1500 bytes to be consistent with Ethernet. However, on the High Speed Serial Interface (HSSI), the default MTU size is 4470 bytes. If a larger MTU is used, the **mtu** command must be entered before the **encapsulation smds** command.

Caution The Cisco MCI card has buffer limitations that prevent setting the MTU size higher than 2048, and the HSSI card has buffer limitations that prevent setting the MTU size higher than 4500. Configuring higher settings can cause inconsistencies and performance problems.

Examples

The following example shows how to configure the SMDS service on serial interface 0:

```
interface serial 0
 encapsulation smds
```

Related Commands

Command	Description
mtu	Adjusts the maximum packet size or MTU size.

interface serial multipoint

To define a logical subinterface on a serial interface to support multiple logical IP subnetworks over Switched Multimegabit Data Service (SMDS), use the **interface serial multipoint** interface configuration command.

interface serial {*interface* | *slot/port*}**.***subinterface* **multipoint**

Syntax Description

interface	Interface number.
slot/port	Slot and port number related to specified subinterface (for Cisco 7000 and 7500 series routers).
.*subinterface*	Number for this subinterface; values in the range 0 to 255.

Defaults

This command has no default values.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Use this command only for routers that need knowledge of multiple IP networks. Other routers can be configured with information only about their own networks. A period must be used to separate the *interface* or *slot/port* from the *subinterface*.

Examples

The following example configures serial interface 2 with multipoint logical subinterface 1:

```
interface serial 2.1 multipoint
```

The following example configures slot 2 port 0 with multipoint logical subinterface 1:

```
interface serial 2/0.1 multipoint
```

Related Commands

Command	Description
ip address	Sets a primary or secondary IP address for an interface.
smds address	Specifies the SMDS individual address for a particular interface.
smds enable-arp	Enables dynamic ARP.The multicast address for ARP must be set before this command is issued.
smds multicast	Assigns a multicast SMDS E.164 address to a higher-level protocol.

show smds addresses

To display the individual addresses and the interface they are associated with, use the **show smds addresses** privileged EXEC command.

show smds addresses

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show smds addresses** command:

```
Router# show smds addresses

SMDS address - Serial0   c141.5555.1212.FFFF
```

Table 39 describes the fields shown in the display.

Table 39 show smds addresses Field Descriptions

Field	Description
Serial0	Interface to which this SMDS address has been assigned.
c141.5555.1212	SMDS address that has been assigned to the interface.

show smds map

To display all Switched Multimegabit Data Service (SMDS) addresses that are mapped to higher-level protocol addresses, use the **show smds map** privileged EXEC command.

show smds map

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show smds map** command:

```
Router# show smds map

Serial0: ARP maps to e180.0999.9999.FFFF multicast
Serial0: IP maps to e180.0999.9999.FFFF 172.16.42.112 255.255.255.0 multicast
Serial0: XNS 1006.AA00.0400.0C55 maps to c141.5688.1212.FFFF static [broadcast]
Serial0: IPX 1ABC.000.0c00.d8db maps to c111.1111.1111.1111 -- dynamic, TTL: 4 min
```

Table 40 describes the fields shown in the output.

Table 40 show smds map Field Descriptions

Field	Description
Serial0	Name of interface on which SMDS has been enabled.
ARP maps to	Higher-level protocol address that maps to this particular SMDS address.
e180.0999.9999.FFFF	SMDS address. Includes all SMDS addresses entered with either the **smds static-map** command (static) or **smds multicast** command (multicast).
172.16.42.112	IP address.
255.255.255.0	Subnet mask for the IP address.
static/dynamic	The address was obtained from a static map or dynamic map.
TTL	Time to live.

show smds traffic

To display statistics about Switched Multimegabit Data Service (SMDS) packets the router has received, use the **show smds traffic** privileged EXEC command.

show smds traffic

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following is sample output from the **show smds traffic** command:

```
Router# show smds traffic

624363 Input packets
759695 Output packets
2 DXI heartbeat sent
0 DXI heartbeat received
0 DXI DSU polls received
0 DXI DSU polls sent
0 DXI invalid test frames
0 Bad BA size errors
0 Bad Header extension errors
65 Invalid address errors
1 Bad tag errors
```

Table 41 describes the fields shown in the output.

Table 41 show smds traffic Field Descriptions

Field	Description
Input packets	Number of input packets.
Output packets	Number of output packets.
DXI heartbeat sent	Number of Data Exchange Interface (DXI) heartbeat polls transmitted.
DXI heartbeat received	Number of DXI heartbeat polls received.
DXI DSU polls sent	Number of DXI Data Service Unit (DSU) polls sent.
DXI DSU polls received	Number of DXI DSU polls received.
DXI invalid test frames	Number of invalid test frames seen.
Bad BA size errors	Number of packets that have a size less than 32 or greater than 9188 bytes.

Table 41 show smds traffic Field Descriptions (continued)

Field	Description
DXI Header extension errors	Number of extended SMDS Interface Protocol (SIP) Layer 3 header errors.
DXI Invalid address errors	Number of address errors.
Bad tag errors	Status indicating the number of errors that occur when there is a mismatch between the Tag value in the header and the BeTag value in the trailer of an SMDS frame. This usually indicates that there is a misconfiguration (that is, a DXI is connected to a non-DXI) or that the SMDS data service unit (SDSU) is scrambling the Layer 2 protocol data units (PDUs).

smds address

To specify the Switched Multimegabit Data Service (SMDS) individual address for a particular interface, use the **smds address** interface configuration command. To remove the address from the configuration file, use the **no** form of this command.

smds address *smds-address*

no smds address *smds-address*

Syntax Description

smds-address	Individual address provided by the SMDS service provider. It is protocol independent.

Defaults

No address is specified.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

All addresses for SMDS service are assigned by the service provider, and can be assigned to individuals and groups.

Addresses are entered in the Cisco SMDS configuration software using an E prefix for *multicast* addresses and a C prefix for *unicast* addresses. Cisco IOS software expects the addresses to be entered in E.164 format, which is 64 bits. The first 4 bits are the address type, and the remaining 60 bits are the address. If the first 4 bits are 1100 (0xC), the address is a unicast SMDS address, which is the address of an individual SMDS host. If the first 4 bits are 1110 (0xE), the address is a multicast SMDS address, which is used to broadcast a packet to multiple end points. The 60 bits of the address are in binary-coded decimal (BCD) format. Each 4 bits of the address field presents a single telephone number digit, allowing for up to 15 digits. At a minimum, you must specify at least 11 digits (44 bits). Unused bits at the end of this field are filled with ones.

Note If bridging is enabled on any interface, the SMDS address is erased and must be reentered.

Examples

The following example specifies an individual address in Ethernet-style notation:

```
interface serial 0
 smds address c141.5797.1313.FFFF
```

smds dxi

To enable the Data Exchange Interface (DXI) version 3.2 support, use the **smds dxi** interface configuration command. To disable the DXI 3.2 support, use the **no** form of this command.

smds dxi

no smds dxi

Syntax Description

This command has no arguments or keywords.

Defaults

Enabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Adding this command to the configuration enables the DXI version 3.2 mechanism and encapsulates SMDS packets in a DXI frame before they are transmitted. DXI 3.2 adds an additional 4 bytes to the SMDS packet header to communicate with the SMDS data service unit (SDSU). These bytes specify the frame type. The interface expects all packets to arrive with DXI encapsulation.

The DXI 3.2 support also includes the heartbeat process as specified in the SIG-TS-001/1991 standard, revision 3.2. The heartbeat (active process) is enabled when both DXI and keepalives are enabled on the interface. The echo (passive process) is enabled when DXI is enabled on the interface. The heartbeat mechanism automatically generates a heartbeat poll frame every 10 seconds. This default value can be changed with the **keepalive** (LMI) command.

Fast switching of DXI frames is supported, but Interim Local Management Interface (ILMI) is not.

Note If you are running serial lines back-to-back, disable keepalive on SMDS interfaces. Otherwise, DXI declares the link down.

Note Switching in or out of DXI mode causes the IP cache to be cleared. This clearing process is necessary to remove all cached IP entries for the serial line being used. Stale entries must be removed to allow the new MAC header with or without DXI framing to be installed in the cache. This clearing process is not frequently done and is not considered to be a major performance penalty.

Examples

The following example enables DXI 3.2 on interface HSSI 0:

```
interface hssi 0
```

```
encapsulation smds
smds dxi
smds address C120.1111.2222.FFFF
ip address 172.20.1.30 255.255.255.0
smds multicast ip E180.0999.9999
smds enable-arp
```

Related Commands

Command	Description
keepalive (**LMI**)	Enables the LMI mechanism for serial lines using Frame Relay encapsulation.

smds enable-arp

To enable dynamic Address Resolution Protocol (ARP), use the **smds enable-arp** interface configuration command. The multicast address for ARP must be set before this command is issued. To disable the interface once ARP has been enabled, use the **no** form of this command.

smds enable-arp

no smds enable-arp

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example enables the dynamic ARP routing table:

```
interface serial 0
 ip address 172.20.1.30 255.255.255.0
 smds multicast IP E180.0999.9999.2222
 smds enable-arp
```

Related Commands

Command	Description
arp	Enables ARP entries for static routing over the SMDS network.

smds glean

To enable dynamic address mapping for Internet Packet Exchange (IPX) over Switched Multimegabit Data Service (SMDS), use the **smds glean** interface configuration command. To disable dynamic address mapping for IPX over SMDS, use the **no** form of this command.

smds glean *protocol* [*timeout-value*] [**broadcast**]

no smds glean *protocol*

Syntax Description

protocol	Protocol type. Only IPX is supported.
timeout-value	(Optional) Time to live (TTL) value. Value can be from 1 to 65535 minutes. The default is 5 minutes. This value indicates how long a gleaned dynamic map is stored in the SMDS map table.
broadcast	(Optional) Marks the gleaned protocol address as a candidate for broadcast packets. All broadcast requests are sent to the unicast SMDS address.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.1	This command was introduced.

Usage Guidelines

The **smds glean** command uses incoming packets to dynamically map SMDS addresses to higher-level protocol addresses. Therefore the need for static map configuration for the IPX protocol is optional rather than mandatory. However, any static map configuration overrides the dynamic maps.

If a map is gleaned and it already exists as a dynamic map, the timer for the dynamic map is reset to the default value or the user-specified value.

Examples

The following example enables dynamic address mapping for IPX on interface serial 0 and sets the time to live (TTL) to 14 minutes:

```
interface serial 0
 encapsulation smds
 smds address c141.5797.1313.FFFF
 smds multicast ipx e1800.0999.9999.FFFF
 smds glean ipx 14
```

smds multicast

To assign a multicast Switched Multimegabit Data Service (SMDS) E.164 address to a higher-level protocol, use the **smds multicast** interface configuration command. To remove an assigned multicast address, use the **no** form of this command with the appropriate address.

smds multicast *protocol smds-address*

no smds multicast *protocol smds-address*

Syntax Description

protocol	Protocol type. See Table 42 for a list of supported protocols and their keywords.
smds-address	SMDS address. Because SMDS does not incorporate broadcast addressing, a group address for a particular protocol must be defined to serve the broadcast function.

Defaults

No mapping is defined.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

When configuring DECnet, you must enter all four DEC keywords (**decnet**, **decnet_router-L1**, **decnet_router-L2**, and **decnet_node**) in the configuration.

Table 42 lists the high-level protocols supported by the **smds multicast** command.

Table 42 smds multicast Supported Protocols

Keyword	Protocol
aarp	AppleTalk Address Resolution Protocol
appletalk	AppleTalk
arp	Address Resolution Protocol
bridge	Transparent bridging
clns	International Organization for Standardization (ISO) Connectionless Network Service (CLNS)
clns_es	Multicast address for all CLNS end systems
clns_is	Multicast address for all CLNS intermediate systems
decnet	DECnet
decnet_node	DECnet multicast address for all end systems
decnet_router-L1	DECnet multicast address for all Level 1 (intra-area) routers

Table 42 smds multicast Supported Protocols (continued)

Keyword	Protocol
decnet_router-L2	DECnet multicast address for all Level 2 (interarea) routers
ip	Internet Protocol (IP)
ipx	Novell IPX
vines	Banyan VINES
xns	Xerox Network Systems (XNS)

For IP, the IP NETwork and MASK fields are no longer required. The Cisco IOS software accepts these arguments, but ignores the values. These were required commands for the previous multiple logical IP subnetworks configuration. The software continues to accept the arguments to allow for backward compatibility, but ignores the contents.

Examples

The following example maps the IP broadcast address to the SMDS group address E180.0999.9999:

```
interface serial 0
 smds multicast IP E180.0999.9999.FFFF
```

smds multicast arp

To map the Switched Multimegabit Data Service (SMDS) address to a multicast address, use the **smds multicast arp** interface configuration command. To disable this feature, use the **no** form of this command.

smds multicast arp *smds-address* [*ip-address mask*]

no smds multicast arp *smds-address* [*ip-address mask*]

Syntax Description

smds-address	SMDS address in E.164 format.
ip-address	(Optional) IP address.
mask	(Optional) Subnet mask for the IP address.

Defaults

No mapping is defined.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is used only when an Address Resolution Protocol (ARP) server is present on a network. When broadcast ARPs are sent, SMDS first attempts to send the packet to all multicast ARP SMDS addresses. If none exist in the configuration, broadcast ARPs are sent to all multicast IP SMDS multicast addresses. If the optional ARP multicast address is missing, each entered IP multicast command is used for broadcasting.

Examples

The following example configures broadcast ARP messages:

```
interface serial 0
 smds multicast arp E180.0999.9999.2222
```

Related Commands

Command	Description
smds multicast ip	Maps an SMDS group address to a secondary IP address.

smds multicast bridge

To enable spanning-tree updates, use the **smds multicast bridge** interface configuration command. To disable this function, use the **no** form of this command.

smds multicast bridge *smds-address*

no smds multicast bridge *smds-address*

Syntax Description

smds-address	SMDS multicast address in E.164 format.

Defaults

No multicast SMDS address is defined. Spanning tree updates are disabled for transparent bridging across SMDS networks.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

To allow transparent bridging of packets across serial and High-Speed Serial Interface (HSSI) interfaces in an SMDS network, the SMDS interface must be added to an active bridge group. Also, standard bridging commands are necessary to enable bridging on an SMDS interface.

When the **smds multicast bridge** command is added to the configuration, broadcast packets are encapsulated with the specified SMDS multicast address configured for bridging. Two broadcast Address Resolution Protocol (ARP) packets are sent to the multicast address. One is sent with a standard (SMDS) ARP encapsulation, while the other is sent with the ARP packet encapsulated in an 802.3 MAC header. The native ARP is sent as a regular ARP broadcast.

Cisco's implementation of IEEE 802.6i transparent bridging for SMDS supports 802.3, 802.5, and FDDI frame formats. The router can accept frames with or without frame check sequence (FCS). Fast-switched transparent bridging is the default and is not configurable. If a packet cannot be fast switched, it is process switched.

In Cisco IOS Release 10.2 software (or earlier), bridging over multiple logical IP subnetworks is not supported. Bridging of IP packets in a multiple logical IP subnetworks environment is unpredictable.

Examples

In the following example, all broadcast bridge packets are sent to the configured SMDS multicast address:

```
interface hssi 0
 encapsulation smds
 smds address C120.1111.2222.FFFF
 ip address 172.16.0.0 255.255.255.0
 smds multicast bridge E180.0999.9999.FFFF
 bridge-group 5
```

Related Commands

Command	Description
bridge-group	Assigns each network interface to a bridge group.

smds multicast ip

To map a Switched Multimegabit Data Service (SMDS) group address to a secondary IP address, use the **smds multicast ip** interface configuration command. To remove the address map, use the **no** form of this command.

smds multicast ip *smds-address* [*ip-address mask*]

no smds multicast ip *smds-address* [*ip-address mask*]

Syntax Description

smds-address	SMDS address in E.164 format.
ip-address	(Optional) IP address.
mask	(Optional) Subnet mask for the IP address.

Defaults

The IP address and mask default to the primary address of the interface if they are left out of the configuration.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command allows a single SMDS interface to be treated as multiple logical IP subnetworks. If taking advantage of the multiple logical IP subnetworks support in SMDS, you can use more than one multicast address on the SMDS interface (by entering multiple commands). However, each **smds multicast ip** command entry must be associated with a different IP address on the SMDS interface.

Broadcasts can be sent on the SMDS interface by means of the multicast address. By sending broadcasts in this manner, the router is not required to replicate broadcasts messages to every remote host.

In addition, the higher-level protocols such as Open Shortest Path First (OSPF) and Intermediate System-to-Intermediate System (IS-IS) can use the multicast capability by sending one update packet or routing packet to the multicast address.

If the optional IP address and mask arguments are not present, the SMDS address and multicast address are associated with the primary IP address of the interface. This association allows the command to be backward compatible with earlier versions of the software.

If an Address Resolution Protocol (ARP) multicast address is missing, each entered IP multicast command is used for broadcasting. The ARP multicast command has the same format as the IP multicast command and is typically used only when an ARP server is present in the network.

Note All routers at the other end of the SMDS cloud must have the multiple logical IP subnetworks capability enabled. If you allocate a different SMDS subinterface for each logical IP subnetwork on the SMDS interface, you do not have to configure secondary IP addresses.

Examples

The following example configures an interface with two subinterfaces to support two different IP subnets with different multicast addresses to each network:

```
interface serial 2/0
 encapsulation smds
 smds address C120.1111.2222.4444

interface serial 2/0.1 multipoint
 smds addr c111.3333.3333.3333
 ip address 2.2.2.1 255.0.0.0
 smds multicast ip e222.2222.2222.2222
 smds enable-arp

interface serial 2/0.2 multipoint
 smds addr c111.2222.3333.3333.3333
 ip address 2.3.3.3 255.0.0.0
 smds multicast ip E180.0999.9999.FFFF
 smds enable-arp
```

Related Commands

Command	Description
smds multicast arp	Maps the SMDS address to a multicast address.

smds static-map

To configure a static map between an individual Switched Multimegabit Data Service (SMDS) address and a higher-level protocol address, use the **smds static-map** interface configuration command. To remove the map, use the **no** form of this command with the appropriate arguments.

smds static-map *protocol protocol-address smds-address* [**broadcast**]

no smds static-map *protocol protocol-address smds-address* [**broadcast**]

Syntax Description

protocol	Higher-level protocol. It can be one of the following values: **appletalk**, **clns**, **decnet**, **ip**, **ipx**, **vines,** or **xns**.
protocol-address	Address of the higher-level protocol.
smds-address	SMDS address, to complete the mapping.
broadcast	(Optional) Marks the specified protocol address as a candidate for broadcast packets. All broadcast requests are sent to the unicast SMDS address.

Defaults

No mapping is defined.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The **smds static-map** command provides *pseudobroadcasting* by allowing the use of broadcasts on those hosts that cannot support SMDS multicast addresses.

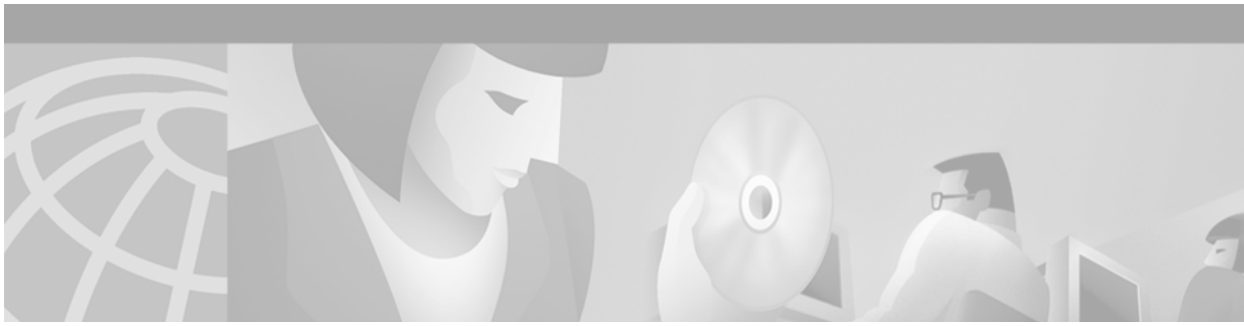
Examples

The following example illustrates how to enable pseudobroadcasting. The router at address C120.4444.9999 will receive a copy of the broadcast request because the broadcast keyword is specified with the **smds static-map** command. The host at address 172.16.1.15 is incapable of receiving multicast packets. The multicasting is simulated with this feature.

```
interface hssi 0
 encapsulation smds
 smds address C120.1111.2222.FFFF
 ip address 172.16.1.30 255.255.255.0
 smds static-map ip 172.16.1.15 C120.4444.9999.FFFF broadcast
 smds enable-arp
```

The following example illustrates how to enable multicasting. In addition to IP and ARP requests to E100.0999.9999, the router at address C120.4444.9999 will also receive a copy of the multicast request. The host at address 172.16.1.15 is incapable of receiving broadcast packets.

```
interface hssi 0
 encapsulation smds
 smds address C120.1111.2222.FFFF
 ip address 172.16.1.30 255.255.255.0
 smds multicast ip E100.0999.999.FFFF
 smds static-map ip 172.16.1.15 C120.4444.9999.FFFF
 smds enable-arp
```



X.25 and LAPB Commands

Use the commands in this chapter to configure the following:

- Link Access Procedure, Balanced (LAPB)
- X.25 services (X.25, X.25 over TCP [XOT] and Connection-Mode Network Service [CMNS])
- Defense Data Network (DDN) X.25
- Blacker Front End (BFE).

X.25 provides remote terminal access and bridging. X.25 also provides encapsulation for the following protocols:

- IP
- DECnet
- Xerox Network Services (XNS)
- International Organization for Standardization (ISO) Connectionless Network Service (CLNS) AppleTalk
- Novell IPX
- Banyan VINES
- Apollo Domain

X.25 virtual circuits can be switched as follows:

- Between interfaces—for local routing
- Between two routers—for remote routing using X.25-over-TCP (XOT)
- Over nonserial media—for Connection-Mode Network Service (CMNS)

To translate between X.25 and another protocol, refer to the chapter "Configuring Protocol Translation and Virtual Asynchronous Devices" in the *Cisco IOS Terminal Services Configuration Guide*.

For X.25 and LAPB configuration information and examples, refer to the "Configuring X.25 and LAPB" chapter in the *Cisco IOS Wide-Area Networking Configuration Guide*.

access-class (X.25)

To configure an incoming access class on virtual terminals, use the **access-class** (X.25) line configuration command.

access-class *access-list-number* **in**

Syntax Description

access-list-number	An integer from 1 to 199 that you select for the access list.
in	Restricts incoming connections between a particular access server and the addresses in the access list.

Defaults

No incoming access class is defined.

Command Modes

Line configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

The access list number is used for both incoming Transmission Control Protocol (TCP) access and incoming packet assembler/disassembler (PAD) access.

In the case of TCP access, the access server uses the IP access list defined with the **access-list** command.

For incoming PAD connections, the same numbered X.29 access list is referenced. If you only want to have access restrictions on one of the protocols, you can create an access list that permits all addresses for the other protocol.

Examples

The following example configures an incoming access class on virtual terminal line 4. For information on the **line vty** command see the publication *Configuring the Route Processor for the Catalyst 8540 and Using Flash Memory Cards*.

```
line vty 4
 access-class 4 in
```

Related Commands

Command	Description
access-list	Configures the access list mechanism for filtering frames by protocol type or vendor code.
x29 access-list	Limits access to the access server from certain X.25 hosts.

bfe

This command is no longer supported.

clear x25

To restart an X.25 service or Connection-Mode Network Service (CMNS), to clear a switched virtual circuit (SVC), or to reset a permanent virtual circuit (PVC), use the **clear x25** privileged EXEC command.

clear x25 {**serial** *number* | {**ethernet** | **fastethernet** | **tokenring** | **fddi**} *number mac-address*} [*vc-number*] | [*dlci number*]

Syntax Description

serial *number*	Local serial interface being used for X.25 service.
ethernet | **fastethernet** | **tokenring** | **fddi** *number mac-address*	Local CMNS interface (Ethernet, Fast Ethernet, Token Ring, or FDDI interface) and MAC address of the remote device; this information identifies a CMNS service.
vc-number	(Optional) SVC or PVC number, in the range 1 to 4095. If specified, the SVC is cleared or the PVC is reset. If not specified, the X.25 or CMNS service is restarted.
dlci number	(Optional) When combined with a serial interface number, it triggers a restart event for an Annex G logical X.25 VC.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.2	This command was introduced. This command replaces the **clear x25-vc** command, which first appeared in Cisco IOS Release 8.3.
12.0(3)T	Annex G restart or clear options were added.

Usage Guidelines

This command form is used to disrupt service forcibly on an individual circuit or on all circuits using a specific X.25 service or CMNS service.

If this command is used without the *vc-number* value, a restart event is initiated, which implicitly clears all SVCs and resets all PVCs.

This command allows the option of restarting an Annex G connection per data-link connection identifier (DLCI) number, clearing all X.25 connections, or clearing a specific X.25 logical circuit number on that Annex G link.

Examples

The following example clears the SVC or resets the PVC specified:

```
clear x25 serial 0 1
```

The following example forces an X.25 restart, which implicitly clears all SVCs and resets all PVCs using the interface:

```
clear x25 serial 0
```

The following example restarts the specified CMNS service (if active), which implicitly clears all SVCs using the service:

```
clear x25 ethernet 0 0001.0002.0003
```

The following example clears the specified DLCI Annex G connection (**40**) from the specified interface:

```
clear x25 serial 1 40
```

Related Commands

Command	Description
clear xot	Clears an XOT SVC or resets an XOT PVC.
frame-relay interface-dlci	Assigns a DLCI to a specified Frame Relay subinterface on the router or access server.
show x25 context	Displays details of an Annex G DLCI link.
show x25 services	Displays information about X.25 services.
show x25 vc	Displays information about active X.25 virtual circuits.

clear x25-vc

This command is replaced by the **clear x25** command. See the description of the **clear x25** command earlier in this chapter for more information.

clear xot

To clear an X.25 over TCP (XOT) switched virtual circuit (SVC) or reset an XOT permanent virtual circuit (PVC), use the **clear xot** EXEC command.

clear xot remote *ip-address port* **local** *ip-address port*

Syntax Description

remote *ip-address port*	Remote IP address and port number of an XOT connection ID.
local *ip-address port*	Local IP address and port number of an XOT connection ID.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

Each SVC or PVC supported by the XOT service uses a TCP connection to communicate X.25 packets. A TCP connection is uniquely identified by the data quartet: remote IP address, remote TCP port, local IP address, and local TCP port. This command form is used to forcibly disrupt service on an individual XOT circuit.

XOT connections are sent to TCP port 1998, so XOT connections originated by the router will have that remote port number, and connections received by the router will have that local port number.

Examples

The following command will clear or reset, respectively, the SVC or PVC using the TCP connection identified:

```
clear xot remote 10.1.1.1 1998 local 172.2.2.2 2000
```

Related Commands

Command	Description
show x25 services	Displays information pertaining to the X.25 services.

cmns enable

To enable the Connection-Mode Network Service (CMNS) on a nonserial interface, use the **cmns enable** interface configuration command. To disable this capability, use the **no** form of this command.

cmns enable

no cmns enable

Syntax Description

This command has no arguments or keywords.

Defaults

Each nonserial interface must be explicitly configured to use CMNS.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

After this command is processed on the LAN interfaces—Ethernet, Fiber Distributed Data Interface (FDDI), and Token Ring—all the X.25-related interface configuration commands are made available.

Examples

The following example enables CMNS on Ethernet interface 0:

```
interface ethernet 0
 cmns enable
```

Related Commands

Command	Description
x25 route	Creates an entry in the X.25 routing table (to be consulted for forwarding incoming calls and for placing outgoing PAD or protocol translation calls).

encapsulation lapb

To exchange datagrams over a serial interface using Link Access Procedure, Balanced (LAPB) encapsulation, use the **encapsulation lapb** interface configuration command.

encapsulation lapb [**dte** | **dce**] [**multi** | *protocol*]

Syntax Description

dte	(Optional) Specifies operation as a data terminal equipment (DTE) device. This is the default LAPB mode.
dce	(Optional) Specifies operation as a data communications equipment (DCE) device.
multi	(Optional) Specifies use of multiple local-area network (LAN) protocols to be carried on the LAPB line.
protocol	(Optional) A single protocol to be carried on the LAPB line. A single protocol can be one of the following: **apollo**, **appletalk**, **clns** (ISO CLNS), **decnet**, **ip**, **ipx** (Novell IPX), **vines**, and **xns**. IP is the default protocol.

Defaults

The default serial encapsulation is High-Level Data Link Control (HDLC). You must explicitly configure a LAPB encapsulation method.

DTE operation is the default LAPB mode. IP is the default protocol.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
10.3	The following keywords and argument were introduced: • **dte** • **dce** • **multi** • *protocol*

Usage Guidelines

LAPB encapsulations are appropriate only for private connections, where you have complete control over both ends of the link. Connections to X.25 networks should use an X.25 encapsulation configuration, which operates the X.25 Layer 3 protocol above a LAPB Layer 2.

One end of the link must be a logical DCE device, and the other end a logical DTE device. (This assignment is independent of the interface's hardware DTE or DCE identity.)

Both ends of the LAPB link must specify the same protocol encapsulation.

LAPB encapsulation is supported on serial lines configured for dial-on-demand routing (DDR). It can be configured on DDR synchronous serial and ISDN interfaces and on DDR dialer rotary groups. It is not supported on asynchronous dialer interfaces.

A single-protocol LAPB encapsulation exchanges datagrams of the given protocol, each in a separate LAPB information frame. You must configure the interface with the protocol-specific parameters needed—for example, a link that carries IP traffic will have an IP address defined for the interface.

A multiprotocol LAPB encapsulation can exchange any or all of the protocols allowed for a LAPB interface. It exchanges datagrams, each in a separate LAPB information frame. Two bytes of protocol identification data precede the protocol data. You need to configure the interface with all the protocol-specific parameters needed for each protocol carried.

Beginning with Cisco IOS Release 11.0, *multiprotocol* LAPB encapsulation supports transparent bridging. This feature requires use of the **encapsulation lapb multi** command followed by the **bridge-group** command, which identifies the bridge group associated with multiprotocol LAPB encapsulation. This feature does *not* support use of the **encapsulation lapb** *protocol* command with a **bridge** keyword.

Beginning with Release 10.3, LAPB encapsulation supports the priority and custom queueing features.

Examples

The following example sets the operating mode as DTE and specifies that AppleTalk protocol traffic will be carried on the LAPB line:

```
interface serial 1
 encapsulation lapb dte appletalk
```

Related Commands

Command	Description
bridge-group	Assigns each network interface to a bridge group.

encapsulation x25

To specify a serial interface's operation as an X.25 device, use the **encapsulation x25** interface configuration command.

encapsulation x25 [**dte** | **dce**] [**ddn** | **bfe**] | [**ietf**]

no encapsulation x25 [**dte** | **dce**] [**ddn** | **bfe**] | [**ietf**]

Syntax Description

dte	(Optional) Specifies operation as a data terminal equipment (DTE). This is the default X.25 mode.
dce	(Optional) Specifies operation as a data communications equipment (DCE).
ddn	(Optional) Specifies Defense Data Network (DDN) encapsulation on an interface using DDN X.25 Standard Service.
bfe	(Optional) Specifies Blacker Front End (BFE) encapsulation on an interface attached to a BFE device.
ietf	(Optional) Specifies that the interface's datagram encapsulation defaults to use of the Internet Engineering Task Force (IETF) standard method, as defined by RFC 1356.

Defaults

The default serial encapsulation is High-Level Data Link Control (HDLC). You must explicitly configure an X.25 encapsulation method.

DTE operation is the default X.25 mode. Cisco's traditional X.25 encapsulation method is the default.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
10.3	The following keywords were added: • **dte** • **dce** • **ddn** • **bfe** • **ietf**

Usage Guidelines

One end of an X.25 link must be a logical DCE device and the other end a logical DTE device. (This assignment is independent of the interface's hardware DTE or DCE identity.) Typically, when connecting to a public data network (PDN), the customer equipment acts as the DTE device and the PDN attachment acts as the DCE.

Cisco has long supported the encapsulation of a number of datagram protocols, using a standard means when available and a proprietary means when necessary. More recently the IETF adopted a standard, RFC 1356, for encapsulating most types of datagram traffic over X.25. X.25 interfaces use Cisco's traditional method unless explicitly configured for IETF operation; if the **ietf** keyword is specified, that standard is used unless Cisco's traditional method is explicitly configured. For details see the **x25 map** command.

You can configure a router attaching to the DDN or to a BFE device to use their respective algorithms to convert between IP and X.121 addresses by using the **ddn** or **bfe** option, respectively. An IP address must be assigned to the interface, from which the algorithm will generate the interface's X.121 address. For proper operation, this X.121 address must not be modified.

A router DDN attachment can operate as either a DTE or a DCE device. A BFE attachment can operate only as a DTE device. The **ietf** option is not available if either the **ddn** or **bfe** option is selected.

Examples

The following example configures the interface for connection to a BFE device:

```
interface serial 0
 encapsulation x25 bfe
```

Related Commands

Command	Description
x25 map	Sets up the LAN protocols-to-remote host mapping.

lapb interface-outage

To specify the period for which a link will remain connected, even if a brief hardware outage occurs (partial Link Access Procedure, Balanced [LAPB] T3 timer functionality), use the **lapb interface-outage** interface configuration command.

lapb interface-outage *milliseconds*

Syntax Description

milliseconds	Number of milliseconds (ms) a hardware outage can last without the protocol disconnecting the service.

Defaults

0 ms, which disables this feature.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

If a hardware outage lasts longer than the LAPB hardware outage period you select, normal protocol operations will occur. The link will be declared down, and when it is restored, a link setup will be initiated.

Examples

The following example sets the interface outage period to 100 ms. The link remains connected for outages equal to or shorter than that period.

```
encapsulation lapb dte ip
lapb interface-outage 100
```

Related Commands

Command	Description
lapb n1	Sets the maximum number of bits a frame can hold (LAPB N1 parameter).
lapb n2	Specifies the maximum number of times a data frame can be sent (LAPB N2 parameter).
lapb t1	Sets the retransmission timer period (LAPB T1 parameter).
lapb t2	Sets the explicit acknowledge deferral timer (LAPB T2 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.

lapb k

To specify the maximum permissible number of outstanding frames, called the *window size*, use the **lapb k** interface configuration command.

lapb k *window-size*

Syntax Description

window-size	Frame count. It can be a value from 1 to the modulo size minus 1 (the maximum is 7 if the modulo size is 8; it is 127 if the modulo size is 128).

Defaults

7 frames

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

If the window size is changed while the protocol is up, the new value takes effect only when the protocol is reset. You will be informed that the new value will not take effect immediately.

When using the Link Access Procedure, Balanced (LAPB) modulo 128 mode (extended mode), you must increase the window parameter k to send a larger number of frames before acknowledgment is required. This increase is the basis for the router's ability to achieve greater throughput on high-speed links that have a low error rate.

This configured value must match the value configured in the peer X.25 switch. Nonmatching values will cause repeated LAPB reject (REJ) frames.

Examples

The following example sets the LAPB window size (the k parameter) to 10 frames:

```
interface serial 0
 lapb modulo
 lapb k 10
```

Related Commands

Command	Description
lapb modulo	Specifies the LAPB basic (modulo 8) or extended (modulo 128) protocol mode.

lapb modulo

To specify the Link Access Procedure, Balanced (LAPB) basic (modulo 8) or extended (modulo 128) protocol mode, use the **lapb modulo** interface configuration command.

lapb modulo *modulus*

Syntax Description

modulus	Either 8 or 128. The value 8 specifies LAPB's basic mode; the value 128 specifies LAPB's extended mode.

Defaults

Modulo 8

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The modulo parameter determines which of LAPB's two modes is to be used. The modulo values derive from the fact that basic mode numbers information frames between 0 and 7, whereas extended mode numbers them between 0 and 127. Basic mode is widely available and is sufficient for most links. Extended mode is an optional LAPB feature that may achieve greater throughput on high-speed links that have a low error rate.

The LAPB operating mode may be set on X.25 links as well as LAPB links. The X.25 modulo is independent of the LAPB layer modulo. Both ends of a link must use the same LAPB mode.

When using modulo 128 mode, you must increase the window parameter k to send a larger number of frames before acknowledgment is required. This increase is the basis for the router's ability to achieve greater throughput on high-speed links that have a low error rate.

If the modulo value is changed while the protocol is up, the new value takes effect only when the protocol is reset. You will be informed that the new value will not take effect immediately.

Examples

The following example configures a high-speed X.25 link to use LAPB's extended mode:

```
interface serial 1
 encapsulation x25
 lapb modulo 128
 lapb k 40
 clock rate 2000000
```

Related Commands

Command	Description
lapb k	Specifies the maximum permissible number of outstanding frames, called the window size.

lapb n1

To specify the maximum number of bits a frame can hold (the Link Access Procedure, Balanced [LAPB] N1 parameter), use the **lapb n1** interface configuration command.

lapb n1 *bits*

Syntax Description

bits	Maximum number of bits in multiples of eight. The minimum and maximum range is dynamically set. Use the question mark (**?**) to view the range.

Defaults

The largest (maximum) value available for the particular interface is the default. The Cisco IOS software dynamically calculates N1 whenever you change the maximum transmission unit (MTU), the L2/L3 modulo, or compression on a LAPB interface.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The Cisco IOS software uses the following formula to determine the minimum N1 value:

*(128 (default packet size) + LAPB overhead + X.25 overhead + 2 bytes of CRC) * 8*

The Cisco IOS software uses the following formula to determine for the maximum N1 value:

*(hardware MTU + LAPB overhead + X.25 overhead + 2 bytes of CRC) * 8*

LAPB overhead is 2 bytes for modulo 8 and 3 bytes for modulo 128.

X.25 overhead is 3 bytes for modulo 8 and 4 bytes for modulo 128.

You need not set N1 to an exact value to support a particular X.25 data packet size. The N1 parameter prevents the processing of any huge frames that result from a "jabbering" interface, an unlikely event.

In addition, the various standards bodies specify that N1 be given in bits rather than bytes. While some equipment can be configured in bytes or will automatically adjust for some of the overhead information present, Cisco devices are configured using the true value, in bits, of N1.

You cannot set the N1 parameter to a value less than that required to support an X.25 data packet size of 128 bytes. All X.25 implementations must be able to support 128-byte data packets. Moreover, if you configure N1 to be less than 2104 bits, you receive a warning message that X.25 might have problems because some nondata packets can use up to 259 bytes.

You cannot set the N1 parameter to a value larger than the default unless the hardware MTU size is first increased.

The X.25 software accepts default packet sizes and calls that specify maximum packet sizes greater than those the LAPB layer supports, but negotiates the calls placed on the interface to the largest value that can be supported. For switched calls, the packet size negotiation takes place end-to-end through the router so the call will not have a maximum packet size that exceeds the capability of either of the two interfaces involved.

Caution The LAPB N1 parameter provides little benefit beyond the interface MTU and can easily cause link failures if misconfigured. Cisco recommends that this parameter be left at its default value.

Examples

The following example shows how to use the question mark (**?**) command to display the minimum and maximum N1 value. In this example, X.25 encapsulation has both the LAPB and X.25 modulo set to 8. Any violation of this N1 range results in an "Invalid input" error message.

```
router(config)# interface serial 1
router(config-if)# lapb n1 ?

<1080-12056> LAPB N1 parameter (bits; multiple of 8)
```

The following example sets the N1 bits to 16440:

```
router(config)# interface serial 0
router(config-if)# lapb n1 16440
router(config-if)# mtu 2048
```

Related Commands

Command	Description
lapb interface-outage	Partial LAPB T3 timer function that sets the time-length a link will remain connected during a hardware outage.
lapb n2	Specifies the maximum number of times a data frame can be sent (LAPB N2 parameter).
lapb t1	Sets the retransmission timer period (LAPB T1 parameter).
lapb t2	Sets the explicit acknowledge deferral timer (LAPB T2 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.
mtu	Adjusts the maximum packet size or MTU size.

lapb n2

To specify the maximum number of times a data frame can be sent (the Link Access Procedure, Balanced [LAPB] N2 parameter), use the **lapb n2** interface configuration command.

lapb n2 *tries*

Syntax Description

tries	Transmission count. It can be a value from 1 to 255.

Defaults

20 transmissions

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the N2 tries to 50:

```
interface serial 0
 lapb n2 50
```

Related Commands

Command	Description
lapb interface-outage	Partial LAPB T3 timer function that sets the time-length a link will remain connected during a hardware outage.
lapb n1	Sets the maximum number of bits a frame can hold (LAPB N1 parameter).
lapb t1	Sets the retransmission timer period (LAPB T1 parameter).
lapb t2	Sets the explicit acknowledge deferral timer (LAPB T2 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.

lapb protocol

The **lapb protocol** command has been replaced by the [*protocol* | **multi**] option of the **encapsulation lapb** command. See the description of the [*protocol* | **multi**] option of the **encapsulation lapb** command earlier in this chapter for more information.

lapb t1

To set the retransmission timer period (the Link Access Procedure, Balanced [LAPB] T1 parameter), use the **lapb t1** interface configuration command.

lapb t1 *milliseconds*

Syntax Description

milliseconds	Time in milliseconds. It can be a value from 1 to 64000.

Defaults

3000 ms

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The retransmission timer determines how long a transmitted frame can remain unacknowledged before the LAPB software polls for an acknowledgment. The design of the LAPB protocol specifies that a frame is presumed to be lost if it is not acknowledged within T1; a T1 value that is too small may result in duplicated control information, which can severely disrupt service.

To determine an optimal value for the retransmission timer, use the **ping** privileged EXEC command to measure the round-trip time of a maximum-sized frame on the link. Multiply this time by a safety factor that takes into account the speed of the link, the link quality, and the distance. A typical safety factor is 1.5. Choosing a larger safety factor can result in slower data transfer if the line is noisy. However, this disadvantage is minor compared to the excessive retransmissions and effective bandwidth reduction caused by a timer setting that is too small.

Examples

The following example sets the T1 retransmission timer to 2000 ms:

```
interface serial 0
 lapb t1 2000
```

Related Commands

Command	Description
lapb interface-outage	Partial LAPB T3 timer function that sets the time-length a link will remain connected during a hardware outage.
lapb n1	Sets the maximum number of bits a frame can hold (LAPB N1 parameter).
lapb n2	Specifies the maximum number of times a data frame can be sent (LAPB N2 parameter).

Command	Description
lapb t2	Sets the explicit acknowledge deferral timer (LAPB T2 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.

lapb t2

To set the explicit acknowledge deferral timer (the Link Access Procedure, Balanced [LAPB] T2 parameter), use the **lapb t2** interface configuration command.

lapb t2 *milliseconds*

Syntax Description

milliseconds	Time in milliseconds. It can be a value from 1 to 32000. Default is 0 ms (disabled) and the recommended setting.

Defaults

0 ms (disabled), which means that the software will send an acknowledgement as quickly as possible.

Command Modes

Interface configuration

Command History

Release	Modification
12.0	This command was introduced.

Usage Guidelines

The explicit acknowledge deferral timer determines the time that the software waits before sending an explicit acknowledgement. The acknowledgement is piggybacked with the data, unless there is no data and then an explicit acknowledgement is sent when the timer expires.

Caution It is usually not necessary (or recommended) to set the LAPB T2 timer, but if there is a requirement, it must be set to a value smaller than that set for the LAPB T1 timer; see the ITU X.25 specifications for details.

Related Commands

Command	Description
lapb interface-outage	Partial LAPB T3 timer function that sets the time-length a link will remain connected during a hardware outage.
lapb n1	Sets the maximum number of bits a frame can hold (LAPB N1 parameter).
lapb n2	Specifies the maximum number of times a data frame can be sent (LAPB N2 parameter).
lapb t1	Sets the retransmission timer period (LAPB T1 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.

lapb t4

To set the T4 idle timer, after which the Cisco IOS software sends out a Poll packet to determine whether the link has suffered an unsignaled failure, use the **lapb t4** interface configuration command.

lapb t4 *seconds*

Syntax Description

seconds	Number of seconds between receipt of the last frame and transmission of the outgoing poll.

Defaults

0 seconds

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Any non-zero T4 duration must be greater than T1, the Link Access Procedure, Balanced (LAPB) retransmission timer period.

Examples

The following example will poll the other end of an active link if it has been 10 seconds since the last frame was received. If the far host has failed, the service will be declared down after **n2** tries are timed out.

```
interface serial0
 encapsulation x25
 lapb t4 10
```

Related Commands

Command	Description
lapb interface-outage	Partial LAPB T3 timer function that sets the time-length a link will remain connected during a hardware outage.
lapb n1	Sets the maximum number of bits a frame can hold (LAPB N1 parameter).
lapb n2	Specifies the maximum number of times a data frame can be sent (LAPB N2 parameter).
lapb t1	Sets the retransmission timer period (LAPB T1 parameter).
lapb t4	Sets the LAPB T4 idle timer, after which time a poll packet is sent to determine state of an unsignaled failure on the link.

service pad

To enable all packet assembler/disassembler (PAD) commands and connections between PAD devices and access servers, use the **service pad** global configuration command. To disable this service, use the **no** form of this command.

service pad [**cmns**][**from-xot**][**to-xot**]

no service pad [**cmns**][**from-xot**][**to-xot**]

Syntax Description

cmns	(Optional) Specifies sending and receiving PAD calls over CMNS.
from-xot	(Optional) Accepts XOT to PAD connections.
to-xot	(Optional) Allows outgoing PAD calls over XOT.

Defaults

All PAD commands and associated connections are enabled. PAD services over XOT or CMNS are not enabled.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3	The **cmns** keyword was added.

Usage Guidelines

The options **from-xot** and **to-xot** enable PAD calls to destinations that are not reachable over physical X.25 interfaces, but instead over TCP tunnels. This feature is known as PAD over XOT (X.25 over TCP).

Examples

If **service pad** is disabled, the EXEC **pad** command and all PAD related configurations, such as X.29, are unrecognized, as shown in the following example:

```
Router(config)# no service pad
Router(config)# x29 ?
% Unrecognized command
Router(config)# exit
Router# pad ?
% Unrecognized command
```

If **service pad** is enabled, the EXEC **pad** command and access to an X.29 configuration are granted as shown in the following example:

```
Router# config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# service pad
Router(config)# x29 ?
access-list       Define an X.29 access list
inviteclear-time  Wait for response to X.29 Invite Clear message
profile           Create an X.3 profile
```

```
Router# pad ?
WORD   X121 address or name of a remote system
```

In the following example, PAD services over CMNS are enabled:

```
! Enable CMNS on a nonserial interface
interface ethernet0
 cmns enable
!
!Enable inbound and outbound PAD over CMNS service
service pad cmns
!
! Specify an X.25 route entry pointing to an interface's CMNS destination MAC address
x25 route ^2193330 interface Ethernet0 mac 00e0.b0e3.0d62

Router# show x25 vc

SVC 1,  State: D1,  Interface: Ethernet0
     Started 00:00:08, last input 00:00:08, output 00:00:08

     Line: 0   con 0    Location: console Host: 2193330
      connected to 2193330 PAD <--> CMNS Ethernet0 00e0.b0e3.0d62

     Window size input: 2, output: 2
     Packet size input: 128, output: 128
     PS: 2  PR: 3  ACK: 3  Remote PR: 2  RCNT: 0  RNR: no
     P/D state timeouts: 0  timer (secs): 0
     data bytes 54/19 packets 2/3 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Related Commands

Command	Description
cmns enable	Enables the CMNS on a nonserial interface.
show x25 vc	Displays information about active SVCs and PVCs.
x29 access-list	Limits access to the access server from certain X.25 hosts.
x29 profile	Creates a PAD profile script for use by the translate command.

service pad from-xot

To permit incoming X.25 over TCP (XOT) calls to be accepted as a packet assembler/disassembler (PAD) session, use the **service pad from-xot** global configuration command. To disable this service, use the **no** form of this command.

service pad from-xot

no service pad from-xot

Syntax Description

This command has no arguments or keywords.

Defaults

Incoming XOT connections are ignored.

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

If **service pad from-xot** is enabled, the calls received using the XOT service may be accepted for processing a PAD session.

Examples

The following example prevents incoming XOT calls from being accepted as a PAD session:

```
no service pad from-xot
```

Related Commands

Command	Description
x25 route	Creates an entry in the X.25 routing table (to be consulted for forwarding incoming calls and for placing outgoing PAD or protocol translation calls).
x29 access-list	Limits access to the access server from certain X.25 hosts.
x29 profile	Creates a PAD profile script for use by the translate command.

service pad to-xot

To permit outgoing PAD sessions to use routes to an XOT destination, use the **service pad to-xot** global configuration command. To disable this service, use the **no** form of this command.

service pad to-xot

no service pad to-xot

Syntax Description

This command has no arguments or keywords.

Defaults

XOT routes pointing to XOT are not considered.

Command Modes

Global configuration

Command History

Release	Modification
11.2	This command was introduced.

Examples

If **service pad to-xot** is enabled, the configured routes to XOT destinations may be used when the router determines where to send a PAD Call, as shown in the following example:

```
service pad to-xot
```

Related Commands

Command	Description
x25 route	Creates an entry in the X.25 routing table (to be consulted for forwarding incoming calls and for placing outgoing PAD or protocol translation calls).
x29 access-list	Limits access to the access server from certain X.25 hosts.
x29 profile	Creates a PAD profile script for use by the translate command.

show cmns

Effective with Cisco IOS Release 11.3, this command is no longer available.

show x25 context

To view operating configuration status details of an X.25 link, use the **show x25 context** EXEC command.

show x25 context [**interface** *number* **dlci** *number*]

Syntax Description

interface *number*	(Optional) Specific logical X.25 virtual circuit interface.
dlci *number*	(Optional) Specific DLCI link.

Command Modes

EXEC

Command History

Release	Modification
12.0(3)T	This command was introduced.
12.1(5)T	This command was modified to display information about X.25 Failover.

Examples

The following is sample output from the **show x25 context** command:

```
Router# show x25 context

Serial1 DLCI 20
PROFILE DCE, address <none>, state R1, modulo 8, timer 0
      Defaults: idle VC timeout 0
        input/output window sizes 2/2, packet sizes 128/128
      Timers: T10 60, T11 180, T12 60, T13 60
      Channels: Incoming-only none, Two-way 1-1024, Outgoing-only none
      RESTARTs 1/0 CALLs 0+0/0+0/0+0 DIAGs 0/0
  LAPB DCE, state CONNECT, modulo 8, k 7, N1 12056, N2 20
      T1 3000, T2 0, interface outage (partial T3) 0, T4 0
      VS 7, VR 6, tx NR 6, Remote VR 7, Retransmissions 0
      Queues: U/S frames 0, I frames 0, unack. 0, reTx 0
      IFRAMEs 111/118 RNRs 0/0 REJs 0/0 SABM/Es 14/1 FRMRs 0/0 DISCs 0/0
```

The following is sample output from the **show x25 context** command when the X.25 Failover feature is configured. The "Fail-over delay" field appears when the primary interface has gone down and come back up again. The number of seconds indicates the time remaining until the secondary interface will reset.

```
Router# show x25 context

Serial1 DLCI 33
  PROFILE dxe/DCE, address 3032, state R1, modulo 8, timer 0
      Defaults:idle VC timeout 0
        input/output window sizes 2/2, packet sizes 128/128
      Timers:T20 180, T21 200, T22 180, T23 180
      Channels:Incoming-only none, Two-way 1-4095, Outgoing-only none
      RESTARTs 12/0 CALLs 5+4/0+0/0+0 DIAGs 0/0
      Fail-over delay:16 seconds remaining on Dialer0
  LAPB dxe/DCE, state CONNECT, modulo 8, k 7, N1 12056, N2 20
      T1 3000, T2 0, interface outage (partial T3) 0, T4 0
      VS 1, VR 1, tx NR 1, Remote VR 1, Retransmissions 0
```

```
Queues:U/S frames 0, I frames 0, unack. 0, reTx 0
IFRAMEs 97/88 RNRs 0/0 REJs 0/0 SABM/Es 55490/12 FRMRs 186/0 DISCs
```

Table 43 describes significant fields shown in the display.

Table 43 show x25 context Field Descriptions

Field	Description
address	Address to which the interface is connected.
state	State of the interface. Possible values are: R1- normal ready state R2 - DTE restarting state R3 - DCE restarting state If state is R2 or R3, the interface is awaiting acknowledgment of a Restart packet.
modulo	Modulo packet sequence numbering scheme.
timer	Interface timer value (zero unless the interface state is R2 or R3).
Defaults: idle VC timeout	Inactivity time before clearing VC.
input/output window sizes	Default window sizes (in packets) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
packet sizes	Default maximum packet sizes (in bytes) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
Timers	Values of the X.25 timers: T10 through T13 for a DCE device T20 through T23 for a DTE device
Channels	Virtual circuit ranges for this interface.
RESTARTs	Restart packet statistics for the interface using the format Sent/Received.
CALLs	(Number of successful calls sent + calls failed)/(calls received + calls failed)/(calls forwarded + calls failed). Calls forwarded are counted as calls sent.
DIAGs	Number of diagnostic messages sent and received.
Fail-over delay	Number of seconds remaining until secondary interface resets.

Related Commands

Command	Description
show x25 profile	Displays information about configured X.25 profiles.
show x25 vc	Displays information about active X.25 virtual circuits.
x25 profile	Configures an X.25 profile without allocating any hardware-specific information.

show x25 cug

To display information about all closed user groups (CUGs) or specific CUGs (defined by the local or network CUG number), use the **show x25 cug** EXEC command.

show x25 cug {**local-cug** *number* | **network-cug** *number*}

Syntax Description

local-cug	Locally significant CUG identifier.
number	Local CUG number (0 to 9999).
network-cug	Network translated CUG identifier.
number	Network CUG number (0 to 9999).

Command Modes

EXEC

Command History

Release	Modification
12.0(7)T	This command was introduced.
12.1(5)T	This command was modified to show information about CUG selection facility suppression.

Usage Guidelines

You must designate either the **local-cug** or the **network-cug** keyword with this command. Within these designations you can view all CUGs or a specific CUG defined by its local or network CUG identifier.

Examples

CUG Selection Facility Suppress Option Example

The following is sample output for the **show x25 cug** command when CUG selection facility is suppressed for all CUGs on serial interface 1/2 and for the preferential CUG on the X.25 profile named "cug".

```
Router# show x25 cug local-cug

X.25 Serial1/2, 2 CUGs subscribed with no public access
  CUG selection facility suppressed for all CUGs
  local-cug 100 <-> network-cug 10
  local-cug 1 <-> network-cug 11
PROFILE cug, 2 CUGs subscribed with incoming public access
  CUG selection facility suppressed for preferential CUG
  local-cug 0 <-> network-cug 0 , preferential
  local-cug 100 <-> network-cug 100
  local-cug 200 <-> network-cug 200
```

Local CUG Example

The following is sample output from the **show x25 cug local-cug** command, displaying information about all local CUGs on X.25 serial interface 0. Four CUGs have been subscribed to on serial interface 0, and they all have been configured for incoming and outgoing public access.

```
Router# show x25 cug local-cug
```

```
X.25 Serial0, 4 CUGs subscribed with incoming and outgoing public access
  local-cug 100 <-> network-cug 11
  local-cug 200 <-> network-cug 22
  local-cug 300 <-> network-cug 33
  local-cug 5000 <-> network-cug 55, preferential
```

Network CUG Example

The following is sample output from the **show x25 cug network-cug** command specifically for network number 33 showing that local CUG 300 is associated with it.

```
Router# show x25 cug network-cug 33

X.25 Serial1/2, 5 CUGs subscribed with no public access
  network-cug 33 <-> local-cug 300
```

Table 44 describes the fields shown in the display for the **show x25 cug** command.

Table 44 show x25 cug Field Descriptions

Field	Description
X.25 Serial 0	DCE interface with X.25 CUG service subscription.
local-cug	Local CUG details.
network-cug	Network CUG details.
preferential	Identifies which CUG, if any, is preferential. A single CUG listed for an interface is assumed to be preferential.

Related Commands

Command	Description
x25 subscribe cug-service	Enables and controls standard CUG behavior on an X.25 DCE interface.
x25 subscribe local-cug	Configures a DCE X.25 interface for a specific CUG subscription.

show x25 hunt-group

To display hunt groups and view detailed interface statistics and distribution methods, use the **show x25 hunt-group** EXEC command.

show x25 hunt-group [*name*]

Syntax Description

name	(Optional) Displays the specific hunt group named.

Command Modes

EXEC

Command History

Release	Modification
12.0(3)T	This command was introduced.
12.0(5)T	The command output status field was modified to include “unoperational” as a type of interface status.

Usage Guidelines

Use the **clear counters** or the **clear x25** commands in EXEC mode to clear the count of VCs in use in the “status” field and the number of bytes of data transmitted and received in the “traffic” field. Since the "uses" field is a hunt-group-specific counter, it will not be cleared using the **clear counters** or **clear x25** commands. The “uses” field is only cleared at boot time or when the hunt group is defined.

Examples

The following is sample output from the **show x25 hunt-group** command:

```
Router# show x25 hunt-group

   ID      Type      Target                    uses      status    traffic(out/in)
 ================================================================================
 HG1       rotary    Serial1                   2         next      1158/1691
                     Serial2                   2         next      1328/2146
                     xot 172.17.125.54         2         last_used 137/3154
                     xot 172.17.125.34         1         next      137/3154


 HG2       vc-count  Serial2                   4         5 VCs     6921/1364
                     Serial3                   2         1 VC      70/1259
```

Table 45 describes significant fields shown in the display.

Table 45 show x25 hunt-group Field Descriptions

Field	Description
ID	Hunt group name.
Type	Method of load balancing (rotary or vc-count).
Target	Range of interfaces that a call within the hunt group can go to.

Table 45 show x25 hunt-group Field Descriptions (continued)

Field	Description
uses	Total number of call attempts (failed plus successful) made to the interface.
status	State of interface at that moment. The status of an interface may be one of the following: • next—Interface will be used next for rotary distribution method. • last used—Interface was just used for rotary distribution method. • unavailable—Interface is shutdown. • full—All logical channels on the interface are in use. • # VC—(vc-count only) Number of VCs currently in use on the interface. • unoper— All VCs on the interface are unoperational.
traffic (out/in)	Number of data bytes transmitted through the interface.

Related Commands

Command	Description
clear x25	Restarts an X.25 or CMNS service, clears an SVC, or resets a PVC.
x25 hunt-group	Creates and maintains a hunt group.

show x25 interface

To display information about virtual circuits (VCs) that use an X.25 interface and, optionally, about a specified virtual circuit, use the **show x25 interface** EXEC command.

show x25 interface [**serial** *number* | *cmns-interface* **mac** *mac-address*]

Syntax Description

serial *number*	(Optional) Keyword **serial** and number of the serial interface used for X.25.
cmns-interface **mac** *mac-address*	(Optional) Local CMNS interface type and number, plus the MAC address of the remote device. CMNS interface types are Ethernet, Token Ring, or FDDI. The interface numbering scheme depends on the router interface hardware.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Examples

The following **show x25 interface** sample output displays X.25 information about VCs on serial interface 0:

```
Router# show x25 interface serial 0

SVC 1,  State: D1,  Interface: Serial0
  Started 00:13:52, last input 00:00:05, output never
  Connects 3334 <-> ip 3.3.3.4
  Call PID ietf, Data PID none
  Window size input: 7, output: 7
  Packet size input: 512, output: 512
  PS: 0  PR: 6  ACK: 1  Remote PR: 0  RCNT: 5  RNR: no
  P/D state timeouts: 0  timer (secs): 0
  data bytes 0/2508 packets 0/54 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
SVC 32,  State: D1,  Interface: Serial0.11
  Started 00:16:53, last input 00:00:37, output 00:00:28
  Connects 3334 <-> clns
  Call PID cisco, Data PID none
  Window size input: 7, output: 7
  Packet size input: 512, output: 512
  PS: 5  PR: 4  ACK: 4  Remote PR: 4  RCNT: 0  RNR: no
  P/D state timeouts: 0  timer (secs): 0
  data bytes 378/360 packets 21/20 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

show x25 map

To display information about configured address maps, use the **show x25 map** EXEC command.

show x25 map

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The **show x25 map** command shows information about the following:

- Configured maps (defined by the **x25 map** command)
- Maps implicitly defined by encapsulation permanent virtual circuits (PVCs) (defined by the encapsulating version of the **x25 pvc** command)
- Dynamic maps (from the X.25 Defense Data Network [DDN] or Blacker Front End [BFE] operations)
- Temporary maps (from unconfigured Connection-Mode Network Service [CMNS] endpoints)

Examples

The following is sample output from the **show x25 map** command:

```
Router# show x25 map

Serial0: X.121 1311001 <--> ip 172.20.170.1
  PERMANENT, BROADCAST, 2 VCS: 3 4*
Serial0: X.121 1311005 <--> appletalk 128.1
  PERMANENT
Serial1: X.121 2194441 cud hello <--> pad
  PERMANENT, windowsize 5 5, accept-reverse, idle 5
Serial1: X.121 1311005 <--> bridge
  PERMANENT, BROADCAST
Serial2: X.121 001003 <--> apollo 1.3,
         appletalk 1.3,
         ip 172.20.1.3,
         decnet 1.3,
         novell 1.0000.0c04.35df,
         vines 00000001:0003,
         xns 1.0000.0c04.35df,
         clns
  PERMANENT, NVC 8, 1 VC: 1024
```

The display shows that four maps have been configured for a router: two for serial interface 0, one for serial interface 1, and one for the serial interface 2 (which maps eight protocols to the host).

Table 46 describes fields shown in the display.

Table 46 show x25 map Field Descriptions

Field	Description
Serial0	Interface on which this map is configured.
X.121 1311001	X.121 address of the mapped encapsulation host.
ip 172.20.170.1	Type and address of the higher-level protocol(s) mapped to the remote host. Bridge maps do not have a higher-level address; all bridge datagrams are sent to the mapped X.121 address. Connectionless Network Service (CLNS) maps refer to a configured neighbor as identified by the X.121 address.
PERMANENT	Address-mapping type that has been configured for the interface in this entry. Possible values include the following: • CONSTRUCTED—Derived with the DDN or BFE address conversion scheme. • PERMANENT—Map was entered with the **x25 map** interface configuration command. • PVC—Map was configured with the **x25 pvc** interface command. • TEMPORARY—A temporary map was created for an incoming unconfigured CMNS connection.
BROADCAST	If any options are configured for an address mapping, they are listed; the example shows a map that is configured to forward datagram broadcasts to the mapped host.
2 VCs:	If the map has any active virtual circuits, they are identified.
3 4*	Identifies the circuit number of the active virtual circuits. The asterisk (*) marks the virtual circuit last used to send data. Note that a single protocol virtual circuit can be associated with a multiprotocol map.

show x25 profile

To view details of X.25 profiles on your router, use the **show x25 profile** command in EXEC mode.

show x25 profile [*name*]

Syntax Description

name	(Optional) Name of X.25 profile.

Command Modes

EXEC

Command History

Release	Modification
12.0(3)T	This command was introduced.

Examples

The following is sample output from the **show x25 profile** command, showing all profiles configured on the same interface. When the X.25 profile name is not specified, the output shows all configured profiles for that interface.

```
Router# show x25 profile

X.25 profile name:NetworkNodeA
  Number of references:2
  In use by:
      Annex G:Serial1 DLCI 20
      Annex G:Serial1 DLCI 30
  PROFILE DCE, address <none>, state R/Inactive, modulo 128, timer 0
      Defaults:idle VC timeout 5
        input/output window sizes 2/2, packet sizes 128/128
      Timers:T10 60, T11 180, T12 60, T13 60
      Channels:Incoming-only none, Two-way 1-128, Outgoing-only none
  LAPB DCE, modulo 8, k 7, N1 default, N2 20
      T1 3000, T2 0, interface outage (partial T3) 0, T4 0

X.25 profile name:NetworkNodeB
  Number of references:1
  In use by:
      Annex G:Serial1 DLCI 40
  PROFILE DTE, address 1111, state R/Inactive, modulo 8, timer 0
      Defaults:idle VC timeout 0
        input/output window sizes 2/2, packet sizes 128/128
      Timers:T20 180, T21 200, T22 180, T23 180
      Channels:Incoming-only none, Two-way 1-1024, Outgoing-only none
LAPB DTE, modulo 8, k 7, N1 default, N2 20
      T1 3000, T2 0, interface outage (partial T3) 0, T4 0
```

Table 47 describes significant fields shown in the display.

Table 47 show x25 profile Field Descriptions

Field	Description
Number of references	Number of X.25 connections using this profile.
In use by	Shows the interface and X.25 service using this profile.
address	Address to which interface is connected.
state	State of the interface. Possible values are R1 - normal ready state. R2 - data terminal equipment (DTE) restarting state. R3 - data communications equipment (DCE) restarting state. If state is R2 or R3, the interface is awaiting acknowledgment of a Restart packet.
modulo	Value that determines the packet sequence numbering scheme used.
timer	Interface timer value (zero unless the interface state is R2 or R3).
Defaults: idle VC timeout	Inactivity time before clearing virtual circuit (VC).
input/output window sizes	Default window sizes (in packets) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
packet sizes	Default maximum packet sizes (in bytes) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
Timers	Values of the X.25 timers: T10 through T13 for a DCE device. T20 through T23 for a DTE device.
Channels:	Virtual circuit ranges for this interface.

Related Commands

Command	Description
show x25 context	Displays details of an Annex G DLCI link.
show x25 vc	Displays information about active X.25 virtual circuits.
x25 profile	Configures an X.25 profile without allocating any hardware-specific information.

show x25 remote-red

This command is no longer supported.

show x25 route

To display the X.25 routing table, use the **show x25 route** EXEC command.

show x25 route

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.0(5)T	The **dns** keyword was added.

Examples

The following example shows output from the **show x25 route** command:

```
Router# show x25 route

# Match                      Substitute              Route To
1 dest ^1311001$                                     Serial0, 0 uses
2 dest ^1311002$                                     xot 172.20.170.10
3 dest 444                                           xot dns \0
4 dest 555                                           xot dns \0
```

Table 48 describes significant fields shown in the display.

Table 48 show x25 route Field Descriptions

Field	Description
#	Number identifying the entry in the X.25 routing table.
Match	The match criteria and patterns associated with this entry.
Route To	Destination to which the router will forward a call; X.25 destinations identify an interface; CMNS destinations identify an interface and host MAC address; XOT destinations either identify up to six IP addresses (#2), or the **x25 route** pattern for retrieving up to six IP addresses from the DNS (#3 and #4).

Related Commands

Command	Description
x25 route	Creates an entry in the X.25 routing table (to be consulted for forwarding incoming calls and for placing outgoing PAD or protocol translation calls).

show x25 services

To display information pertaining to the X.25 services, use the **show x25 services** EXEC command.

show x25 services

Syntax Description

This command has no arguments or keywords.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command is the default form of the **show x25** command.

Examples

The following is sample output from the **show x25 services** command:

```
Router# show x25 services

X.25 software, Version 3.0.0.
  3 configurations supporting 3 active contexts
  VCs allocated, freed and in use: 7 - 0 = 7
  VCs active and idle: 4, 3
XOT software, Version 2.0.0.
  VCs allocated, freed and in use: 2 - 1 = 1
  connections in-progress: 0 outgoing and 0 incoming
  active VCs: 1, connected to 1 remote hosts
```

Related Commands

Command	Description
show x25 interface	Displays information about VCs that use an X.25 interface and, optionally, about a specified VC.
show x25 map	Displays information about configured address maps.
show x25 route	Displays the X.25 routing table.
show x25 vc	Displays information about active SVCs and PVCs.

show x25 vc

To display information about active switched virtual circuits (SVCs) and permanent virtual circuits (PVCs), use the **show x25 vc** EXEC command.

show x25 vc [*lcn*]

Syntax Description

lcn	(Optional) Logical channel number (LCN).

Command Modes

EXEC

Command History

Release	Modification
8.3	This command was introduced in a release prior to Release 8.3.

Usage Guidelines

To examine a particular virtual circuit number, add an LCN argument to the **show x25 vc** command.

This command displays information about virtual circuits. Virtual circuits may be used for a number of purposes, such as the following:

- Encapsulation traffic
- Traffic switched between X.25 services (X.25, Connection-Mode Network Service [CMNS] and X.25 over TCP/IP [XOT])
- PAD traffic
- QLLC traffic

The connectivity information displayed will vary according to the traffic carried by the virtual circuit. For multiprotocol circuits, the output varies depending on the number and identity of the protocols mapped to the X.121 address and the encapsulation method selected for the circuit.

Examples

Encapsulated Traffic Example

The following is sample output from the **show x25 vc** command used on an encapsulated traffic circuit:

```
Router# show x25 vc 1024

SVC 1024, State: D1, Interface: Serial0
 Started 0:00:31, last input 0:00:31, output 0:00:31
 Connects 170090 <-->
    compressedtcp 172.20.170.90
    ip 172.20.170.90
 Call PID multi, Data PID ietf
 Reverse charged
 Window size input: 2, output: 2
 Packet size input: 128, output: 128
 PS: 5 PR: 5 ACK: 4 Remote PR: 5 RCNT: 1 RNR: FALSE
 Window is closed
 P/D state timeouts: 0 Timer (secs): 0
  data bytes 505/505 packets 5/5 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Table 49 describes the fields shown in the sample output that are typical for virtual circuits.

Table 49 show x25 vc Field Descriptions

Field	Description
SVC *n* or PVC *n*	Identifies the type of virtual circuit (switched or permanent) and its LCN (also called its "virtual circuit number").
State	State of the virtual circuit (which is independent of the states of other virtual circuits); D1 is the normal ready state. See the International Telecommunication Union Telecommunication Standardization Sector (ITU-T)[1] X.25 Recommendation for a description of virtual circuit states.
Interface	Interface or subinterface on which the virtual circuit is established.
Started	Time elapsed since the virtual circuit was created.
last input	Time of last input.
output	Shows time of last output.
Connects...<-->..	Describes the traffic-specific connection information. See Table 50, Table 51, Table 52, and Table 53 for more information.
D-bit permitted	Indicates that the X.25 D-bit (Delivery Confirmation) may be used on this circuit (displayed as needed).
Fast select VC	Indicates that the Fast Select facility was present on the incoming call (displayed as needed).
Reverse charged	Indicates reverse charged virtual circuit (displayed as needed).
Window size	Window sizes for the virtual circuit.
Packet size	Maximum packet sizes for the virtual circuit.
PS	Current send sequence number.
PR	Current receive sequence number.
ACK	Last acknowledged incoming packet.
Remote PR	Last receive sequence number received from the other end of the circuit.
RCNT	Count of unacknowledged input packets.
RNR	State of the Receiver Not Ready flag; this field is true if the network sends a Receiver-not-Ready packet.
Window is closed	This line appears if the router cannot transmit any more packets until the X.25 Layer 3 peer has acknowledged some outstanding packets.
P/D state timeouts	Number of times a supervisory packet (Reset or Clear) has been retransmitted.
Timer	A nonzero time value indicates that a control packet has not been acknowledged yet or that the virtual circuit is being timed for inactivity.
Reassembly	Number of bytes received and held for reassembly. Packets with the M-bit set are reassembled into datagrams for encapsulation virtual circuits; switched X.25 traffic is not reassembled (displayed only when values are non-zero).
Held Fragments/Packets	Number of X.25 data fragments to transmit to complete an outgoing datagram, and the number of datagram packets waiting for transmission (displayed only when values are non-zero).
data bytes *m*/*n* packets *p*/*q*	Total number of data bytes sent (m), data bytes received (n), data packets sent (p), and data packets received (q) since the circuit was established.

Table 49 show x25 vc Field Descriptions (continued)

Field	Description
Resets *t*/*r*	Total number of Reset packets transmitted/received since the circuit was established.
RNRs *t*/*r*	Total number of Receiver Not Ready packets transmitted/received since the circuit was established.
REJs *t*/*r*	Total number of Reject packets transmitted/received since the circuit was established.
INTs *t*/*r*	Total number of Interrupt packets transmitted/received since the circuit was established.

1. The ITU-T carries out the functions of the former Consultative Committee for International Telegraph and Telephone (CCITT).

Table 50 describes the connection fields specific for encapsulation traffic.

Table 50 show x25 vc Encapsulation Traffic Field Descriptions

Field	Description
170090	The X.121 address of the remote host.
ip 172.20.170.90	The higher-level protocol and address values that are mapped to the virtual circuit.
Call PID	Identifies the method used for protocol identification (PID) in the Call User Data (CUD) field. Because PVCs are not set up using a Call packet, this field is not displayed for encapsulation PVCs. The available methods are as follows: • cisco—Cisco's traditional method was used to set up a single protocol virtual circuit. • ietf—The IETF's standard RFC 1356 method was used to set up a single protocol virtual circuit. • snap—The IETF's Subnetwork Access Protocol (SNAP) method for IP encapsulation was used. • multi—the IETF's multiprotocol encapsulation method was used.
Data PID	Identifies the method used for PID when sending datagrams. The available methods are as follows: • none—The virtual circuit is a single-protocol virtual circuit; no PID is used. • ietf—The IETF's standard RFC 1356 method for identifying the protocol is used. • snap—The IETF's SNAP method for identifying IP datagrams is used.

Locally Switched X.25 Traffic Example

The following is sample output from the **show x25 vc** command used on a virtual circuit carrying locally switched X.25 traffic:

```
Router# show x25 vc

PVC 1, State: D1, Interface: Serial2
  Started 0:01:26, last input never, output never
  PVC <--> Serial1 PVC 1, connected
  Window size input: 2, output: 2
  Packet size input: 128, output: 128
  PS: 0 PR: 0 ACK: 0 Remote PR: 0 RCNT: 0 RNR: FALSE
  P/D state timeouts: 0 Timer (secs): 0
  data bytes 0/0 packets 0/0 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0

SVC 5, State: D1, Interface: Serial2
  Started 0:00:16, last input 0:00:15, output 0:00:15
  Connects 170093 <--> 170090 from Serial1 VC 5
  Window size input: 2, output: 2
  Packet size input: 128, output: 128
  PS: 5 PR: 5 ACK: 4 Remote PR: 5 RCNT: 1 RNR: FALSE
  P/D state timeouts: 0 Timer (secs): 0
  data bytes 505/505 packets 5/5 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Table 51 describes the connection fields for virtual circuits carrying locally switched X.25 traffic.

Table 51 show x25 vc Local Traffic Field Descriptions

Field	Description
PVC <-->	Indicates a switched connection between two PVCs.
Serial1 PVC 1	Identifies the other half of a local PVC connection.
connected	Identifies connection status for a switched connection between two PVCs. See Table 54 for PVC status messages.
170093	Identifies the Calling (source) Address of the connection. If a Calling Address Extension was encoded in the call facilities, it is also displayed. If the source host is a CMNS host, its MAC address is also displayed.
170090	Identifies the Called (destination) Address of the connection. If a Called Address Extension was encoded in the call facilities, it is also displayed. If the destination host is a CMNS host, its MAC address is also displayed.
from Serial1	Indicates the direction of the call and the connecting interface.
VC 5	Identifies the circuit type and LCN for the connecting interface. VC indicates an SVC, and PVC indicates a PVC. If the connecting host is a CMNS host, its MAC address is also displayed.

Locally Switched X.25 Traffic Between PVCs and SVCs Example

The following is sample output from the **show x25 vc** command used on a virtual circuit carrying locally switched PVC to SVC X.25 traffic:

```
Router# show x25 vc

PVC 5,  State: D1,  Interface: Serial0
  Started 4d21h, last input 00:00:14, output 00:00:14
  Connects 101600 <--> 201700 from Serial2 VC 700
  D-bit permitted
  Window size input: 2, output: 2
```

```
  Packet size input: 128, output: 128
  PS: 5  PR: 5  ACK: 4  Remote PR: 5  RCNT: 1  RNR: no
  P/D state timeouts: 0  timer (secs): 0
  data bytes 1000/1000 packets 10/10 Resets 1/0 RNRs 0/0 REJs 0/0 INTs 0/0

SVC 700,  State: D1,  Interface: Serial2
  Started 00:00:16, last input 00:00:16, output 00:00:16
  Connects 101600 <--> 201700 from Serial0 PVC 5
  Window size input: 2, output: 2
  Packet size input: 128, output: 128
  PS: 5  PR: 5  ACK: 5  Remote PR: 4  RCNT: 0  RNR: no
  P/D state timeouts: 0  timer (secs): 103
  data bytes 500/500 packets 5/5 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Table 52 describes the connection fields for virtual circuits carrying locally switched X.25 traffic between PVCs and SVCs.

Table 52 show x25 vc Locally Switched PVC to SVC Traffic Field Descriptions

Field	Description
101600	Identifies the Calling (source) Address of the connection. If a Calling Address Extension was encoded in the call facilities, it is also displayed. If the source host is a CMNS host, its MAC address is also displayed.
201700	Identifies the Called (destination) Address of the connection. If a Called Address Extension was encoded in the call facilities, it is also displayed. If the destination host is a CMNS host, its MAC address is also displayed.
from Serial2	Indicates the direction of the call and the connecting interface.
VC 700	Identifies the circuit type and LCN for the connecting interface. VC indicates an SVC and PVC indicates a PVC. If the remote host is a CMNS host, its MAC address is also displayed.

Remotely Switched X.25 Traffic Example

The following is sample output from the **show x25 vc** command used on a virtual circuit carrying remotely switched X.25 traffic:

```
Router# show x25 vc

PVC 2, State: D1, Interface: Serial2
 Started 0:01:25, last input never, output never
 PVC <--> [172.20.165.92] Serial2/0 PVC 1 connected
 XOT between 171.20.165.91, 1998 and 172.20.165.92, 27801
 Window size input: 2, output: 2
 Packet size input: 128, output: 128
 PS: 0 PR: 0 ACK: 0 Remote PR: 0 RCNT: 0 RNR: FALSE
 P/D state timeouts: 0 Timer (secs): 0 Reassembly (bytes): 0
 Held Fragments/Packets: 0/0
 data bytes 0/0 packets 0/0 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0

SVC 6, State: D1, Interface: Serial2
 Started 0:00:04, last input 0:00:04, output 0:00:04
 Connects 170093 <--> 170090 from
 XOT between 172.20.165.91, 1998 and 172.20.165.92, 27896
 Window size input: 2, output: 2
 Packet size input: 128, output: 128
 PS: 5 PR: 5 ACK: 4 Remote PR: 5 RCNT: 1 RNR: FALSE
 P/D state timeouts: 0 Timer (secs): 0 Reassembly (bytes): 0
 Held Fragments/Packets: 0/0
 data bytes 505/505 packets 5/5 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Table 53 describes the connection fields for virtual circuits carrying remotely switched X.25 traffic.

Table 53 show x25 vc Remote X.25 Traffic Field Descriptions

Field	Description
PVC	Flags PVC information.
[172.20.165.92]	Indicates the IP address of the router remotely connecting the PVC.
Serial 2/0 PVC 1	Identifies the remote interface and PVC number.
connected	Identifies connection status for a switched connection between two PVCs. See Table 54 for PVC status messages.
170093	Identifies the Calling (source) Address of the connection. If a Calling Address Extension was encoded in the call facilities, it is also displayed.
170090	Identifies the Called (destination) Address of the connection. If a Called Address Extension was encoded in the call facilities, it is also displayed.
from	Indicates the direction of the call.
XOT between...	Identifies the IP addresses and port numbers of the X.25-over-TCP (XOT) connection.

Table 54 lists the PVC states that can be reported. These states are also reported by the **debug x25** command in PVC-SETUP packets (for remote PVCs only) as well as in the PVCBAD system error message. Some states apply only to remotely switched PVCs.

Table 54 X.25 PVC States

Status Message	Description
awaiting PVC-SETUP reply	A remote PVC has initiated an XOT TCP connection and is waiting for a reply to the setup message.
can't support flow control values	The window sizes or packet sizes of the PVC cannot be supported by one of its two interfaces.
connected	The PVC is up.
dest. disconnected	The other end disconnected the PVC.
dest interface is not up	The target interface's X.25 service is down.
dest PVC config mismatch	The targeted PVC is already connected.
mismatched flow control values	The configured flow control values do not match.
no such dest. interface	The remote destination interface was reported to be in error by the remote router.
no such dest. PVC	The targeted PVC does not exist.
non-X.25 dest. interface	The target interface is not configured for X.25.
PVC/TCP connect timed out	A remote PVC XOT TCP connection attempt timed out.
PVC/TCP connection refused	A remote PVC XOT TCP connection was tried and refused.
PVC/TCP routing error	A remote PVC XOT TCP connection routing error was reported.

Table 54 X.25 PVC States (continued)

Status Message	Description
trying to connect via TCP	A remote PVC XOT TCP connection is established and is in the process of connecting.
waiting to connect	The PVC is waiting to be processed for connecting.

show x25 xot

To display information for all X.25 over TCP (XOT) virtual circuits that match a given criterion, use the **show x25 xot** EXEC command.

show x25 xot [**local** *ip-address* [**port** *port*]] [**remote** *ip-address* [**port** *port*]]

Syntax Description

local *ip-address* [**port** *port*]	(Optional) Local IP address and optional port number.
remote *ip-address* [**port** *port*]	(Optional) Remote IP address and optional port number.

Command Modes

EXEC

Command History

Release	Modification
11.2	This command was introduced.

Examples

The following **show x25 xot** sample output displays information about all XOT virtual circuits:

```
Router> show x25 xot

SVC 11,  State: D1,  Interface: [10.2.2.2,1998/10.2.2.1,11002]
  Started 00:00:08, last input 00:00:08, output 00:00:08

  Line: 0   con 0    Location:  Host: 5678
  111 connected to 5678 PAD <--> XOT 2.2.2.2,1998

  Window size input: 2, output: 2
  Packet size input: 128, output: 128
  PS: 2  PR: 3  ACK: 3  Remote PR: 2  RCNT: 0  RNR: no
  P/D state timeouts: 0  timer (secs): 0
  data bytes 54/18 packets 2/3 Resets 0/0 RNRs 0/0 REJs 0/0 INTs 0/0
```

Related Commands

Command	Description
show x25 interface	Displays information about VCs that use an X.25 interface and, optionally, about a specified VC.
show x25 services	Displays information pertaining to the X.25 services.

x25 accept-reverse

To configure the Cisco IOS software to accept all reverse-charge calls, use the **x25 accept-reverse** interface configuration command. To disable this facility, use the **no** form of this command.

x25 accept-reverse

no x25 accept-reverse

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command causes the interface to accept reverse-charge calls by default. You can also configure this behavior for each peer with the **x25 map** interface configuration command.

Examples

The following example sets acceptance of reverse-charge calls:

```
interface serial 0
 x25 accept-reverse
```

Related Commands

Command	Description
x25 map	Sets up the LAN protocols-to-remote host mapping.

x25 address

To set the X.121 address of a particular network interface, use the **x25 address** interface configuration command.

x25 address *x121-address*

Syntax Description

x121-address	Variable-length X.121 address. It is assigned by the X.25 network service provider.

Defaults

Defense Data Network (DDN) and Blacker Front End (BFE) encapsulations have a default interface address generated from the interface IP address. For proper DDN or BFE operation, this generated X.121 address must not be changed. Standard X.25 encapsulations do not have a default.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

When you are connecting to a public data network (PDN), the PDN administrator will assign the X.121 address to be used. Other applications (for example, a private X.25 service), may assign arbitrary X.121 addresses as required by the network and service design. X.25 interfaces that engage in X.25 switching only do not need to assign an X.121 address.

Examples

The following example sets the X.121 address for the interface:

```
interface serial 0
 encapsulation x25
 x25 address 00000123005
```

The address must match that assigned by the X.25 network service provider.

x25 alias

To configure an interface alias address that will allow this interface to accept calls with other destination addresses, use the **x25 alias** interface configuration command.

x25 alias {*destination-pattern* | *x121-address-pattern*} [**cud** *cud-pattern*]

Syntax Description

destination-pattern	Regular expression used to match against the destination address of a received call.
x121-address-pattern	Alias X.121 address for the interface, allowing it to act as destination host for calls having different destination address.
cud *cud-pattern*	(Optional) Call user data (CUD) pattern, a regular expression of ASCII text. The CUD field might be present in a call packet. The first few bytes (commonly 4 bytes long) identify a protocol; the specified pattern is applied to any user data after the protocol identification.

Defaults

No alias is configured.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
11.2	This command was introduced. It replaces the functionality that was provided by the **alias** keyword of the **x25 route** command.

Usage Guidelines

Encapsulation, packet assembler/disassembler (PAD), and Qualified Logical Link Control (QLLC) calls are normally accepted when the destination address is that of the interface (or the zero-length address). Those calls will also be accepted when the destination address matches a configured alias.

Examples

An X.25 call may be addressed to the receiving interface; calls addressed to the receiving interface are eligible for acceptance as a datagram encapsulation, PAD or QLLC connection, and may not be routed. In the following example, serial interface 0 is configured with a native address of 0000123 and a destination alias for any address that starts with 1111123. That is, serial interface 0 can accept its own calls and calls for any destination that starts with 1111123.

```
interface serial 0
 encapsulation x25
 x25 address 0000123
 x25 alias ^1111123.*
```

x25 bfe-decision

This command is no longer supported.

x25 bfe-emergency

This command is no longer supported.

x25 default

To set a default protocol that Cisco IOS software will assume applies to incoming calls with unknown or missing protocol identifier in the call user data (CUD), use the **x25 default** interface configuration command. To remove the default protocol specified, use the **no** form of this command.

x25 default *protocol*

no x25 default *protocol*

Syntax Description

protocol	Specifies the protocol to assume; may be **ip** or **pad**.

Defaults

No default protocol is specified.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command specifies the protocol assumed by the Cisco IOS software for incoming calls with unknown or missing protocol identifier in the call user data (CUD). If you do not use the **x25 default** interface configuration command, the software clears any incoming calls with unrecognized CUD.

Examples

The following example establishes IP as the default protocol for X.25 calls:

```
interface serial 0
 x25 default ip
```

Related Commands

Command	Description
x25 map	Sets up the LAN protocols-to-remote host mapping.

x25 facility

To force facilities on a per-call basis for calls originated by the router (switched calls are not affected), use the **x25 facility** interface configuration command. To disable a facility, use the **no** form of this command.

x25 facility option *value*

no x25 facility option *value*

Syntax Description

option	Set of user facilities options. See Table 55 for a list of supported facilities and their values.
value	Option value. See Table 55 for a list of supported facilities and their values.

Defaults

No facility is sent.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Table 55 lists the set of **x25 facility** command user facilities options.

Table 55 x25 facility User Facilities Options

User Facilities Option	Description
cug *number*	Specifies a closed user group (CUG) number; CUGs numbered from 1 to 9999 are allowed. CUGs can be used by a public data network (PDN) to create a virtual private network within the larger network and to restrict access.
packetsize *in-size out-size*	Proposes input maximum packet size *(in-size)* and output maximum packet size (*out-size*) for flow control parameter negotiation. Both values must be one of the following values: 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096.
windowsize *in-size out-size*	Proposes the packet count for input windows (*in-size*) and output windows (*out-size*) for flow control parameter negotiation. Both values must be in the range 1 to 127 and must not be greater than or equal to the value set for the **x25 modulo** command.
reverse	Specifies reverses charging on all calls originated by the interface.
throughput *in out*	Sets the requested throughput class negotiation values for input (*in*) and output (*out*) throughput across the network. Values for *in* and *out* are in bits per second (bps) and range from 75 to 48000 bps.

Table 55 x25 facility User Facilities Options (continued)

User Facilities Option	Description
transit-delay *value*	Specifies a network transit delay to request for the duration of outgoing calls for networks that support transit delay. The transit delay value can be between 0 and 65534 milliseconds.
roa *name*	Specifies the name defined by the **x25 roa** command for a list of transit Recognized Operation Agencies (ROAs) to use in outgoing Call Request packets.

Examples

The following example specifies a transit delay value in an X.25 configuration:

```
interface serial 0
 x25 facility transit-delay 24000
```

The following example sets an ROA name and then sends the list via the X.25 user facilities:

```
x25 roa green_list 23 35 36
interface serial 0
 x25 facility roa green_list
```

Related Commands

Command	Description
x25 suppress-called-address	Omits the destination address in outgoing calls.

x25 fail-over

To configure a secondary interface and set the number of seconds for which a primary interface must be up before the secondary interface resets, use the **x25 fail-over** command in the appropriate configuration mode. To prevent the secondary interface from resetting, use the **no** form of this command.

x25 fail-over *seconds* **interface** *type number* [*dlci* | *mac-address*]

no x25 fail-over *seconds* **interface** *type number* [*dlci* | *mac-address*]

Syntax Description

seconds	Number of seconds for which the primary interface must be up before the secondary interface resets.
interface	Secondary interface.
type	Interface type.
number	Interface number.
dlci	(Optional) DLCI number.
mac-address	(Optional) MAC address.

Defaults

No default behavior or values.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
Release 12.1(1)T	This command was introduced.

Usage Guidelines

The **x25 fail-over** command can be configured on a primary X.25 interface or an X.25 profile only.

Examples

In the following example, X.25 failover is configured on a network that is also configured for Annex G. If data-link connection identifier (DLCI) 13 or DLCI 14 on serial interface 1/0 goes down, dialer interface 1 will serve as the secondary interface. After DLCI 13 or 14 comes back up and remains up for 20 seconds, dialer interface 1 will reset, sending all calls back to the primary interface.

```
interface serial1/0
 encapsulation frame-relay
 frame-relay interface-dlci 13
 x25-profile frame1
  exit
 frame-relay interface-dlci 14
 x25-profile frame1 dte
  exit
!
interface dialer1
 encapsulation x25
```

```
   exit

x25 route ^1234 interface serial1/0 dlci 13
x25 route ^1234 interface serial1/0 dlci 14
x25 route ^1234 interface dialer1
!
x25 profile frame1
 x25 fail-over 20 interface dialer1
  exit
!
```

Related Commands

Command	Description
show x25 context	Displays information about X.25 links.
x25 profile	Configures an X.25 profile without specifying any hardware-specific information.

x25 hic

To set the highest incoming-only virtual circuit (VC) number, use the **x25 hic** interface configuration command.

x25 hic *circuit-number*

Syntax Description

circuit-number	VC number from 1 to 4095, or 0 if there is no incoming-only VC range.

Defaults

0

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is applicable only if you have the X.25 switch configured for an incoming-only VC range. *Incoming* is from the perspective of the X.25 data terminal equipment (DTE). If you do not want any outgoing calls from your DTE, configure both ends to disable the two-way range (set the values of **x25 ltc** and **x25 htc** to 0) and configure an incoming-only range. Any incoming-only range must come before (that is, must be numerically less than) any two-way range. Any two-way range must come before any outgoing-only range.

Examples

The following example sets a valid incoming-only VC range of 1 to 5:

```
interface serial 0
 x25 lic 1
 x25 hic 5
```

Related Commands

Command	Description
x25 lic	Sets the lowest incoming-only VC number.

x25 hoc

To set the highest outgoing-only virtual circuit (VC) number, use the **x25 hoc** interface configuration command.

x25 hoc *circuit-number*

Syntax Description

circuit-number	VC number from 1 to 4095, or 0 if there is no incoming-only VC range.

Defaults

0

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is applicable only if you have the X.25 switch configured for an outgoing-only VC range. *Outgoing* is from the perspective of the X.25 data terminal equipment (DTE). If you do not want any incoming calls on your DTE, disable the two-way range (set the values of **x25 ltc** and **x25 htc** to 0) and configure an outgoing-only range. Any outgoing-only range must come after (that is, be numerically greater than) any other range.

Examples

The following example sets a valid outgoing-only VC range of 2000 to 2005:

```
interface serial 0
 x25 loc 2000
 x25 hoc 2005
```

Related Commands

Command	Description
x25 loc	Sets the lowest outgoing-only VC number.

x25 hold-queue

To set the maximum number of packets to hold until a virtual circuit (VC) is able to send, use the **x25 hold-queue** interface configuration command. To remove this command from the configuration file and restore the default value, use the **no** form of this command without an argument.

x25 hold-queue *packets*

no x25 hold-queue [*packets*]

Syntax Description

packets	Number of packets. A hold queue value of 0 allows an unlimited number of packets in the hold queue.

Defaults

10 packets

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

If you set the *queue-size* argument to 0 when using the **no x25 hold-queue** command, there will be no hold queue limit. While this setting will prevent drops until the router runs out of memory, it is only rarely appropriate. A VC hold queue value is determined when it is created; changing this parameter will not affect the hold queue limits of the existing virtual circuits.

Examples

The following example sets the X.25 hold queue to hold 25 packets:

```
interface serial 0
 x25 hold-queue 25
```

Related Commands

Command	Description
ip mtu	Sets the MTU size of IP packets sent on an interface.
x25 ips	Sets the interface default maximum input packet size to match that of the network.
x25 ops	Sets the interface default maximum output packet size to match that of the network.

x25 hold-vc-timer

To start the timer that prevents additional calls to a destination for a given period of time (thus preventing overruns on some X.25 switches caused by Call Request packets), use the **x25 hold-vc-timer** interface configuration command. To restore the default value for the timer, use the **no** form of this command.

x25 hold-vc-timer *minutes*

no x25 hold-vc-timer

Syntax Description

minutes	Number of minutes that calls to a previously failed destination will be prevented. Incoming calls are still accepted.

Defaults

0 minutes

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Only Call Requests that the router originates are held down; routed X.25 Call Requests are not affected by this parameter.

Upon receiving a Clear Request for an outstanding Call Request, the X.25 support code immediately tries another Call Request if it has more traffic to send, and this action might cause overrun problems.

Examples

The following example sets this timer to 3 minutes:

```
interface serial 0
 x25 hold-vc-timer 3
```

x25 host

To define a static host name-to-address mapping, use the **x25 host** global configuration command. To remove the host name, use the **no** form of the command.

x25 host *name x121-address* [**cud** *call-user-data*]

no x25 host *name*

Syntax Description

name	Host name.
x121-address	The X.121 address.
cud *call-user-data*	(Optional) Sets the Call User Data (CUD) field in the X.25 Call Request packet.

Defaults

No static host name-to-address mapping is defined.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command permits you to map an X.121 address to an easily recognizable name. You can later use this host name instead of the X.121 address when you issue the **translate** command for X.25.

Examples

The following example specifies a static address mapping:

```
x25 host Willard 4085551212
```

The following example removes a static address mapping:

```
no x25 host Willard
```

The following example specifies static address mapping from the X.121 address 12345678 to the host name “ocean”. It then uses the name “ocean” in the **translate** command in place of the X.121 address when translating from the X.25 host to the PPP host with address 10.0.0.2.

```
x25 host ocean 12345678
translate x25 ocean ppp 10.0.0.2 routing
```

Related Commands

Command	Description
translate x25	When an X.25 connection request to a particular destination address is received, the Cisco router can automatically translate the request to another outgoing protocol connection type.

x25 htc

To set the highest two-way virtual circuit (VC) number, use the **x25 htc** interface configuration command.

x25 htc *circuit-number*

Syntax Description

circuit-number	VC number from 1 to 4095, or 0 if there is no two-way VC range.

Defaults

1024 for X.25 network service interfaces; 4095 for CMNS network service interfaces.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is applicable if the X.25 switch is configured for a two-way VC range. Any two-way VC range must come after (that is, be numerically larger than) any incoming-only range, and must come before any outgoing-only range.

Examples

The following example sets a valid two-way VC range of 5 to 25:

```
interface serial 0
 x25 ltc 5
 x25 htc 25
```

Related Commands

Command	Description
cmns enable	Enables the CMNS on a nonserial interface.
x25 ltc	Sets the lowest two-way VC number.

x25 hunt-group

To create and maintain a hunt group, use the **x25 hunt-group** global configuration command. To delete this hunt group, use the **no** form of this command.

x25 hunt-group *name* {**rotary** | **vc-count**}

no x25 hunt-group *name*

Syntax Description

name	Name you assign to the particular hunt group.
rotary	Each call steps to the next interface.
vc-count	Each call is placed on the interface with most available logical channels.

Command Modes

Global configuration

Command History

Release	Modification
12.0(3)T	This command was introduced.

Usage Guidelines

Only one load-balancing distribution method can be selected for a hunt group, although one interface can participate in one or more hunt groups.

The rotary distribution method sends every call to the next available interface regardless of line speed and the number of available VCs on that interface.

The vc-count distribution method sends calls to the interface with the largest number of available logical channels. This method ensures a good load balance when you have lines of equal speed. If the line speeds are unequal, the vc-count method will favor the line with the higher speed. In cases where interfaces have the same line speed, the call is sent to the interface that is defined earliest in the hunt group.

To distribute calls equally among interfaces regardless of line speed, configure each interface with the same number of VCs.

With the vc-count distribution method, if a hunt group does not contain an operational interface, the call will be forwarded to the next route if one was specified. If a session is terminated on an interface within the hunt group, that interface now has more available VCs and it will be chosen next.

Examples

X.25 Load Balancing Using VC-Count Distribution Method Example

In the following example, the vc-count distribution method is used on a hunt group that contains two serial interfaces that have different numbers of VCs. Assuming no sessions are being terminated at this time, the first 450 calls will be sent to Serial1, and subsequent calls will alternate between Serial0 and Serial1 until the interfaces are full.

```
interface serial0
  description 56k link supporting 50 virtual circuits
  x25 htc 50
!
```

```
interface serial1
  description T1 line supporting 500 virtual circuits
  x25 htc 500
!
x25 hunt-group hg-vc vc-count
  interface serial0
  interface serial1
!
```

Hunt Group Configuration Example

The following example shows the creation of hunt group “HG1” with serial interfaces 1 and 2 and two specific XOT target IP addresses (172.17.125.54 and 172.17.125.34). Hunt group "HG1" is configured to use rotary distribution method. The example also shows the creation of hunt group “HG2” with serial interfaces 0 and 3. Hunt group "HG2" will use vc-count distribution method.

```
x25 hunt-group HG1 rotary
 interface serial 1
 interface serial 2
 xot 172.17.125.54
 xot 172.17.125.34
 exit
x25 hunt-group HG2 vc-count
 interface serial 0
 interface serial 3
```

Related Commands

Command	Description
show x25 hunt-group	Displays X.25 hunt groups, detailed interface statistics, and distribution methods.

x25 idle

To define the period of inactivity after which the router can clear a switched virtual circuit (SVC), use the **x25 idle** interface configuration command.

x25 idle *minutes*

Syntax Description

minutes	Idle period in minutes.

Defaults

0 (the SVC is kept open indefinitely)

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Calls originated and terminated by the router are cleared; packet assembler/disassembler (PAD) and switched virtual circuits are not affected. To clear one or all virtual circuits at once, use the **clear x25** privileged EXEC command.

Examples

The following example sets a 5-minute wait period before an idle circuit is cleared:

```
interface serial 2
 x25 idle 5
```

Related Commands

Command	Description
clear x25	Restarts an X.25 or CMNS service, to clear an SVC, or to reset a PVC.

x25 ip-precedence

To enable the Cisco IOS software to use the IP precedence value when it opens a new virtual circuit (VC), use the **x25 ip-precedence** interface configuration command. To cause the Cisco IOS software to ignore the precedence value when opening VCs, use the **no** form of this command.

x25 ip-precedence

no x25 ip-precedence

Syntax Description

This command has no arguments or keywords.

Defaults

The router opens one VC for all types of service.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This feature is useful only for Defense Data Network (DDN) or Blacker Front End (BFE) encapsulations because only these methods have an IP precedence facility defined to allow the source and destination devices to both use the VC for traffic of the given IP priority.

Verify that your host does not send nonstandard data in the IP type of service (TOS) field because it can cause multiple wasteful virtual circuits to be created.

Four VCs may be opened based on IP precedence to encapsulate routine, priority, immediate, and all higher precedences.

The **x25 map nvc** limit or the default **x25 nvc** limit still applies.

Examples

The following example allows new IP encapsulation VCs based on the IP precedence:

```
interface serial 3
 x25 ip-precedence
```

x25 ips

To set the interface default maximum input packet size to match that of the network, use the **x25 ips** interface configuration command.

x25 ips *bytes*

Syntax Description

bytes	Byte count. It can be one of the following values: 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096.

Defaults

128 bytes

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

X.25 network connections have a default maximum input packet size set by the network administrator. Larger packet sizes require less overhead processing. To send a packet larger than the X.25 packet size over an X.25 virtual circuit, the Cisco IOS software must break the packet into two or more X.25 packets with the more data bit (M-bit) set. The receiving device collects all packets with the M-bit set and reassembles the original packet.

Note Set the **x25 ips** and **x25 ops** commands to the same value unless your network supports asymmetric input and output packet sizes.

Examples

The following example sets the default maximum packet sizes to 512:

```
interface serial 1
 x25 ips 512
 x25 ops 512
```

Related Commands

Command	Description
x25 facility	Forces facilities on a per-call basis for calls originated by the router (switched calls are not affected).
x25 ops	Sets the interface default maximum output packet size to match that of the network.

x25 lic

To set the lowest incoming-only virtual circuit (VC) number, use the **x25 lic** interface configuration command.

x25 lic *circuit-number*

Syntax Description

circuit-number	VC number from 1 to 4095, or 0 if there is no incoming-only VC range.

Defaults

0

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is applicable only if you have the X.25 switch configured for an incoming-only VC range. *Incoming* is from the perspective of the X.25 DTE device. If you do not want any outgoing calls on your DTE device, disable the two-way range (set the values of **x25 ltc** and **x25 htc** to 0).

The following example sets a valid incoming-only VC range of 1 to 5, and sets the lowest two-way VC number:

```
interface serial 0
 x25 lic 1
 x25 hic 5
 x25 ltc 6
```

Related Commands

Command	Description
x25 hic	Sets the highest incoming-only VC number.

x25 linkrestart

To force X.25 Level 3 (packet level) to restart when Level 2 (Link Access Procedure, Balanced [LAPB], the link level) resets, use the **x25 linkrestart** interface configuration command. To disable this function, use the **no** form of this command.

x25 linkrestart

no x25 linkrestart

Syntax Description

This command has no arguments or keywords.

Defaults

Forcing packet-level restarts is the default and is necessary for networks that expect this behavior.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example disables the link-level restart:

```
interface serial 3
 no x25 linkrestart
```

x25 loc

To set the lowest outgoing-only virtual circuit (VC) number, use the **x25 loc** interface configuration command.

x25 loc *circuit-number*

Syntax Description

circuit-number	VC number from 1 to 4095, or 0 if there is no outgoing-only VC range.

Defaults

0

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is applicable only if you have the X.25 switch configured for an outgoing-only VC range. *Outgoing* is from the perspective of the X.25 DTE device. If you do not want any incoming calls from your DTE device, configure the values of **x25 loc** and **x25 hoc** and set the values of **x25 ltc** and **x25 htc** to 0.

Examples

The following example sets a valid outgoing-only virtual circuit range of 2000 to 2005:

```
interface serial 0
 x25 loc 2000
 x25 hoc 2005
```

Related Commands

Command	Description
x25 hoc	Sets the highest outgoing-only VC number.

x25 ltc

To set the lowest two-way virtual circuit (VC) number, use the **x25 ltc** interface configuration command.

x25 ltc *circuit-number*

Syntax Description

circuit-number	VC number from 1 to 4095, or 0 if there is no two-way VC range.

Defaults

1

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command is applicable if you have the X.25 switch configured for a two-way virtual circuit range. Any two-way virtual circuit range must come after (that is, be numerically larger than) any incoming-only range, and must come before any outgoing-only range.

Examples

The following example sets a valid two-way virtual circuit range of 5 to 25:

```
interface serial 0
 x25 ltc 5
 x25 htc 25
```

Related Commands

Command	Description
x25 htc	Sets the highest two-way VC number.

x25 map

To set up the LAN protocols-to-remote host mapping, use the **x25 map** interface configuration command. To retract a prior mapping, use the **no** form of this command with the appropriate network protocols and X.121 *address* argument.

x25 map *protocol address* [*protocol2 address2* [...[*protocol9 address9*]]] *x121-address* [*option*]

no x25 map *protocol address x121-address*

Syntax Description

protocol	Protocol type, entered by keyword. Supported protocols are entered by keyword, as listed in Table 56. As many as nine protocol and address pairs can be specified in one command line.
address	Protocol address.
x121-address	X.121 address of the remote host.
option	(Optional) Additional functionality that can be specified for originated calls. Can be any of the options listed in Table 57.

Defaults

No LAN protocol-to-remote host mapping is set up.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Because no defined protocol can dynamically determine LAN protocol-to-remote host mappings, you must enter all the information for each host with which the router may exchange X.25 encapsulation traffic.

Two methods are available to encapsulate traffic: Cisco's long-available encapsulation method and the Internet Engineering Task Force (IETF) standard method (defined in RFC 1356); the latter allows hosts to exchange several protocols over a single virtual circuit. Cisco's encapsulation method is the default (for backward compatibility) unless the interface configuration command specifies the **ietf** keyword.

When you configure multiprotocol maps, you can specify a maximum of nine protocol and address pairs in an **x25 map** command. However, you can specify a protocol only once. For example, you can specify the IP protocol and an IP address, but you cannot specify another IP address. If the **compressedtcp** and **ip** keywords are both specified, the same IP address must be used.

Bridging is supported only if you are using Cisco's traditional encapsulation method. For correct operation, bridging maps must specify the **broadcast** option.

Since most datagram routing protocols rely on broadcasts or multicasts to send routing information to their neighbors, the **broadcast** keyword is needed to run such routing protocols over X.25.

Encapsulation maps might also specify that traffic between the two hosts should be compressed, thus increasing the effective bandwidth between them at the expense of memory and computation time. Because each compression virtual circuit requires memory and computation resources, compression must be used with care and monitored to maintain acceptable resource usage and overall performance.

Open Shortest Path First (OSPF) Protocol treats a nonbroadcast, multiaccess network such as X.25 in much the same way as it treats a broadcast network by requiring the selection of a designated router. In previous releases, this required manual assignment in the OSPF configuration using the **neighbor** router configuration command. When the **x25 map** command is included in the configuration with the broadcast, and the **ip ospf network** command (with the **broadcast** keyword) is configured, there is no need to configure any neighbors manually. OSPF will now run over the X.25 network as a broadcast network. (Refer to the **ip ospf network** interface configuration command for more detail.)

Note The OSPF broadcast mechanism assumes that IP class D addresses are never used for regular traffic over X.25.

You can modify the options of an **x25 map** command by restating the complete set of protocols and addresses specified for the map, followed by the desired options. To delete a map command, you must also specify the complete set of protocols and addresses; the options can be omitted when deleting a map.

Once defined, a map's protocols and addresses cannot be changed. This requirement exists because the Cisco IOS software cannot determine whether you want to add to, delete from, or modify an existing map's protocol and address specification, or simply mistyped the command. To change a map's protocol and address specification, you must delete it and create a new map.

A given protocol-address pair cannot be used in more than one map on the same interface.

Table 56 lists the protocols supported by X.25.

Table 56 Protocols Supported by X.25

Keyword	Protocol
apollo	Apollo Domain
appletalk	AppleTalk
bridge	Bridging[1]
clns	ISO Connectionless Network Service
compressedtcp	TCP/IP header compression
decnet	DECnet
ip	IP
ipx	Novell IPX
pad	PAD links[2]
qllc	System Network Architecture (SNA) encapsulation in X.25[3]
vines	Banyan VINES
xns	XNS

1. Bridging traffic is supported only for Cisco's traditional encapsulation method, so a bridge map cannot specify other protocols.
2. Packet assembler/disassembler (PAD) maps are used to configure session and protocol translation access, therefore, this protocol is not available for multiprotocol encapsulation.
3. Qualified Logical Link Control (QLLC) is not available for multiprotocol encapsulation.

Note The Connection-Mode Network Service (CMNS) map form is obsolete; its function is replaced by the enhanced **x25 route** command.

Table 57 lists the map options supported by X.25 using the **x25 map** command.

Table 57 x25 map Options

Option	Description
accept-reverse	Causes the Cisco IOS software to accept incoming reverse-charged calls. If this option is not present, the Cisco IOS software clears reverse-charged calls unless the interface accepts all reverse-charged calls.
broadcast	Causes the Cisco IOS software to direct any broadcasts sent through this interface to the specified X.121 address. This option also simplifies the configuration of OSPF; see "Usage Guidelines" for more detail.
cug *group-number*	Specifies a closed user group (CUG) number (from 1 to 9999) for the mapping in an outgoing call.
compress	Specifies that X.25 payload compression be used for mapping the traffic to this host. Each virtual circuit established for compressed traffic uses a significant amount of memory (for a table of learned data patterns) and for computation (for compression and decompression of all data). Cisco recommends that compression be used with careful consideration of its impact on overall performance.
idle *minutes*	Specifies an idle timeout for calls other than the interface default; 0 minutes disables the idle timeout.
method {**cisco** | **ietf** | **snap** | **multi**}	Specifies the encapsulation method. The choices are as follows: • **cisco**—Cisco's proprietary encapsulation; not available if more than one protocol is to be carried. • **ietf**—Default RFC 1356 operation: protocol identification of single-protocol virtual circuits and protocol identification within multiprotocol virtual circuits use the standard encoding, which is compatible with RFC 877. Multiprotocol virtual circuits are used only if needed. • **snap**—RFC 1356 operation where IP is identified with SNAP rather than the standard IETF method (the standard method is compatible with RFC 877). • **multi**—Forces a map that specifies a single protocol to set up a multiprotocol virtual circuit when a call is originated; also forces a single-protocol PVC to use multiprotocol data identification methods for all datagrams sent and received.
no-incoming	Use the map only to originate calls.
no-outgoing	Do not originate calls when using the map.

Table 57 x25 map Options (continued)

Option	Description
nudata *string*	Specifies the network user identification in a format determined by the network administrator (as allowed by the standards). This option is provided for connecting to non-Cisco equipment that requires an NUID facility. The string should not exceed 130 characters and must be enclosed in quotation marks (“ ”) if there are any spaces present. This option only works if the router is configured as an X.25 DTE.
nuid *username password*	Specifies that a network user ID (NUID) facility be sent in the outgoing call with the specified TACACS username and password (in a format defined by Cisco). This option should be used only when connecting to another Cisco router. The combined length of the username and password should not exceed 127 characters. This option only works if the router is configured as an X.25 data terminal equipment (DTE).
nvc *count*	Sets the maximum number of virtual circuits for this map or host. The default *count* is the **x25 nvc** setting of the interface. A maximum number of eight virtual circuits can be configured for each map. Compressed TCP may use only 1 virtual circuit.
packetsize *in-size out-size*	Proposes maximum input packet size (*in-size*) and maximum output packet size (*out-size*) for an outgoing call. Both values typically are the same and must be one of the following values: 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096.
passive	Specifies that the X.25 interface should send compressed outgoing TCP datagrams only if they were already compressed when they were received. This option is available only for compressed TCP maps.
reverse	Specifies reverse charging for outgoing calls.
roa *name*	Specifies the name defined by the **x25 roa** command for a list of transit Recognized Operating Agencies (ROAs, formerly called Recognized Private Operating Agencies, or RPOAs) to use in outgoing Call Request packets.
throughput *in out*	Sets the requested throughput class values for input (*in*) and output (*out*) throughput across the network for an outgoing call. Values for *in* and *out* are in bits per second (bps) and range from 75 to 48000 bps.
transit-delay *milliseconds*	Specifies the transit delay value in milliseconds (0 to 65534) for an outgoing call, for networks that support transit delay.
windowsize *in-size out-size*	Proposes the packet count for input window (*in-size*) and output window (*out-size*) for an outgoing call. Both values typically are the same, must be in the range 1 to 127, and must be less than the value set by the **x25 modulo** command.

Examples

The following example maps IP address 172.20.2.5 to X.121 address 000000010300. The **broadcast** keyword directs any broadcasts sent through this interface to the specified X.121 address.

```
interface serial 0
 x25 map ip 171.20.2.5 000000010300 broadcast
```

The following example specifies an ROA name to be used for originating connections:

```
x25 roa green_list 23 35 36
interface serial 0
 x25 map ip 172.20.170.26 10 roa green_list
```

The following example specifies an NUID facility to send on calls originated for the address map:

```
interface serial 0
 x25 map ip 172.20.174.32 2 nudata "Network User ID 35"
```

Strings can be quoted, but quotation marks are not required unless embedded blanks are present.

Related Commands

Command	Description
ip ospf network	Configures the OSPF network type to a type other than the default for a given medium.
show x25 map	Displays information about configured address maps.
x25 facility	Forces facilities on a per-call basis for calls originated by the router (switched calls are not affected).
x25 map bridge	Configures an Internet-to-X.121 address mapping for bridging over X.25.
x25 map compressedtcp	Maps compressed TCP traffic to an X.121 address.
x25 map pad	Configures an X.121 address mapping for PAD access over X.25.
x25 route	Creates an entry in the X.25 routing table (to be consulted for forwarding incoming calls and for placing outgoing PAD or protocol translation calls).
x25 suppress-called-address	Omits the destination address in outgoing calls.

x25 map bridge

To configure an Internet-to-X.121 address mapping for bridging of packets in X.25 frames, use the **x25 map bridge** interface configuration command. Use the **no** form of this command to disable the Internet-to-X.121 address mapping.

x25 map bridge *x121-address* **broadcast** [*option*]

Syntax Description

x121-address	The X.121 address.
broadcast	Required keyword for bridging over X.25.
option	(Optional) Services that can be added to this map (same options as the **x25 map** command). See Table 6 for more details.

Defaults

No bridging over X.25 is configured.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The X.25 bridging software uses the same spanning-tree algorithm as the other bridging functions, but allows packets to be encapsulated in X.25 frames and transmitted across X.25 media. This command specifies IP-to-X.121 address mapping and maintains a table of both the Ethernet and X.121 addresses.

Table 58 lists **x25 map bridge** options.

Table 58 x25 map bridge Options

Option	Description
accept-reverse	Causes the Cisco IOS software to accept incoming reverse-charged calls. If this option is not present, the Cisco IOS software clears reverse-charged calls unless the interface accepts all reverse-charged calls.
broadcast	Causes the Cisco IOS software to direct any broadcasts sent through this interface to the specified X.121 address. This option also simplifies the configuration of Open Shortest Path First (OSPF) Protocol; see “Usage Guidelines” for more detail.

Table 58 x25 map bridge Options (continued)

Option	Description
compress	Specifies that X.25 payload compression be used for mapping the traffic to this host. Each virtual circuit established for compressed traffic uses a significant amount of memory (for a table of learned data patterns) and for computation (for compression and decompression of all data). Cisco recommends that compression be used with careful consideration of its impact on overall performance.
cug *group-number*	Specifies a closed user group (CUG) number (from 1 to 9999) for the mapping in an outgoing call.
idle *minutes*	Specifies an idle timeout for calls other than the interface default; 0 minutes disables the idle timeout.
method {**cisco** | **ietf** | **snap** | **multi**}	Specifies the encapsulation method. The choices are as follows: • **cisco**—Cisco's proprietary encapsulation; not available if more than one protocol is to be carried. • **ietf**—Default RFC 1356 operation: protocol identification of single-protocol virtual circuits and protocol identification within multiprotocol virtual circuits use the standard encoding, which is compatible with RFC 877. Multiprotocol virtual circuits are used only if needed. • **snap**—RFC 1356 operation where IP is identified with SNAP rather than the standard Internet Engineering Task Force (IETF) method (the standard method is compatible with RFC 877). • **multi**—Forces a map that specifies a single protocol to set up a multiprotocol virtual circuit when a call is originated; also forces a single-protocol permanent virtual circuit (PVC) to use multiprotocol data identification methods for all datagrams sent and received.
no-incoming	Uses the map only to originate calls.
no-outgoing	Does not originate calls when using the map.
nudata *string*	Specifies the network user identification in a format determined by the network administrator (as allowed by the standards). This option is provided for connecting to non-Cisco equipment that requires an NUID facility. The string should not exceed 130 characters and must be enclosed in quotation marks (" ") if there are any spaces present. This option only works if the router is configured as an X.25 DTE device.
nuid *username password*	Specifies that a network user ID (NUID) facility be sent in the outgoing call with the specified Terminal Access Controller Access Control System (TACACS) username and password (in a format defined by Cisco). This option should be used only when connecting to another Cisco router. The combined length of the username and password should not exceed 127 characters. This option only works if the router is configured as an X.25 DTE.

Table 58 x25 map bridge Options (continued)

Option	Description
nvc *count*	Sets the maximum number of virtual circuits for this map or host. The default *count* is the **x25 nvc** setting of the interface. A maximum number of eight virtual circuits can be configured for each map. Compressed TCP may use only 1 virtual circuit.
packetsize *in-size out-size*	Proposes maximum input packet size (*in-size*) and maximum output packet size (*out-size*) for an outgoing call. Both values typically are the same and must be one of the following values: 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096.
passive	Specifies that the X.25 interface should send compressed outgoing TCP datagrams only if they were already compressed when they were received. This option is available only for compressed TCP maps.
reverse	Specifies reverse charging for outgoing calls.
roa *name*	Specifies the name defined by the **x25 roa** command for a list of transit Recognized Operating Agencies (ROAs, formerly called Recognized Private Operating Agencies, or RPOAs) to use in outgoing Call Request packets.
throughput *in out*	Sets the requested throughput class values for input (*in*) and output (*out*) throughput across the network for an outgoing call. Values for *in* and *out* are in bits per second (bps) and range from 75 to 48000 bps.
transit-delay *milliseconds*	Specifies the transit delay value in milliseconds (0 to 65534) for an outgoing call, for networks that support transit delay.
windowsize *in-size out-size*	Proposes the packet count for input window (*in-size*) and output window (*out-size*) for an outgoing call. Both values typically are the same, must be in the range 1 to 127, and must be less than the value set by the **x25 modulo** command.

Examples

The following example configures transparent bridging over X.25 between two Cisco routers using a maximum of six virtual circuits:

```
interface serial 1
 x25 map bridge 000000010300 broadcast nvc 6
```

Related Commands

Command	Description
x25 map	Sets up the LAN protocols-to-remote host mapping.
x25 address	Sets the X.121 address of a particular network interface.

x25 map cmns

The **x25 map cmns** command is replaced by the enhanced **x25 route** command. See the description of the **x25 route** command in this chapter for more information.

x25 map compressedtcp

To map compressed TCP traffic to an X.121 address, use the **x25 map compressedtcp** interface configuration command. To delete a TCP/IP header compression map for the link, use the **no** form of this command.

x25 map compressedtcp *ip-address* [*protocol2 address2* [...[*protocol9 address9*]]] *x121-address* [*option*]

no x25 map compressedtcp *address* [*protocol2 address2* [...[*protocol9 address9*]]] *x121-address*

Syntax Description

ip-address	IP address.
protocol	(Optional) Protocol type, entered by keyword. Supported protocols are entered by keyword, as listed in Table 56 earlier in this chapter. As many as nine protocol and address pairs can be specified in one command line.
address	(Optional) Protocol address.
x121-address	X.121 address.
option	(Optional) The same options as those for the **x25 map** command; see Table 57 earlier in this chapter.

Defaults

No mapping is configured.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Cisco supports RFC 1144 TCP/IP header compression (THC) on serial lines using HDLC and X.25 encapsulation. THC encapsulation is only slightly different from other encapsulation traffic, but these differences are worth noting. The implementation of compressed TCP over X.25 uses one virtual circuit to pass the compressed packets. Any IP traffic (including standard TCP) is separate from TCH traffic; it is carried over separate IP encapsulation virtual circuits or identified separately in a multiprotocol virtual circuit.

Note If you specify both **ip** and **compressedtcp** in the same **x25 map compressedtcp** command, they must both specify the same IP address.

The **nvc** map option cannot be used for TCP/IP header compression, because only one virtual circuit can carry compressed TCP/IP header traffic to a given host.

Examples

The following example establishes a map for TCP/IP header compression on serial interface 4:

```
interface serial 4
 ip tcp header-compression
 x25 map compressedtcp 172.20.2.5 000000010300
```

Related Commands

Command	Description
x25 map	Sets up the LAN protocols-to-remote host mapping.

x25 map pad

To configure an X.121 address mapping for packet assembler/disassembler (PAD) access over X.25, use the **x25 map pad** interface configuration command.

x25 map pad *x121-address* [*option*]

Syntax Description

x121-address	X.121 address of the interface.
option	(Optional) Services that can be added to this map—the same options as the **x25 map** command; see Table 57 earlier in this chapter.

Defaults

No specific options are used for PAD access.

Command Modes

Interface configuration

Command History

Release	Modification
10.2	This command was introduced.

Usage Guidelines

Use a PAD map to configure optional X.25 facility use for PAD access. When used with the **x25 pad-access** interface configuration command, the **x25 map pad** command restricts incoming PAD access to those statically mapped hosts.

Examples

The following example configures an X.25 interface to restrict incoming PAD access to the single mapped host. This example requires that both incoming and outgoing PAD access use the network user identification (NUID) user authentication.

```
interface serial 1
 x25 pad-access
 x25 map pad 000000010300 nuid johndoe secret
```

Related Commands

Command	Description
x25 map	Sets up the LAN protocols-to-remote host mapping.
x25 pad-access	Causes the PAD software to accept PAD connections only from statically mapped X.25 hosts.

x25 modulo

To set the window modulus, use the **x25 modulo** interface configuration command.

x25 modulo *modulus*

Syntax Description

modulus	Either 8 or 128. The value of the modulo parameter must agree with that of the device on the other end of the X.25 link.

Defaults

8

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

X.25 supports flow control with a sliding window sequence count. The window counter restarts at zero upon reaching the upper limit, which is called the *window modulus*. Modulo 128 operation is also referred to as *extended packet sequence numbering*, which allows larger packet windows.

Examples

The following example sets the window modulus to 128:

```
interface serial 0
 x25 modulo 128
```

Related Commands

Command	Description
x25 facility	Forces facilities on a per-call basis for calls originated by the router (switched calls are not affected).
x25 win	Changes the default incoming window size to match that of the network.
x25 wout	Changes the default outgoing window size to match that of the network.

x25 nvc

To specify the maximum number of virtual circuits (VCs) that a protocol can have open simultaneously to one host, use the **x25 nvc** interface configuration command. To increase throughput across networks, you can establish up to eight virtual circuits to a host and protocol.

x25 nvc *count*

Syntax Description

count	Circuit count from 1 to 8. A maximum of eight virtual circuits can be configured for each protocol-host pair. Protocols that do not tolerate out-of-sequence delivery, such as encapsulated TCP/IP header compression, will use only one virtual circuit despite this value. Permitting more than one VC may help throughput on slow networks.

Defaults

1

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

When the windows and output queues of all existing connections to a host are full, a new virtual circuit will be opened to the designated circuit count. If a new connection cannot be opened, the data is dropped.

Note The *count* value specified for the**x25 nvc** command affects the default value for the number of VCs. It does not affect the **nvc** option for any **x25 map** commands that are configured.

Examples

The following example sets the default maximum number of VCs that each map can have open simultaneously to 4:

```
interface serial 0
 x25 nvc 4
```

x25 ops

To set the interface default maximum output packet size to match that of the network, use the **x25 ops** interface configuration command.

x25 ops *bytes*

Syntax Description

bytes	Byte count that is one of the following: 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096.

Defaults

128 bytes

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

X.25 networks use maximum output packet sizes set by the network administrator. Larger packet sizes are better because smaller packets require more overhead processing. To send a packet larger than the X.25 packet size over an X.25 virtual circuit, the Cisco IOS software must break the packet into two or more X.25 packets with the more data bit (M-bit) set. The receiving device collects all packets with the M-bit set and reassembles the original packet.

Note Set the **x25 ips** and **x25 ops** commands to the same value unless your network supports asymmetry between input and output packets.

Examples

The following example sets the default maximum packet sizes to 512:

```
interface serial 1
 x25 ips 512
 x25 ops 512
```

Related Commands

Command	Description
x25 ips	Sets the interface default maximum input packet size to match that of the network.

x25 pad-access

To cause the packet assembler/disassembler (PAD) software to accept PAD connections only from statically mapped X.25 hosts, use the **x25 pad-access** interface configuration command. To disable checking maps on PAD connections, use the **no** form of this command.

x25 pad-access

no x25 pad-access

Syntax Description

This command has no arguments or keywords.

Defaults

Accept PAD connections from any host.

Command Modes

Interface configuration

Command History

Release	Modification
10.2	This command was introduced.

Usage Guidelines

By default, all PAD connection attempts are processed for session creation or protocol translation, subject to the configuration of those functions. If you use the **x25 pad-access** command, PAD connections are processed only for incoming calls with a source address that matches a statically mapped address configured with the **x25 map pad** interface configuration command. PAD connections are refused for any incoming calls with a source address that has not been statically mapped.

Examples

The following example restricts incoming PAD access on the interface to attempts from the host with the X.121 address 000000010300:

```
interface serial 1
 x25 pad-access
 x25 map pad 000000010300
```

Related Commands

Command	Description
service pad	Enables all PAD commands and connections between PAD devices and access servers.
x25 map pad	Configures an X.121 address mapping for PAD access over X.25.
x29 access-list	Limits access to the access server from certain X.25 hosts.
x29 profile	Creates a PAD profile script for use by the translate command.

x25 profile

To configure an X.25 profile without allocating any hardware specific information, use the **x25 profile** command in global configuration mode. To delete this profile, use the **no** form of this command.

x25 profile *name* {**dce** | **dte** | **dxe**}

no x25 profile *name*

Syntax Description

name	X.25 profile name that you assign.
dce	Indicates a data communications equipment (DCE) interface.
dte	Indicates a data terminal equipment (DTE) interface.
dxe	Indicates a data exchange equipment (DXE) interface.

Defaults

dte

Command Modes

Global configuration

Command History

Release	Modification
12.0(3)T	This command was introduced.
12.0(7)T	The **x25 subscribe flow-control** command was added to the X.25 profile configuration mode X.25 options.

Usage Guidelines

You can enable many X.25 commands in X.25 profile configuration mode. Table 59 lists the following X.25 commands in X.25 profile configuration mode, which you may use to create your X.25 profile.

Table 59 x25 profile Configuration Mode X.25 Options

Command	Description
x25 accept-reverse	Accepts all reverse charged calls.
x25 address	Sets interface X.121 address.
x25 alias	Defines an alias address pattern.
x25 aodi	Enables AODI (Always On/Direct ISDN) Service.
x25 default	Sets protocol for calls with unknown Call User Data.
x25 facility	Sets explicit facilities for originated calls.
x25 hic	Sets highest incoming channel.
x25 hoc	Sets highest outgoing channel.
x25 hold-queue	Sets limit on packets queued per circuit.
x25 hold-vc-timer	Sets time to prevent calls to a failed destination.

Table 59 x25 profile Configuration Mode X.25 Options (continued)

Command	Description
x25 htc	Sets highest two-way channel.
x25 idle	Sets inactivity time before clearing switched virtual circuit (SVC).
x25 lic	Sets lowest incoming channel.
x25 linkrestart	Restarts when Link Access Procedure, Balanced (LAPB) resets.
x25 loc	Sets lowest outgoing channel.
x25 ltc	Sets lowest two-way channel.
x25 map	Maps protocol addresses to X.121 address.
x25 modulo	Sets operating standard.
x25 nonzero-dte-cause	Allows non-zero DTE cause codes.
x25 nvc	Sets maximum virtual circuits (VCs) simultaneously open to one host per protocol.
x25 ops	Sets default maximum output packet size.
x25 subscribe flow-control	Controls flow control parameter negotiation facilities in call setup packets.
x25 suppress-called-address	Omits destination address in outgoing calls.
x25 suppress-calling-address	Omits source address in outgoing calls.
x25 t10	Sets DCE Restart Request retransmission timer.
x25 t11	Sets DCE Call Request retransmission timer.
x25 t12	Sets DCE Reset Request retransmission timer.
x25 t13	Sets DCE Clear Request retransmission timer.
x25 threshold	Sets packet count acknowledgment threshold.
x25 use-source-address	Uses local source address for forwarded calls.
x25 win	Sets default input window (maximum unacknowledged packets).
x25 wout	Sets default output window (maximum unacknowledged packets).

Table 60 lists LAPB commands in X.25 configuration mode, which you may use to create your X.25 profile.

Table 60 x25 profile lapb Options

Command	Description
interface-outage	Interface outage deadband (partial T3).
k	Maximum number of outstanding frames (window size).
modulo	Set frame numbering modulus.
N2	Maximum number of attempts to transmit a frame.
T1	Retransmission timer.

Table 60 x25 profile lapb Options (continued)

Command	Description
T2	Explicit acknowledge deferral timer.
T4	Keepalive timer.

Examples

The following example shows the NetworkNodeA profile being set as a DCE interface, and with **x25 htc**, **x25 idle**, **x25 accept-reverse**, and **x25 modulo** commands enabled:

```
Router(config)# x25 profile NetworkNodeA dce
Router(config-x25)# x25 htc 128
Router(config-x25)# x25 idle 5
Router(config-x25)# x25 accept-reverse
Router(config-x25)# x25 modulo 128
```

Related Commands

Command	Description
show x25 profile	Displays information about configured X.25 profiles.

x25 pvc (encapsulation)

To establish an encapsulation permanent virtual circuit (PVC), use the encapsulating version of the **x25 pvc** interface configuration command. To delete the PVC, use the **no** form of this command with the appropriate channel number.

x25 pvc *circuit protocol address* [*protocol2 address2* [...[*protocol9 address9*]]] *x121-address* [*option*]

no x25 pvc *circuit*

Syntax Description

circuit	Virtual-circuit channel number, which must be less than the virtual circuits assigned to the switched virtual circuits (SVCs).
protocol	Protocol type, entered by keyword. Supported protocols are listed in Table 61. As many as nine protocol and address pairs can be specified in one command line.
address	Protocol address of the host at the other end of the PVC.
x121-address	X.121 address.
option	(Optional) Provides additional functionality or allows X.25 parameters to be specified for the PVC. Can be any of the options listed in Table 62.

Defaults

The PVC window and maximum packet sizes default to the interface default values.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

PVCs are not supported for ISO Connection-Mode Network Service (CMNS).

You no longer need to specify a datagram protocol-to-address mapping before you can set up a PVC; a map is implied from the PVC configuration. Configurations generated by the router will no longer specify a map for encapsulating PVCs.

When configuring a PVC to carry CLNS traffic, use the X.121 address as the subnetwork point of attachment (SNPA) to associate the PVC with a CLNS neighbor configuration. When configuring a PVC to carry transparent bridge traffic, the X.121 address is required to identify the remote host to the bridging function. Other encapsulation PVCs do not require an X.121 address.

Table 61 lists supported protocols.

Table 61 Protocols Supported by X.25 PVCs

Keyword	Protocol
apollo	Apollo Domain
appletalk	AppleTalk
bridge	Bridging[1]
clns	OSI Connectionless Network Service
compressedtcp	TCP/IP header compression
decnet	DECnet
ip	IP
ipx	Novell IPX
qllc	SNA encapsulation in X.25[2]
vines	Banyan VINES
xns	XNS

1. Bridging traffic is supported only for Cisco's traditional encapsulation method, so a bridge PVC cannot specify other protocols.
2. QLLC is not available for multiprotocol encapsulation.

Table 62 lists supported X.25 PVC options.

Table 62 x25 pvc Options

Option	Description
broadcast	Causes the Cisco IOS software to direct any broadcasts sent through this interface to this PVC. This option also simplifies the configuration of OSPF.
method {**cisco** | **ietf** | **snap** | **multi**}	Specifies the encapsulation method. The choices are as follows: • **cisco**—Single protocol encapsulation; not available if more than one protocol is carried. • **ietf**—Default RFC 1356 operation; single-protocol encapsulation unless more than one protocol is carried, and protocol identification when more than one protocol is carried. • **snap**—RFC 1356 operation where IP is identified when more than one protocol is carried using the SNAP encoding. • **multi**—Multiprotocol encapsulation used on the PVC.
packetsize *in-size out-size*	Maximum input packet size (*in-size*) and output packet size (*out-size*) for the PVC. Both values are typically the same and must be one of the following values: 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096.
passive	Specifies that transmitted TCP datagrams will be compressed only if they were received compressed. This option is available only for PVCs carrying compressed TCP/IP header traffic.
windowsize *in-size out-size*	Packet count for input window (*in-size*) and output window (*out-size*) for the PVC. Both values are typically the same, must be in the range 1 to 127, and must be less than the value set for the **x25 modulo** command.

Examples

The following example establishes a PVC on channel 2 to encapsulate VINES and IP with the far host:

```
interface serial 0
 x25 ltc 5
 x25 pvc 2 vines 60002A2D:0001 ip 172.20.170.91 11110001
```

Related Commands

Command	Description
x25 map	Sets up the LAN protocols-to-remote host mapping.

x25 pvc (switched)

To configure a switched permanent virtual circuit (PVC) for a given interface, use the switched version of the **x25 pvc** interface configuration command.

x25 pvc *number1* **interface** *type number* **pvc** *number2* [*option*]

Syntax Description

number1	PVC number that will be used on the local interface (as defined by the primary interface command).
interface	Required keyword to specify an interface.
type	Remote interface type.
number	Remote interface number.
pvc	Required keyword to specify a switched PVC.
number2	PVC number that will be used on the remote interface.
option	(Optional) Adds certain features to the mapping specified; can be either option listed in Table 63.

Defaults

The PVC window and maximum packet sizes default to the interface default values.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

You can configure X.25 PVCs in the X.25 switching software. As a result, data terminal equipment (DTE) devices that require permanent circuits can be connected to the router acting as an X.25 switch and have a properly functioning connection. X.25 resets will be sent to indicate when the circuit comes up or goes down.

PVC circuit numbers must come before (that is, be numerically smaller than) the circuit numbers allocated to any SVC range.

Table 63 lists the switched PVC options supported by X.25.

Table 63 x25 pvc Switched PVC Options

Option	Description
packetsize *in-size out-size*	Maximum input packet size (*in-size*) and output packet size (*out-size*) for the PVC. Both values must be one of the following values: 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096.
windowsize *in-size out-size*	Packet count for input window (*in-size*) and output window (*out-size*) for the PVC. Both values should be the same, must be in the range 1 to 127, and must not be greater than the value set for the **x25 modulo** command.

Examples

The following example configures a PVC connected between two serial interfaces on the same router. In this type of interconnection configuration, the alternate interface must be specified along with the PVC number on that interface. To make a working PVC connection, two commands must be specified, each pointing to the other, as this example illustrates.

```
interface serial 0
 encapsulation x25
 x25 ltc 5
 x25 pvc 1 interface serial 1 pvc 1
interface serial 1
 encapsulation x25
 x25 ltc 5
 x25 pvc 1 interface serial 0 pvc 1
```

x25 pvc (switched PVC to SVC)

To configure a switched permanent virtual circuit (PVC) to a switched virtual circuit (SVC) for a given interface, use the switched PVC to SVC version of the **x25 pvc** interface configuration command.

x25 pvc *number1* **svc** *x121-address* [*flow-control-options*] [*call-control-options*]

Syntax Description

number1	Logical channel ID of the PVC. Value must be lower than any range of circuit numbers defined for SVCs.
svc	Specifies a SVC type.
x121-address	Destination X.121 address for opening an outbound SVC and source X.121 address for matching an inbound SVC.
flow-control-options	(Optional) Adds certain features to the mapping specified. It can be any of the options listed in Table 64.
call-control-options	(Optional) Adds certain features to the mapping specified. It can be any of the options listed in Table 65.

Defaults

This command has no default values.

Command Modes

Interface configuration

Command History

Release	Modification
11.2 F	This command was introduced.

Usage Guidelines

The PVC window and maximum packet sizes default to the interface default values. The default idle time comes from the interface on which the **x25 pvc** command is configured, not the interface on which the call is sent/received.

PVC circuit numbers must come before (that is, be numerically smaller than) the circuit numbers allocated to any SVC range.

On an outgoing call, the packet size facilities and window size facilities will be included. The call will be cleared if the call accepted packet specifies different values.

On an incoming call, requested values that do not match the configured values will be refused.

Table 64 lists the flow control options supported by X.25 during PVC to SVC switching.

Table 64 x25 pvc Flow Control Options

Option	Description
packetsize *in-size out-size*	Maximum input packet size (*in-size*) and output packet size (*out-size*) for both the PVC and SVC. Values may differ but must be one of the following: 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096.
windowsize *in-size out-size*	Packet count for input window (*in-size*) and output window (*out-size*) for both the PVC and SVC. Both values may differ but must be in the range 1 to 127 and must be less than the value set for the **x25 modulo** command.

Table 65 lists the call control options supported by X.25 during PVC to SVC switching.

Table 65 x25 pvc Call Control Options

Option	Description
accept-reverse	Causes the Cisco IOS software to accept incoming reverse-charged calls. If this option is not present, the Cisco IOS software clears reverse-charged calls unless the interface accepts all reverse-charged calls.
idle *minutes*	Idle time-out for the SVC. This option will override the interface's **x25 idle** command value only for this circuit.
no-incoming	Establishes a switched virtual circuit to the specified X.121 address when data is received from the permanent virtual circuit, but does not accept calls from this X.121 address.
no-outgoing	Accepts an incoming call from the specified X.121 address, but does not attempt to place a call when data is received from the permanent virtual circuit. If data is received from the permanent virtual circuit while no call is connected, the PVC will be reset.

Examples

The following example configures PVC to SVC switching between two serial interfaces:

```
x25 routing
interface serial0
 encapsulation x25
 x25 address 201700
 x25 ltc 128
 x25 idle 2
interface serial2
 encapsulation x25 dce
 x25 address 101702

x25 route ^20 interface serial0
x25 route ^10 interface serial2
interface serial0

 x25 pvc 5 svc 101601 packetsize 128 128 windowsize 2 2 no-incoming
 x25 pvc 6 svc 101602 packetsize 128 128 windowsize 2 2 no-outgoing idle 0
 x25 pvc 7 svc 101603 packetsize 128 128 windowsize 2 2
```

Any call with a destination address beginning with 20 will be routed to serial interface 0. Any call with a destination address beginning with 10 will be routed to serial interface 2. (Note that incoming calls will not be routed back to the same interface from which they arrived.)

Traffic received on PVC 5 on serial interface 0 will cause a call to be placed from address 201700 to the X.121 address 101601. The routing table will then forward the call to serial interface 2. If no data is sent or received on the circuit for two minutes, the call will be cleared, as defined by the **x25 idle** command. All incoming calls from 101601 to 201700 will be refused, as defined by the *no-incoming* attribute.

The second **x25 pvc** command configures the circuit to allow incoming calls from 101602 to 201700 to be connected to PVC 6 on serial interface 1. Because idle is set to 0, the call will remain connected until cleared by the remote host or an X.25 restart. Because outgoing calls are not permitted for this connection, if traffic is received on PVC 6 on serial interface 0 before the call is established, the traffic will be discarded and the PVC will be reset.

The last **x25 pvc** command configures the circuit to accept an incoming call from 101603 to 201700 and connects the call to PVC 7 on serial interface 0. If no data is sent or received on the circuit for two minutes, the call will be cleared. If traffic is received on PVC 7 on serial interface 0 before the call is established, a call will be placed to 101503 to 201700.

x25 pvc (XOT)

To connect two permanent virtual circuits (PVCs) across a TCP/IP LAN, use the X.25-over-TCP (XOT) service form of the **x25 pvc** interface configuration command.

x25 pvc *number1* **xot** *address* **interface serial** *string* **pvc** *number2* [*option*]

Syntax Description

number1	PVC number of the connecting device.
xot	Indicates two PVCs will be connected across a TCP/IP LAN using XOT.
address	IP address of the device to which you are connecting.
interface serial	Indicates the interface is serial.
string	Serial interface specification that accepts either a number or a string in model 7000 format (*number*/*number*) to denote the serial interface.
pvc	Indicates a PVC.
number2	Remote PVC number on the target interface.
option	(Optional) Adds certain features for the connection; can be one or more of the options listed in Table 66.

Defaults

The PVC window and packet sizes default to the interface default values.

The default for the **xot-keepalive-period** option is 60 seconds.

The default for the **xot-keepalive-tries** option is 4 tries.

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

Use the PVC tunnel commands to tell the Cisco IOS software what the far end of the PVC is connected to. The incoming and outgoing packet sizes and window sizes must match the remote PVC outgoing and incoming sizes.

It is recommended that the **xot-source** option be used on the remote host so that a consistent IP address is used for the connection.

Table 66 lists the PVC tunnel options supported by X.25.

Table 66 x25 pvc PVC Tunnel Options

Option	Description
packetsize *in-size out-size*	Maximum input packet size (*in-size*) and output packet size (*out-size*) for the PVC. Both values must be one of the following values: 16, 32, 64, 128, 256, 512, 1024, 2048, or 4096.
windowsize *in-size out-size*	Packet count for input window (*in-size*) and output window (*out-size*) for the PVC. Both values should be the same, must be in the range 1 to 127, and must not be greater than or equal to the value set for the **x25 modulo** command.
xot-keepalive-period *seconds*	Number of seconds between keepalives for XOT connections. The default is 60 seconds.
xot-keepalive-tries *count*	Number of times TCP keepalives should be sent before dropping the connection. The default value is 4 times.
xot-promiscuous	Indicates that the remote IP address should be ignored when matching an incoming XOT connection with the XOT PVC parameters.
xot-source *interface*	Specifies an interface whose IP address should be used as the local IP address of the TCP connection.

Each XOT connection relies on a TCP session to carry traffic. To ensure that these TCP sessions remain connected in the absence of XOT traffic, use the **service tcp-keepalives-in** and **service tcp-keepalives-out** global configuration commands. If TCP keepalives are not enabled, the XOT PVCs might encounter problems if one end of the connection is reloaded. When the reloaded host attempts to establish a new connection, the other host refuses the new connection because it has not been informed that the old session is no longer active. Recovery from this state requires the other host to be informed that its TCP session is no longer viable so that it attempts to reconnect the PVC.

Also, TCP keepalives inform a router when an XOT switched virtual circuit (SVC) session is not active, thus freeing the router's resources.

Examples

The following example enters the parameters for one side of a connection destined for a platform other than the Cisco 7000 series with RSP7000:

```
service tcp-keepalives-in
service tcp-keepalives-out
interface serial 0
 x25 pvc 1 xot 172.20.1.2 interface serial 1 pvc 2

The following example enters the parameters for one side of a connection destined for the
Cisco 7000 series with RSP7000:
service tcp-keepalives-in
service tcp-keepalives-out
interface serial 0
 x25 pvc 1 xot 172.20.1.2 interface serial 1/1 pvc 2
```

Refer to the section "X.25 and LAPB Configuration Examples" in the *Cisco IOS Wide-Area Networking Configuration Guide* for more complete configuration examples.

Related Commands

Command	Description
service tcp-keepalives-in	Generates keepalive packets on idle incoming network connections (initiated by the remote host).
service tcp-keepalives-out	Generates keepalive packets on idle outgoing network connections (initiated by a user).

x25 remote-red

This command is no longer supported.

x25 retry

To activate a secondary route while also retrying a failed primary route, use the **x25 retry** interface configuration command in conjunction with the ip route or backup interface commands. To discontinue implementing secondary X.25 routes and retrying of primary X.25 routes, use the **no** form of this command.

x25 retry interval *seconds* **attempts** *count*

no x25 retry interval *seconds* **attempts** *count*

Syntax Description

interval	Keyword defining interval between attempts.
seconds	Number of seconds between attempts.
attempts	Keyword defining number of attempts.
count	Number of attempts to reestablish the closed link before discontinuing.

Defaults

No default behavior or values.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

The **x25 retry** command is triggered when no switched virtual circuits (SVCs) are up, and an outgoing call fails.

The retry attempts will continue until any of the following happens:

- The configured retry attempts limit is reached.
- The attempt to reestablish the link is successful.
- An incoming call is received on the subinterface.
- The X.25 packet layer on the interface is restarted.

If the number of retry attempts exceeds the configured limit, the interface will remain marked “down” until any of the following happens:

- An incoming call is received on the subinterface.
- The X.25 packet layer on the interface is restarted.

Examples

The following example shows the **x25 retry** command being configured on subinterface 1.1 with a retry interval of 60 seconds up to a maximum of 10 attempts:

```
Router(config)# interface serial1.1 point-to-point
Router(config-if)# x25 retry interval 60 attempts 10
```

Related Commands

Command	Description
backup interface	Configures an interface as a secondary or dial backup interface.
clear x25	Restarts an X.25 or CMNS service, clears an SVC, or resets a PVC.
ip route	Establishes static routes and defines the next hop for large-scale dialout.

x25 roa

To specify a sequence of packet network carriers, use the **x25 roa** global configuration command. To remove the specified name, use the **no** form of this command.

x25 roa *name number*

no x25 roa *name*

Syntax Description

name	Recognized Operating Agency (ROA, formerly called a Recognized Private Operating Agency, or RPOA), which must be unique with respect to all other ROA names. It is used in the **x25 facility** and **x25 map** interface configuration commands.
number	A sequence of 1 or more numbers used to describe an ROA; up to 10 numbers are accepted.

Defaults

No packet network carriers are specified.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command specifies a list of transit ROAs to use, referenced by name.

Examples

The following example sets an ROA name and then sends the list via the X.25 user facilities:

```
x25 roa green_list 23 35 36
interface serial 0
 x25 facility roa green_list
 x25 map ip 172.20.170.26 10 roa green_list
```

Related Commands

Command	Description
x25 facility	Forces facilities on a per-call basis for calls originated by the router (switched calls are not affected).
x25 map	Sets up the LAN protocols-to-remote host mapping.

x25 route

To create an entry in the X.25 routing table (to be consulted for forwarding incoming calls and for placing outgoing packet assembler/disassembler (PAD) or protocol translation calls), use the appropriate form of the **x25 route** global configuration command. To remove an entry from the table, use the **no** form of the command.

x25 route [*#position*] [*selection-options*] [*modification-options*] *disposition-options* [*xot-keepalive-options*]

no x25 route [*#position*] [*selection-options*] [*modification-options*] *disposition-options* [*xot-keepalive-options*]

Syntax Description

#position	(Optional) A pound sign (#) followed by a number designates the position in the routing table at which to insert the new entry. If no value for the *position* argument is given, the entry is appended to the end of the routing table.
selection-options	(Optional) The selection options identify when the subsequent modification and disposition options apply to an X.25 call; any or all variables may be specified for a route. For selection keyword and argument options, see Table 67 in the "Usage Guidelines" section. For selection and modification pattern and character matching and replacement see Table 69, Table 70, and Table 71 in the "Usage Guidelines" section. Although each individual selection criterion is optional, at least one selection or modification option must be specified in the **x25 route** command.
modification-options	(Optional) The modification options modify the source or destination addresses of the selected calls. The standard regular expression substitution rules are used, where a match pattern and rewrite string direct the construction of a new string. For modification keyword and argument options, see Table 68 in the "Usage Guidelines" section. For selection and modification pattern and character matching and replacement see Table 69, Table 70, and Table 71 in the "Usage Guidelines" section. Although each individual modification is optional, at least one selection or modification option must be specified in the **x25 route** command.
disposition-options	Specifies the disposition of a call matching the specified selection pattern. For disposition keyword and argument options, see Table 72 in the "Usage Guidelines" section.
xot-keepalive-options	(Optional) The XOT-keepalive options specify an X.25 over TCP (XOT) keepalive period and number of XOT-keepalive retries. XOT relies on TCP to detect when the underlying connection is dead. TCP detects a dead connection when sent data goes unacknowledged for a given number of attempts over a period of time. For XOT-keepalive keyword and argument options, see Table 73 in the "Usage Guidelines" section.

Defaults

No entry is created in the X.25 routing table.

Command Modes

Global configuration

Command History

Release	Modification
11.3	The following modifications were made: • The selection option keywords **source** and **dest-ext** and the interface *disposition* to a Connection-Mode Network Service (CMNS) destination was added. In prior releases, CMNS routing information was implied by maps defining a network service access point (NSAP) prefix for a CMNS host's MAC address. • The **clear interface** *disposition option* was added. In prior releases, the disposition was implicit in a route to the Null 0 interface.
12.0(3)T	The interface-based calling address insertion and removal feature was introduced.
12.0(5)T	The following modifications were made: • For the DNS-Based X.25 Routing feature, the **dns** keyword and *pattern* argument (see Table 71) were added. • The enhanced **x25 route** command replaces the **x25 map cmns** command. The **x25 route alias** form of this command (supported in earlier releases) was replaced by the **x25 alias** command.

Usage Guidelines

The enhanced **x25 route** command replaces the **x25 map cmns** command. The **x25 route alias** form of this command (supported in earlier releases) has been replaced by the **x25 alias** command.

The modification options are long-standing but newly applicable to all dispositions in Cisco IOS Release 11.3 and later.

Note The entire command must be entered on one line.

Selection Options

Selection arguments specify match criteria. When a call matches all selection criteria in an X.25 route, then the specified modification and disposition are used for the call.

As many as four selection options can be used to determine the route:

- Called X.121 network interface address (destination or source host address)
- Called address extension (destination NSAP address)
- X.25 packet's call user data (CUD) field
- Input interface from which the call was received (**input-interface** option)

Table 67 lists the selection options for the **x25 route** command. At least one selection or modification option must be specified.

Table 67 x25 route Selection Options

Selection Option	Description
cud *user-data-pattern*	(Optional) CUD pattern, which is specified as a regular expression of printable ASCII text. The CUD field may be present in a call packet. The first few bytes (commonly 4 bytes long) identify a protocol; the specified pattern is applied to any user data after the protocol identification.
destination-pattern	(Optional) Destination address pattern, which is a regular expression that can represent either one X.121 address (such as ^1111000$) or any address in a group of X.121 addresses (such as ^1111.*).
dest-ext *nsap-destination-pattern*	(Optional) NSAP destination address pattern, which is a regular expression that can represent either an NSAP destination address (such as ^11.1111.0000$) or an NSAP prefix (such as ^11.1111.*). **Note** A period (.) in the pattern is interpreted as a character wildcard, which will not interfere with a match to the actual period in the NSAP; if desired, an explicit character match may be used (such as ^11\.1111\..*).
hunt-group *name*	Routes the selected call to the X.25 hunt group. The chosen router may vary depending on the hunt group configuration.
input interface *interface number*	(Optional) Specifies interface number on which the call will be received.
source *source-pattern*	(Optional) Source address pattern, which is a regular expression that can represent either one X.121 source address (such as ^2222000$) or any address in a group of X.121 addresses (such as ^2222.*).

Note The X.121 and NSAP addresses are specified as regular expressions. A common error is to specify the address digits without anchoring them to the beginning and end of the address. For example, the regular expression 1111 will match an X.121 address that has four successive 1s somewhere in the address; to specify the single X.121 address, the form ^1111$ must be used.

Regular expressions are used to allow pattern-matching operations on the addresses and user data. A common operation is to use prefix matching on the X.121 Data Network Identification Code (DNIC) field and route accordingly. The caret (^) is a special regular expression character that anchors the match at the beginning of the pattern. For example, the pattern ^3306 will match all X.121 addresses with a DNIC of 3306.

Modification Options

Addresses typically need to be modified when traffic from a private network that uses arbitrary X.121 addresses must transit a public data network, which must use its own X.121 addresses. The easiest way to meet the requirement is to specify in the **x25 route** command a way to modify the private address into a network X.121 address, or to modify a network X.121 address into a private address. The addresses are modified so that no change to the private addressing scheme is required.

The modification options use the standard UNIX regular expression substitution operations to change an X.25 field. A pattern match is applied to an address field, which is rewritten as directed by a rewrite pattern.

Table 68 lists the modification options for the **x25 route** command. At least one selection or modification option must be specified.

Table 68 x25 route Modification Options

Modification Option	Description
substitute-dest *rewrite-dest*	(Optional) Called X.121 address rewrite pattern. The destination address, *destination-pattern*, and this *rewrite-dest* pattern are used to form a new destination address. If no *destination-pattern* is specified, a default match pattern of .* is used. See Table 69 and Table 70 for summaries of pattern and character matching, respectively. See Table 71 for a summary of pattern rewrite elements.
substitute-source *rewrite-source*	(Optional) Calling X.121 address rewrite pattern. The *source address*, *source-pattern*, and this *rewrite-source* pattern are used to form a new source address. If no *source-pattern* is specified, any *destination-pattern* match pattern is used. If neither match pattern is specified, a default match pattern of .* is used. See Table 69 and Table 70 for summaries of pattern and character matching, respectively. See Table 71 for a summary of pattern rewrite elements.

Note As of Cisco IOS Release 11.3, the **substitute-source** and **substitute-dest** options also apply to PAD calls.

A modification of the source address is directed by the rewrite string using one of three possible match patterns. If the **source** *source-pattern* selection option is defined, it is used with the *source-rewrite* string to construct the new source address; otherwise, a *destination-pattern* regular expression is used (for backward compatibility) or a wildcard regular expression (.*) is used. In the *rewrite-source* argument, the backslash character (\) indicates that the digit immediately following the argument selects a portion of the matched address to be inserted into the new called address.

A modification of the destination address is directed by the rewrite string using one of two possible match patterns. If the *destination-pattern* selection option is defined, it is used with the *destination-rewrite* string to construct the new destination address; otherwise, a wildcard regular expression (.*) is used. In the *rewrite-dest* argument, the backslash character (\) indicates that the digit immediately following the argument selects a portion of the original called address to be inserted into the new called address.

Pattern and Character Matching and Replacement for Selection and Modification Options

See Table 69, Table 70, and Table 71, respectively, for summaries of pattern matching, character matching, and pattern replacement elements. Note that up to nine pairs of parentheses can be used to identify patterns to be included in the modified string. A more complete description of the pattern-matching characters is found in the "Regular Expressions" appendix in the *Cisco IOS Terminal Services Configuration Guide*.

Table 69 Pattern Matching for x25 route Selection and Modification Options

Pattern	Description
*	Matches 0 or more occurrences of the preceding character.
+	Matches 1 or more occurrences of the preceding character.
?	Matches 0 or 1 occurrences of the preceding character.[1]

1. Precede the question mark with **Ctrl-V** to prevent the question mark from being interpreted as a **help** command.

Table 70 Character Matching for x25 route Selection and Modification Options

Character	Description
^	Matches the beginning of the input string.
$	Matches the end of the input string.
char	Matches the single character *char* specified.
.	Matches any single character.

Table 71 Pattern Replacements for x25 route Selection and Modification Options

Pattern	Description
\0	The pattern is replaced by the entire original address.
\1...9	The pattern is replaced by strings that match the first through ninth parenthetical part of the X.121 address.

Disposition Option

The **xot-source** disposition option can improve the resilience of the TCP connection if, for instance, a loopback interface is specified. By default, a TCP connection's source IP address is that of the interface used to initiate the connection; a TCP connection will fail if either the source or destination IP address is no longer valid. Because a loopback interface never goes down, its IP address is always valid. Any TCP connections originated using a loopback interface can be maintained as long as a path exists to the destination IP address, which may also be the IP address of a loopback interface.

Using the **continue** keyword provides flexibility by reducing the number of X.25 route configurations necessary in the route table by breaking them into separate, simpler, and more manageable tasks. It allows the **x25 route** command to cumulatively hold all specified route entries and carry whatever selection or modification options you may have just specified on the command line. The route table lookup terminates when a matching route is found among the remaining entries in the route table. The **continue** disposition must be the last option on the **x25 route** command line.

Table 72 lists the disposition options for the **x25 route** command. You must select one of these options.

Table 72 x25 route Disposition Options

Disposition Option	Description
clear	Terminates the call.
continue	(Optional) Combines sequential route table lookups, holding onto any "selections" and "modifications" specified on the **x25 route** statement.
hunt-group *name*	Routes the selected call to the X.25 hunt group. The chosen route may vary depending on the hunt group configuration.
interface *interface number*	Routes the selected call to the specified X.25 serial interface.
interface *interface number* **dlci** *number*	(Optional) Routes the X.25 call to the specified Annex G link. You must include the interface number and enter the data link connection identifier (DLCI) number. You only need to do this if you want the router to accept switched calls, as well as originate them.
interface *cmns-interface* **mac** *mac-address*	Routes the selected call out the specified broadcast interface via CMNS to the LAN destination station. The broadcast interface type can be Ethernet, Token Ring, or FDDI. The interface numbering scheme depends on the router interface hardware.
xot *ip-address* [*ip2-address* [...[*ip6-address*]]] [**xot-source** *interface*]	Routes the selected call to the XOT host at the specified IP address. Subsequent IP addresses are tried, in sequence, only if XOT is unable to establish a TCP connection with a prior address.
xot dns *pattern*	Used with DNS-based X.25 routing, this option consults the DNS to get up to six destination IP addresses using whatever lookup pattern you choose (see Table 71).

XOT-Keepalive Options

TCP maintains each connection using a keepalive mechanism that starts with a default time period and number of retry attempts. If a received XOT connection is dispatched using a route with explicit keepalive parameters, those values will be used for the TCP connection. If an XOT connection is sent using a route with explicit keepalive parameters, those values will be used for the TCP connection.

Table 73 lists and describes the xot-keepalive options for the **x25 route** command.

Table 73 x25 route XOT-Keepalive Options

XOT-Keepalive Option	Description
xot-keepalive-period *seconds*	Number of seconds between keepalives for XOT connections. The default is 60 seconds.
xot-keepalive-tries *count*	Number of times TCP keepalives should be sent before dropping the connection. The default value is 4 times.

X.25 Routing Action When a Match Is Found

If a matching route is found, the incoming call is forwarded to the next hop depending on the routing entry. If no match is found, the call is cleared. If the route specifies a serial interface running X.25 or a broadcast interface running CMNS, the router attempts to forward the call to that host. If the interface is not operational, the subsequent routes are checked for forwarding to an operational interface. If the interface is operational but out of available virtual circuits, the call is cleared. Otherwise, the expected Clear Request or Call Accepted packet is forwarded back toward the originator. A call cannot be forwarded out the interface on which it arrived.

If the matching route specifies an XOT disposition, a TCP connection is established to port 1998 at the specified IP address, which must be an XOT host. The Call Request packet is forwarded to the remote host, which applies its own criteria to handle the call. If, upon receiving an XOT call on the remote host, a routing table entry is not present, or the destination is unavailable, a Clear Request is sent back and the TCP connection is closed. Otherwise, the call is handled and the expected Clear Request or Call Accepted packet is returned. Incoming calls received via XOT connections that match a routing entry specifying an XOT destination are cleared. This restriction prevents Cisco routers from establishing an XOT connection to another router that would establish yet another XOT connection.

X.25 Routing Action When No Match Is Found

If no match is found, the action taken is specific to the application. X.25 switching will clear the call if there is no match in the routing table. X.25 PAD and PAD-related applications, such as protocol translation using X.25, will route the call to the default X.25 interface, which is the first X.25 interface configured.

Examples

The following example uses regular expression pattern matching characters to match just the initial portion of the complete X.25 address. Any call with a destination address beginning with 3107 that is received on an interface other than serial 0 is forwarded to serial 0.

```
x25 route ^3107 interface serial 0
```

The following Annex G example routes the X.25 call to the specified Annex G DLCI link. You must include both interface number and DLCI number. It is this combination of both these numbers that indicates the logical X.25 interface over Frame Relay.

```
x25 route ^2222 interface serial 1 dlci 20
```

The following example prevents X.25 routing for calls that do not specify a source address:

```
x25 route source ^$ clear
```

The following example configures alternate XOT hosts for the routing entry. If the first address listed is not available, subsequent addresses are tried until a connection is made. If no connection can be formed, the call is cleared.

```
x25 route ^3106$ xot 172.20.2.5 172.20.7.10 172.10.7.9
```

The following example clears calls that contain a 3 in the source address. The disposition keyword **clear** is new.

```
x25 route source 3 clear
```

The following example clears calls that contain 33 in the source address:

```
x25 route source 33 clear
```

The following example clears a call to the destination address 9999:

```
x25 route ^9999$ clear
```

The following example specifies a route for specific source and destination addresses. (The ability to combine source and destination patterns is a new feature.)

```
x25 route ^9999$ source ^333$ interface serial 0
```

The following example routes the call to the XOT host at the specified IP address. The disposition keyword **xot** is new. In prior releases the keyword **ip** was used.

```
x25 route ^3333$ xot 172.21.53.61
```

The following DNS-based X.25 routing example shows an X.25 request to the DNS. The **\0** pattern indicates that the entire incoming X.121 address is being used as the index into the DNS, which will return the required IP address.

```
x25 route ^.* xot dns \0
```

The following example routes calls containing the destination extension address preamble 11.1234:

```
x25 route dest-ext ^11.1234.* interface serial 0
```

The following example rewrites the destination address as 9999. There must be a minimum of four 8s in the address. (8888888 will change to 9999.)

```
x25 route 8888 substitute-dest 9999 interface serial 0
```

The following example substitutes only part of the destination address. “^88” specifies the original destination string must begin with 88. “(.*)” indicates the string can end with any number, 0-9, and can be more than one digit. “99\1” changes the destination address to 99 plus whatever matches “.*” in the original destination address. For example, 8881 will change to 9981.

```
x25 route ^88(.*) substitute-dest 99\1 interface serial 0
```

The following example substitutes only part of the destination address and also removes a specified number of digits from the address. “^88” specifies the original destination string must begin with 88. “(..)” matches any two digits. “(.*)” specifies the string can end with any number, 0-9, and can occur zero or more times. Thus any address that starts with 88 and has four or more digits will be rewritten to start with 99 and omit the third and fourth digits. For example, 881234 will change to 9934.

```
x25 route ^88(..)(.*) substitute-dest 99\2 interface serial 0
```

The following example looks for a specified destination address and changes the source address. “9999” is the destination address. The original source address changes to “2222” because the call is made to the destination 9999.

```
x25 route ^9999$ substitute-source 2222 interface serial 0
```

The following example shows insertions and removals in the X.121 address as calls from the X.25 network get routed to X.25 devices. For a call coming from interface serial 0 with a called address starting with 2, the 2 is stripped off the called address and the call forwarded to serial interface 2. For a call coming from interface serial 2 with any calling address, a 2 will be inserted to its calling address and the call forwarded to serial interface 0.

```
x25 route ^02(.*) input-interface serial0 substitute-dest \1 interface serial2
x25 route input-interface serial2 source .* substitute-source 2\0 interface serial0
```

The following example shows how to insert the X.121 address to forward calls among local X.25 devices. For a call on interface 1 with a called address of 0255 and any calling address, the call is forwarded to serial interface 2 with a called address of 55 and a calling address inserted with 01. The **continue** keyword continues address substitution without address forwarding.

```
x25 route input-interface serial1 source .* substitute-source 01\0 continue
```

```
x25 route input-interface serial2 source .* substitute-source 02\0 continue
x25 route ^01(.*) substitute-dest \1 interface serial1
x25 route ^02(.*) substitute-dest \1 interface serial2
```

The following example rewrites the source address based on the source address. “9999” matches any destination address with four consecutive 9s. “^...(.*)” matches any source address with at least three digits; the command removes the first three digits and rewrites any digits after the first three as the new source address. For example, a call to 9999 from the source address 77721 will be forwarded using the calling address 21 and the called address 9999.

```
x25 route 9999 source ^...(.*) substitute-source \1 interface serial 0
```

The following example adds a digit to the source and destination addresses patterns. “09990” is the destination address pattern. The source can be any address. “9\0” specifies to add a leading 9 to the destination address pattern. “3\0” specifies to add a leading 3 to the source address pattern. For example, a call using source 03330 and destination 09990 will change to 303330 and 909990, respectively.

```
x25 route 09990 source .* substitute-dest 9\0 substitute-source 3\0 interface serial 0
```

Related Commands

Command	Description
show x25 route	Displays the X.25 routing table.

x25 routing

To enable X.25 switching or tunneling, use the **x25 routing** global configuration command. To disable the forwarding of X.25 calls, use the **no** form of this command.

x25 routing [**acknowledge local | acknowledge end-to-end**] [**tcp-use-if-defs**]

no x25 routing [**acknowledge local | acknowledge end-to-end**] [**tcp-use-if-defs**]

Syntax Description

acknowledge local	(Optional) Sets local acknowledgment on the router.
acknowledge end-to-end	(Optional) Sets end-to-end acknowledgment. (Default acknowledge setting.)
tcp-use-if-defs	(Optional) Accepts calls received over TCP.

Defaults

This command has no default values.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
12.0(7)T	The following keywords were added: • **acknowledge end-to-end** • **acknowledge local**

Usage Guidelines

The **x25 routing** command enables X.25 switching between the X.25 services (X.25, Connection-Mode Network Service [CMNS] and X.25 over TCP [XOT], and Annex G). X.25 calls will not be forwarded until this command is issued.

The **acknowledge local** and **acknowledge end-to-end** keywords are optional, with **acknowledge end-to-end** being the default. To confirm what type of acknowledgment has been set, use the **show protocol** command.

The **tcp-use-if-defs** keyword may be needed for receiving XOT calls from routers using older software versions. Normally, calls received over a TCP connection (remote routing reception) will have the flow control parameters (window sizes and maximum packet sizes) indicated, because proper operation of routed X.25 requires that these values match at both ends of the connection.

Some previous versions of Cisco IOS software, however, do not ensure that these values are present in all calls. In this case, the Cisco IOS software normally forces universally acceptable flow control values (window sizes of 2 and maximum packet sizes of 128) on the connection. Because some equipment disallows modification of the flow control values in the call confirm, the **tcp-use-if-defs** keyword causes the router to use the default flow control values of the outgoing interface and indicate the resulting values in the call confirm. This modified behavior may allow easier migration to newer versions of the Cisco IOS software.

Examples

The following example enables X.25 routing:

```
x25 routing
```

The following example enables X.25 routing with local acknowledgment:

```
x25 routing acknowledge local
```

x25 subscribe cug-service

To enable and control standard closed user group (CUG) behavior on an X.25 data communications equipment (DCE) interface or X.25 profile, use the **x25 subscribe cug-service** interface configuration command. To disable standard CUG behavior on an X.25 DCE interface, use the **no** form of this command.

x25 subscribe cug-service [**incoming-access** | **outgoing-access**] [**suppress preferential** | **suppress all**]

no x25 subscribe cug-service [**incoming-access** | **outgoing-access**] [**suppress preferential** | **suppress all**]

Syntax Description

incoming-access	(Optional) Allows incoming access from the open network to the data terminal equipment (DTE) device.
outgoing-access	(Optional) Allows outgoing access from the DTE device to the open network.
suppress preferential	(Optional) Suppresses CUG selection facility for the preferential CUG.
suppress all	(Optional) Suppresses CUG selection facility for all CUGs.

Defaults

No incoming access and no outgoing access. (This is the most restrictive setting.)

CUG selection facilities are not suppressed.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
12.0(7)T	This command was introduced.
12.1(5)T	The **suppress preferential** and **suppress all** keywords were added to enable CUG selection facility suppression.

Usage Guidelines

When entering this command, specify the **incoming-access** and/or the **outgoing-access** keyword, unless you intend to have neither incoming nor outgoing access on that interface.

This command assumes that an X.25 network connection is being implemented and observes rules defined by X.25 and X.301 for CUG access. This command is enabled on a per-interface basis. Use this command to modify existing specified options without otherwise affecting the CUGs already defined.

Use the **x25 subscribe cug-service** command with the **suppress preferential** or **suppress all** keywords to configure CUG selection facility suppression.

The following restrictions apply to the **x25 subscribe cug-service** command:

- Disabling this command deconfigures all the CUGs defined for the device and disables all CUG-related commands, but it does not terminate the associated CUG switched virtual circuit (SVC) connections.
- The DTE cannot call the open part of the network unless the **outgoing-access** option is configured. Even if **outgoing-access** is permitted, the DCE will enforce any additional CUG requirements when handling an outgoing call (call request) from the DTE.
- The DTE will not receive calls from the open part of the network unless the **incoming-access** option is configured. Even if **incoming-access** is permitted, the DCE will enforce any additional CUG requirements before presenting an incoming call to the DTE.

Examples

CUG Service with CUG Selection Facility Suppression and Incoming Access Example

In the following example, CUG selection facility suppression and incoming access are configured for all CUGs, including the preferential CUG on the X.25 profile:

```
x25 profile CUG-SUPRS-ALL dce
  x25 subscribe cug-service incoming-access suppress all
  x25 subscribe local-cug 0 network-cug 10 preferential
  x25 subscribe local-cug 20 network-cug 202
  x25 subscribe local-cug 40 network-cug 40
```

CUG Service with Incoming and Outgoing Access Example

The following example shows subscribing to both incoming and outgoing CUG service on the interface:

```
interface serial0
  encapsulation x25 dce
  x25 subscribe cug-service incoming-access outgoing-access
```

Related Commands

Command	Description
show x25 cug	Displays information about all CUGs or specific CUGs (defined by the local or network CUG number).
x25 facility	Forces facilities on a per-call basis for calls originated by the router (switched calls are not affected).
x25 map	Sets the maximum number of virtual circuits that a protocol can have open simultaneously to one host.

x25 subscribe flow-control

To control flow control parameter negotiation facilities in call setup packets, use the **x25 subscribe flow-control** interface configuration command. To have flow control parameter negotiation facilities included in call setup (outgoing) packets only when their values differ from the default values, use the **no** form of this command.

x25 subscribe flow-control {**always** | **never**}

no x25 subscribe flow-control

Syntax Description

always	Flow control parameter negotiation facilities are enabled and the flow control parameters are always included with call setup packets and are optional on inbound packets.
never	Flow control parameter negotiation facilities are disabled and the flow control parameters are never included with call setup packets, and are not permitted on inbound packets. Negotiation of flow control parameters is disabled.

Defaults

Flow control parameter negotiation facilities are included only when the parameter values differ from the default values.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
12.0(7)T	This command was introduced.

Usage Guidelines

This command has three states—default behavior (**no x25 subscribe flow-control**), facilities **always** included, or facilities **never** included (flow control parameter negotiation is not enabled).

This command controls inclusion of the X.25 flow control parameter negotiation facilities in call setup packets. By default, these facilities are included in call setup packets only when their values differ from the default values.

Configuring the **no x25 subscribe flow-control** command restores the default behavior. This only includes facilities outbound call setup packets when the requested values do not match the interface defaults.

This command can also be used in X.25 profile configuration mode.

Examples

The following example shows flow control parameter negotiation disabled on serial interface 1/4:

```
Router(config)# interface serial 1/4
Router(config-if)# x25 subscribe flow-control never
```

Related Commands

Command	Description
x25 profile	Configures an X.25 profile without allocating any hardware-specific information.
x25 routing	Enables X.25 switching or tunneling.
x25 subscribe packetsize	Sets permitted and target ranges for packet size during flow control negotiation.
x25 subscribe windowsize	Sets permitted and target ranges for window size during flow control negotiation.

x25 subscribe local-cug

To configure a data circuit-terminating equipment (DCE) X.25 interface for a specific closed user group (CUG) subscription, use the **x25 subscribe local-cug** interface configuration command. To disable the interface for a specific CUG subscription, use the **no** form of this command.

x25 subscribe local-cug *number* **network-cug** *number* [**no-incoming | no-outgoing | preferential**]

no x25 subscribe local-cug *number* **network-cug** *number* [**no-incoming | no-outgoing | preferential**]

Syntax Description

number	Specific local CUG number (0 to 9999).
network-cug	Network translated CUG identifier.
number	Specific network CUG number (0 to 9999).
no-incoming	(Optional) Calls to data terminal equipment (DTE) barred within the specified CUG, unless **x25 subscribe cug-service incoming-access** is configured.
no-outgoing	(Optional) Calls from DTE barred within the specified CUG, unless **x25 subscribe cug-service outgoing-access** is configured.
preferential	(Optional) Specified on only one CUG, and is the assumed CUG when none is provided in call setup. (A single CUG listed at the interface is automatically considered a preferential CUG.)

Defaults

Incoming and outgoing access. (Preferential—if this is the only CUG specified on the interface.)

Command Modes

Interface configuration

Command History

Release	Modification
12.0(7)T	This command was introduced.

Usage Guidelines

The first **x25 subscribe local-cug** command in a group of configurations will automatically enable CUG service behavior on the interface, if it is not already enabled, with the default settings of no public access.

A CUG number has only local significance. Because CUG service is a cooperative process between the network attachments (DCE devices), the local CUG number may need to be translated into a number that is significant to the network as a whole. For instance, two DTE devices may use CUG numbers 1 and 5 to refer to the global CUG number 1043 of the network. In this instance, both DCE devices would be configured to translate between the local CUG number of their DTE and the network CUG number. Duplicate network CUG identifiers are permitted for different local CUG identifiers.

A DTE subscription to a CUG that also includes the **no-incoming** option prevents incoming calls on that CUG (however, the DTE may still receive calls within other CUGs to which it is subscribed, or from the open network if incoming public access is subscribed).

CUG subscription of a DTE will not permit an outgoing call (call request) from the CUG if the **no-outgoing** option is configured.

The CUG will be assumed to be set to “preferential” if there is only one CUG subscribed on that interface.

Examples

The following example subscribes local CUGs 5000, 100, 200, and 300 to networks 55, 11, 22, and 33, respectively, with local CUG 5000 being set as the preferential CUG:

```
Router(config)# interface serial0
Router(config-if)# encapsulation x25 dce
Router(config-if)# x25 subscribe cug-service incoming-access outgoing-access
Router(config-if)# x25 subscribe local-cug 5000 network-cug 55 preferential
Router(config-if)# x25 subscribe local-cug 100 network-cug 11
Router(config-if)# x25 subscribe local-cug 200 network-cug 22
Router(config-if)# x25 subscribe local-cug 300 network-cug 33
```

Related Commands

Command	Description
show x25 cug	Displays information about all or specific (defined by the local or network CUG number) CUGs.
x25 facility	Forces facilities on a per-call basis for calls originated by the router (switched calls are not affected).
x25 map	Sets the maximum number of virtual circuits a protocol can have open simultaneously to one host.
x25 subscribe cug-service	Enables and controls standard CUG behavior on an X.25 DCE interface.

x25 subscribe packetsize

To set permitted and target ranges for packet size during flow control negotiation, use the **x25 subscribe packetsize** interface configuration command. To revert to the default packet size ranges, use the **no** form of this command.

x25 subscribe packetsize {**permit** *pmin pmax* | **target** *pmin pmax*}

no x25 subscribe packetsize {**permit** *pmin pmax* | **target** *pmin pmax*}

Syntax Description

permit	Permitted packet-size range identifier.
pmin	Minimum setting for packet size range (16 to 4096 by a power of two).
pmax	Maximum setting for packet size range (16 to 4096 by a power of two).
target	Target packet-size range identifier.

Defaults

None

Command Modes

Interface configuration

Command History

Release	Modification
12.0(7)T	This command was introduced.

Usage Guidelines

The **x25 subscribe packetsize** command lets you specify the range of permitted and target values for packet size. These are called flow control parameter negotiation facilities. You can specify the permitted minimum and maximum packet sizes and target values for packet transmission (16 to 4096 as a power of two). Setting these values outside the permitted range will result in connection failure. The router attempts to negotiate values within the target range, but will only allow values outside the target range to be negotiated as long as the negotiation complies with the procedure defined in X.25 recommendations.

This command should be configured separately on both the data terminal equipment (DTE) and data circuit-terminating equipment (DCE), so that the permit range will be compatible and calls will be able to pass through the network. The target range is less critical. It only needs to be set on the Cisco router conducting the switching.

The effective ranges will be further constrained by other configuration options including the selection of normal (modulo 8) or extended (modulo 128) sequence numbers, the maximum packet size supported by the interface, and the **x25 subscribe flow-control** command.

Examples

The following example shows X.25 local acknowledgment being configured on serial interface 1/4, with packet size ranges being set at a permitted rate of 64 (minimum) and 1024 (maximum) and target rate of 128 (minimum) and 1024 (maximum):

```
Router(config)# x25 routing acknowledge local
```

```
Router(config)# interface serial 1/4
Router(config-if)# encapsulation x25 dte
Router(config-if)# x25 subscribe packetsize permit 64 1024 target 128 1024
```

Related Commands

Command	Description
x25 routing	Enables X.25 switching or tunneling.
x25 subscribe windowsize	Sets permitted and target ranges for window size during flow control negotiation.
x25 subscribe flow-control	Controls flow control parameter negotiation facilities in call setup packets.

x25 subscribe windowsize

To set permitted and target ranges for window size during flow control negotiation, use the **x25 subscribe windowsize** interface configuration command. To revert to the default window size ranges, use the **no** form of this command.

x25 subscribe windowsize {**permit** *wmin wmax* | **target** *wmin wmax*}

no x25 subscribe windowsize {**permit** *wmin wmax* | **target** *wmin wmax*}

Syntax Description

permit	Permitted window size range identifier.
wmin	Minimum setting for window size range (1 to 127).
wmax	Maximum setting for window size range (1 to 127).
target	Target window-size range identifier.

Defaults

This command has no default values.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(7)T	This command was introduced.

Usage Guidelines

The **x25 subscribe windowsize** command lets you specify the range of permitted and target values for window size. These are called flow control values. You can specify the permitted minimum and maximum window size permitted and target values for packet transmission (1 to 127) at one time. Setting these values outside the permitted range may result in connection failure. The router attempts to negotiate values within the target range, but will only allow values outside the target range to be negotiated as long as the negotiation complies with the procedure defined in X.25 recommendations.

The effective ranges will be further constrained by other configuration options including the selection of normal (modulo 8) or extended (modulo 128) sequence numbers, the maximum window size supported by the interface, and the **x25 subscribe flow-control** command.

Examples

The following example shows X.25 local acknowledgment being configured on serial interface 1/4, with window size ranges being set at a permitted rate of 1 (minimum) and 7 (maximum) and target rate of 2 (minimum) and 4 (maximum):

```
Router(config)# x25 routing acknowledge local
Router(config)# interface serial 1/4
Router(config-if)# encapsulation x25 dte
Router(config-if)# x25 subscribe windowsize permit 1 7 target 2 4
```

Related Commands

Command	Description
x25 routing	Enables X.25 switching or tunneling.
x25 subscribe flow-control	Controls flow control parameter negotiation facilities in call setup packets.
x25 subscribe packetsize	Sets permitted and target ranges for packet size during flow control negotiation.

x25 suppress-called-address

To omit the destination address in outgoing calls, use the **x25 suppress-called-address** interface configuration command. To reset this command to the default state, use the **no** form of this command.

x25 suppress-called-address

no x25 suppress-called-address

Syntax Description

This command has no arguments or keywords.

Defaults

The called address is sent.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3	This command was modified to include packet assembler/disassembler (PAD) calls.

Usage Guidelines

This command omits the called (destination) X.121 address in Call Request packets and is required for networks that expect only subaddresses in the Called Address field.

Examples

The following example suppresses or omits the called address in Call Request packets:

```
interface serial 0
 x25 suppress-called-address
```

x25 suppress-calling-address

To omit the source address in outgoing calls, use the **x25 suppress-calling-address** interface configuration command. To reset this command to the default state, use the **no** form of this command.

x25 suppress-calling-address

no x25 suppress-calling-address

Syntax Description

This command has no arguments or keywords.

Defaults

The calling address is sent.

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3	This command was modified to include packet assembler/disassembler (PAD) calls.

Usage Guidelines

This command omits the calling (source) X.121 address in Call Request packets and is required for networks that expect only subaddresses in the Calling Address field.

Examples

The following example suppresses or omits the calling address in Call Request packets:

```
interface serial 0
 x25 suppress-calling-address
```

x25 t10

To set the value of the Restart Indication retransmission timer (T10) on data communications equipment (DCE) devices, use the **x25 t10** interface configuration command.

x25 t10 *seconds*

Syntax Description

seconds	Time, in seconds.

Defaults

60 seconds

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the T10 timer to 30 seconds:

```
interface serial 0
 x25 t10 30
```

x25 t11

To set the value of the Incoming Call timer (T11) on data communications equipment (DCE) devices, use the **x25 t11** interface configuration command.

x25 t11 *seconds*

Syntax Description

seconds	Time, in seconds.

Defaults

180 seconds

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the T11 timer to 90 seconds:

```
interface serial 0
 x25 t11 90
```

x25 t12

To set the value of the Reset Indication retransmission timer (T12) on data communications equipment (DCE) devices, use the **x25 t12** interface configuration command.

x25 t12 *seconds*

Syntax Description

seconds	Time, in seconds.

Defaults

60 seconds

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the T12 timer to 30 seconds:

```
interface serial 0
 x25 t12 30
```

x25 t13

To set the value of the Clear Indication retransmission timer (T13) on data communications equipment (DCE) devices, use the **x25 t13** interface configuration command.

x25 t13 *seconds*

Syntax Description

seconds	Time, in seconds.

Defaults

60 seconds

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the T13 timer to 30 seconds:

```
interface serial 0
 x25 t13 30
```

x25 t20

To set the value of the Restart Request retransmission timer (T20) on data terminal equipment (DTE) devices, use the **x25 t20** interface configuration command.

x25 t20 *seconds*

Syntax Description

seconds	Time in seconds.

Defaults

180 seconds

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the T20 timer to 90 seconds:

```
interface serial 0
 x25 t20 90
```

x25 t21

To set the value of the Call Request timer (T21) on data terminal equipment (DTE) devices, use the **x25 t21** interface configuration command.

x25 t21 *seconds*

Syntax Description

seconds	Time, in seconds.

Defaults

200 seconds

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the T21 timer to 100 seconds:

```
interface serial 0
 x25 t21 100
```

x25 t22

To set the value of the Reset Request retransmission timer (T22) on data terminal equipment (DTE) devices, use the **x25 t22** interface configuration command.

x25 t22 *seconds*

Syntax Description

seconds	Time, in seconds.

Defaults

180 seconds

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

ExamplesL

The following example sets the T22 timer to 90 seconds:

```
interface serial 0
 x25 t22 90
```

x25 t23

To set the value of the Clear Request retransmission timer (T23) on data terminal equipment (DTE) devices, use the **x25 t23** interface configuration command.

x25 t23 *seconds*

Syntax Description

seconds	Time, in seconds.

Defaults

180 seconds

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the T23 timer to 90 seconds:

```
interface serial 0
 x25 t23 90
```

x25 threshold

To set the data packet acknowledgment threshold, use the **x25 threshold** interface configuration command.

x25 threshold *delay-count*

Syntax Description

delay-count	Value between zero and the input window size. A value of 1 sends one Receiver Ready acknowledgment per packet.

Defaults

0 (which disables the acknowledgment threshold)

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

This command instructs the router to send acknowledgment packets when it is not busy sending other packets, even if the number of input packets has not reached the input window size count.

The router sends an acknowledgment packet when the number of input packets reaches the count you specify, providing there are no other packets to send. For example, if you specify a count of 1, the router will send an acknowledgment per input packet if it is unable to "piggyback" the acknowledgment of an outgoing data packet. This command improves line responsiveness at the expense of bandwidth.

This command only applies to encapsulated traffic over X.25 (datagram transport), not to routed traffic.

Examples

The following example sends an explicit Receiver Ready acknowledgment when it has received 5 data packets that it has not acknowledged:

```
interface serial 1
 x25 threshold 5
```

Related Commands

Command	Description
x25 win	Changes the default incoming window size to match that of the network.
x25 wout	Changes the default outgoing window size to match that of the network.

x25 use-source-address

To override the X.121 addresses of outgoing calls forwarded over a specific interface, use the **x25 use-source-address** interface configuration command. To prevent updating the source addresses of outgoing calls, use the **no** form of this command.

x25 use-source-address

no x25 use-source-address

Syntax Description

This command has no arguments or keywords.

Defaults

Disabled

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Some X.25 calls, when forwarded by the X.25 switching support, need the calling (source) X.121 address updated to that of the outgoing interface. This update is necessary when you are forwarding calls from private data networks to public data networks (PDNs).

Examples

The following example shows how to prevent updating the source addresses of outgoing X.25 calls on serial interface 0 once calls have been forwarded:

```
interface serial 0
 no x25 use-source-address
```

x25 win

To change the default incoming window size to match that of the network, use the **x25 win** interface configuration command.

x25 win *packets*

Syntax Description

packets	Packet count that can range from 1 to one less than the window modulus.

Defaults

2 packets

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command determines the default number of packets a virtual circuit can receive before sending an X.25 acknowledgment. To maintain high bandwidth utilization, assign this limit the largest number that the network allows.

Note Set **x25 win** and **x25 wout** to the same value unless your network supports asymmetric input and output window sizes.

Examples

The following example specifies that 5 packets may be received before an X.25 acknowledgment is sent:

```
interface serial 1
 x25 win 5
```

Related Commands

Command	Description
x25 modulo	Sets the window modulus.
x25 threshold	Sets the data packet acknowledgment threshold.
x25 wout	Changes the default outgoing window size to match that of the network.

x25 wout

To change the default outgoing window size to match that of the network, use the **x25 wout** interface configuration command.

x25 wout *packets*

Syntax Description

packets	Packet count that can range from 1 to one less than the window modulus.

Defaults

2 packets

Command Modes

Interface configuration

X.25 profile configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command determines the default number of packets a virtual circuit can send before waiting for an X.25 acknowledgment. To maintain high bandwidth utilization, assign this limit the largest number that the network allows.

Note Set **x25 win** and **x25 wout** to the same value unless your network supports asymmetric input and output window sizes.

Examples

The following example specifies a default limit of 5 for the number of outstanding unacknowledged packets for virtual circuits:

```
interface serial 1
 x25 wout 5
```

Related Commands

Command	Description
x25 modulo	Sets the window modulus.
x25 threshold	Sets the data packet acknowledgment threshold.
x25 win	Changes the default incoming window size to match that of the network.

x29 access-list

To limit access to the access server from certain X.25 hosts, use the **x29 access-list** global configuration command. To delete an entire access list, use the **no** form of this command.

x29 access-list *access-list-number* {**deny** | **permit**} *x121-address*

no x29 access-list *access-list-number*

Syntax Description

access-list-number	Number of the access list. It can be a value between 1 and 199.
deny	Denies access and clears call requests immediately.
permit	Permits access to the protocol translator.
x121-address	If applied as an inbound access class, specifies the X.121 address that can or cannot have access (with or without regular expression pattern-matching characters). The X.121 address is the source address of the incoming packet. If applied as an outbound access class, then the address specifies a destination to where connections are allowed.

Defaults

No access lists are defined.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The **service pad** global configuration command must be configured before the **x29 access-list** command can be used.

An access list can contain any number of access list items. The list items are processed in the order in which you entered them, with the first match causing the permit or deny condition. If an X.121 address does not match any of the regular expressions in the access list, access is denied.

Access lists take advantage of the message field defined by Recommendation X.29, which describes procedures for exchanging data between two PADs, or between a PAD and a DTE device.

The UNIX-style regular expression characters allow for pattern matching of characters and character strings in the address. Various pattern-matching constructions are available that allow many addresses to be matched by a single regular expressions. For more information, refer to the "Regular Expressions" appendix in the *Cisco IOS Terminal Services Configuration Guide.*

The access lists must be applied to a vty with the **access-class** command.

Examples

The following example permits connections to hosts with addresses beginning with the string 31370:

```
x29 access-list 2 permit ^31370
```

Related Commands

Command	Description
access-class	Restricts incoming and outgoing connections between a particular vty (into a Cisco device) and the addresses in an access list.
service pad	Enables all PAD commands and connections between PAD devices and access servers.

x29 profile

To create a packet assembler/disassembler (PAD) profile script for use by the **translate** command, use the **x29 profile** global configuration command.

x29 profile {**default** | *name*} *parameter*:*value* [*parameter*:*value*]

Syntax Description

default	Specifies default profile script.
name	Name of the PAD profile script.
parameter:*value*	X.3 PAD parameter number and value separated by a colon. You can specify multiple parameter-value pairs on the same line.

Defaults

The default PAD profile script is used. The default for inbound connections is:

```
2:0 4:1 15:0 7:21
```

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

The **service pad** global configuration command must be configured before the **x29 profile** command can be used.

When an X.25 connection is established, the access server acts as if an X.29 Set Parameter packet had been sent containing the parameters and values set by the **x29 profile** command and sets the access server accordingly.

For incoming PAD connections, the Protocol Translator uses a default PAD profile to set the remote X.3 PAD parameters unless a profile script is defined with the **translate** command.

Note If you set the X.29 profile to "default," the profile is applied to all incoming X.25 PAD calls, including the calls used for protocol translation.

Examples

The following profile script turns local edit mode on when the connection is made and establishes local echo and line termination upon receipt of a Return packet. The name *linemode* is used with the **translate** command to effect use of this script.

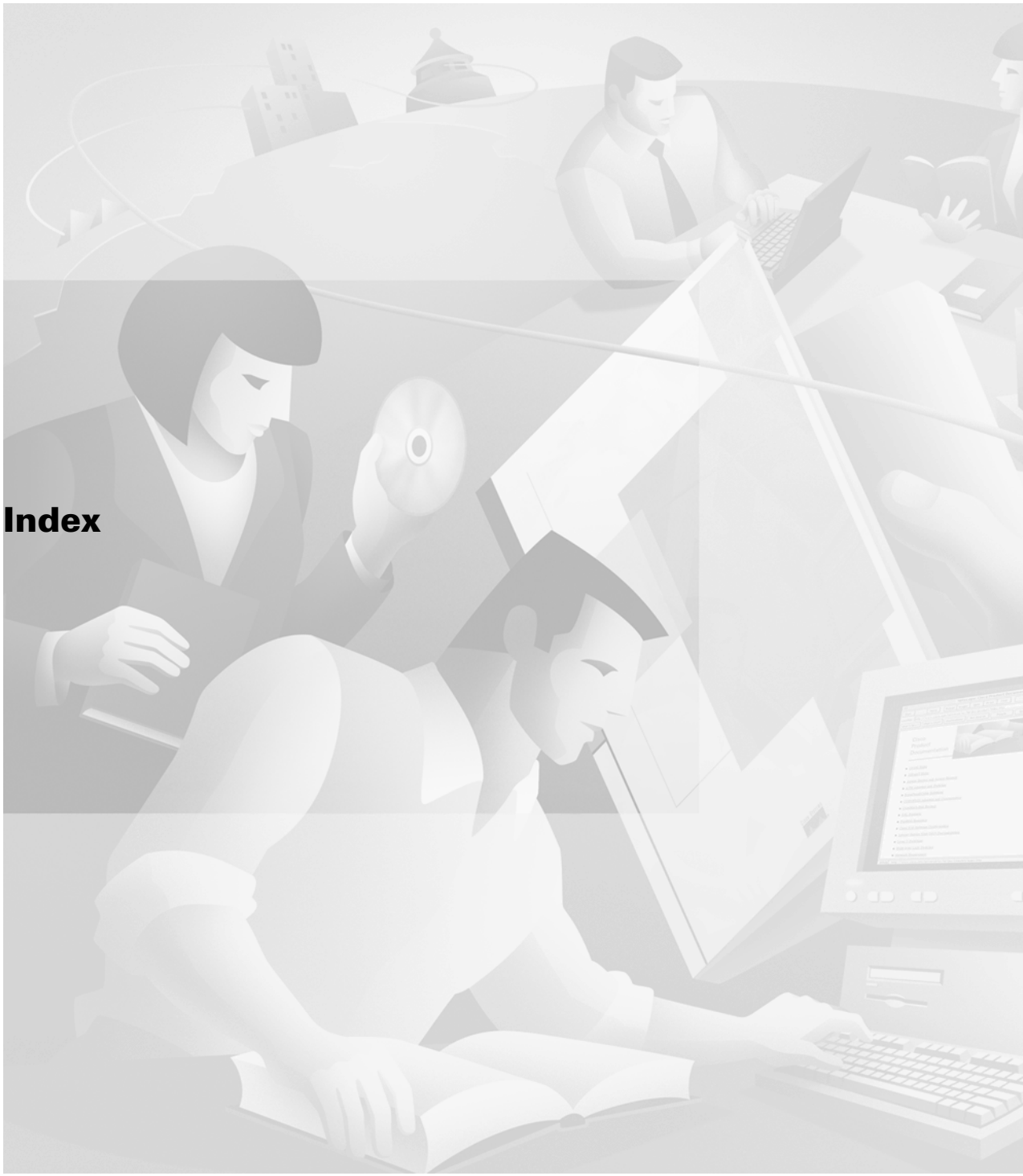
```
x29 profile linemode 2:1 3:2 15:1
```

To override the default PAD profile, create a PAD profile script named "default" by using the following command:

```
x29 profile default 2:1 4:1 15:0 4:0
```

Related Commands

Command	Description
service pad	Enables all PAD commands and connections between PAD devices and access servers.
translate x25	Translates an X.25 connection request automatically to another outgoing protocol connection type.



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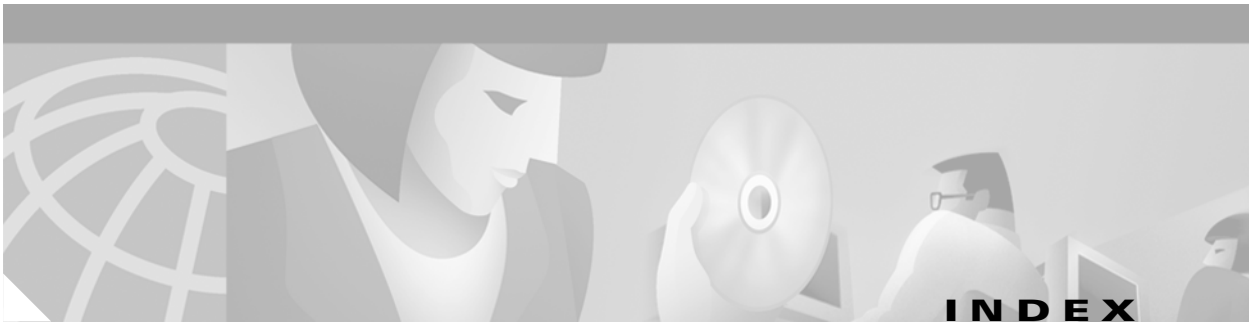

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