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** command in interface configuration mode. 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) or Frame Relay permanent virtual circuit (PVC) bundle that connects to the destination address, use the **frame-relay map** command in interface configuration mode. To delete the map entry, use the **no** form of this command.

frame-relay map *protocol protocol-address* {*dlci* | **vc-bundle** *vc-bundle-name*}[**broadcast**] [**ietf** | **cisco**] [**payload-compression** {**packet-by-packet** | **frf9 stac** [**one-way-negotiation**] [**ratio** *level*] [**skip-zero-sync**] [**software** | *hardware-options*] | **data-stream stac** [**one-way-negotiation**] [**ratio** *level*] [**software** | *hardware-options*]}]

no frame-relay map *protocol protocol-address*

Syntax Description

protocol	One of the following values: **appletalk**, **decnet**, **dlsw, ip**, **ipx**, **llc2**, and **rsrb**.
protocol-address	Destination protocol address.
dlci	DLCI number used to connect to the specified protocol address on the interface. Acceptable numbers are integers from 16 through 1007, inclusive.
vc-bundle *vc-bundle-name*	A specific Frame Relay PVC bundle configured 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, based on RFC 1490 and RFC 2427. Used when the router or access server is connected to another vendor's equipment across a Frame Relay network.
cisco	(Optional) Cisco-proprietary encapsulation method consisting of a four-byte header, with two bytes to identify the DLCI and two bytes to identify the packet type.
payload-compression	(Optional) Enables payload compression.
packet-by-packet	(Optional)Packet-by-packet payload compression using the Stacker method.
frf9 stac	(Optional)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).

one-way-negotiation	(Optional) Enables one-way negotiation. Use this keyword if your router will be negotiating compression with another device that is running Cisco IOS Release 12.1(9) or earlier releases. Later Cisco IOS releases use a two-way handshake by default to negotiate compression.
ratio *level*	(Optional) Sets throughput versus compression ratio. This option is available only with hardware compression. Possible values for the *level* argument are as follows: **high**—high compression versus low throughput **medium**—medium compression versus medium throughput **low**—low compression versus high throughput (default)
software	(Optional) Specifies that compression is implemented in the Cisco IOS software installed in the main processor of the router.
hardware-options	(Optional) Choose one of the following hardware options: **caim** *element-number*—Enables the CAIM[3] to perform compression. **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. **csa** *csa_number*—Specifies the CSA to use for a particular interface. This option applies only to Cisco 7200 series routers.
skip-zero-sync	(Optional) Causes compression frames to be numbered starting from 1 rather than 0. Use this keyword if your router will be interoperating with a device conforming to IBM partner conventions.
data-stream stac	(Optional) 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
3. CAIM = compression Advanced Interface Module

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.
12.2(4)T	The **skip-zero-sync** keyword was added.
12.2(13)T	The **vc-bundle** *vc-bundle-name* keyword and argument pair was added. The **apollo**, **vines**, and **xns** arguments were removed because Apollo Domain, Banyan VINES, and Xerox Network Systems are no longer available in the Cisco IOS software. The **one-way-negotiation** 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 or PVC bundle.

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, for example, that 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-compression** 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 may 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. 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 run automatically 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 to DLCI 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.

IP Address to Frame Relay PVC Bundle Mapping Example

The following example maps the destination IP address 172.16.123.1 to the Frame Relay PVC bundle named "MAIN-1":

```
interface serial 0
 frame-relay map ip 172.16.123.1 vc-bundle MAIN-1 broadcast
```

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-compression 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-compression data-stream stac
```

Related Commands

Command	Description
encapsulation frame-relay	Enables Frame Relay encapsulation on an interface.
frame-relay payload-compression	Enables Stacker payload compression on a specified point-to-point interface or subinterface.
frame-relay vc-bundle	Creates a Frame Relay PVC bundle and enters Frame Relay VC-bundle configuration mode.
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** command in interface configuration mode. 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** command in interface configuration mode. To delete the map entry, use the **no** form of this 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** command in interface configuration mode.

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. Default is 256.

Defaults

Maximum number of TCP header compression connections: 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** command in map-class configuration mode. 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** command in interface configuration mode. 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 multilink ack

To configure the number of seconds that a bundle link will wait for a hello message acknowledgment before resending the hello message, use the **frame-relay multilink ack** command in interface configuration mode. To reset this parameter to the default setting, use the **no** form of this command.

frame-relay multilink ack *seconds*

no frame-relay multilink ack

Syntax Description

seconds	Number of seconds that a bundle link will wait for a hello message acknowledgment before resending the hello message. The range is from 1 to 10 seconds. Default is 4.

Defaults

4 seconds

Command Modes

Interface configuration

Command History

Release	Modification
12.0(17)S	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

The **frame-relay multilink ack** command can be configured only on bundle link interfaces that have been associated with a bundle using the **encapsulation frame-relay mfr** command.

Both ends of a bundle link send out hello messages at regular intervals. When a peer device receives a hello message, it responds by sending an acknowledgment. This exchange of hello messages and acknowledgments serve as a keepalive mechanism for the link. If the bundle link sends a hello message but does not receive an acknowledgment, it will resend the hello message up to a configured maximum number of times. If the bundle link exhausts the maximum number of retries, the bundle link line protocol is considered down (unoperational).

The **frame-relay multilink ack** command setting on the local router is independent of the setting on the peer device.

Examples

The following example shows how to configure the bundle link to wait 6 seconds before resending hello messages:

```
interface serial0
 encapsulation frame-relay mfr0
 frame-relay multilink ack 6
```

Related Commands

Command	Description
encapsulation frame-relay mfr	Creates a multilink Frame Relay bundle link and associates the link with a bundle.
frame-relay multilink hello	Configures the interval at which a bundle link will send out hello messages.
frame-relay multilink retry	Configures the maximum number of times that a bundle link will resend a hello message while waiting for an acknowledgment.

frame-relay multilink bid

To assign a bundle identification (BID) name to a multilink Frame Relay bundle, use the **frame-relay multilink bid** command in interface configuration mode. To reset the name to the default, use the **no** form of this command.

frame-relay multilink bid *name*

no frame-relay multilink bid

Syntax Description

name	Bundle identification name. Maximum length is 49 characters.

Defaults

The default BID is "mfr" plus the number assigned to the bundle using the **interface mfr** command; for example, "mfr0".

Command Modes

Interface configuration

Command History

Release	Modification
12.0(17)S	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

This command can be entered only at the multilink Frame Relay bundle interface.

Note You can enter the **frame-relay multilink bid** command at any time without affecting the current state of the interface; however, the BID will not go into effect until the interface has gone from the down state to the up state. One way to bring the interface down and back up again is by using the **shut** and **no shut** commands in interface configuration mode.

Only one BID is allowed per bundle. A later entry of the **frame-relay multilink bid** command supersedes prior entries.

The local and peer BIDs do not have to be unique.

Examples

The following example shows how to assign a BID of "bundle1" to the multilink Frame Relay bundle. The previous BID for the bundle was "mfr0".

```
interface mfr0
 frame-relay multilink bid bundle1
```

Related Commands

Command	Description
frame-relay multilink lid	Assigns a LID name to a multilink Frame Relay bundle link.
interface mfr	Configures a multilink Frame Relay bundle interface.
show frame-relay multilink	Displays configuration information and statistics about multilink Frame Relay bundles and bundle links.

frame-relay multilink hello

To configure the interval at which a bundle link will send out hello messages, use the **frame-relay multilink hello** command in interface configuration mode. To reset this value to the default setting, use the **no** form of this command.

frame-relay multilink hello *seconds*

no frame-relay multilink hello

Syntax Description

seconds	Interval, in seconds, at which a bundle link will send out hello messages. The range is from 1 to 180.

Defaults

10 seconds

Command Modes

Interface configuration

Command History

Release	Modification
12.0(17)S	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

The **frame-relay multilink hello** command can be configured only on bundle link interfaces that have been associated with a bundle using the **encapsulation frame-relay mfr** command.

Both ends of a bundle link send out hello messages at regular intervals. When a peer device receives a hello message, it responds by sending an acknowledgment. This exchange of hello messages and acknowledgments serves as a keepalive mechanism for the link. If the bundle link sends a hello message but does not receive an acknowledgment, it will resend the hello message up to a configured maximum number of times. If the bundle link exhausts the maximum number of retries, the bundle link line protocol is considered down (unoperational).

The setting of the hello message interval on the local router is independent of the setting on the peer device.

Examples

The following example shows how to configure a bundle link to send hello messages every 15 seconds:

```
interface serial0
 encapsulation frame-relay mfr0
 frame-relay multilink hello 15
```

Related Commands

Command	Description
encapsulation frame-relay mfr	Creates a multilink Frame Relay bundle link and associates the link with a bundle.
frame-relay multilink ack	Configures the number of seconds that a bundle link will wait for a hello message acknowledgment before resending the hello message.
frame-relay multilink retry	Configures the maximum number of times that a bundle link will resend a hello message while waiting for an acknowledgment.

frame-relay multilink lid

To assign a bundle link identification (LID) name to a multilink Frame Relay bundle link, use the **frame-relay multilink lid** command in interface configuration mode. To reset the name to the default, use the **no** form of this command.

frame-relay multilink lid *name*

no frame-relay multilink lid

Syntax Description

name	Bundle link identification name. Maximum length is 49 characters.

Defaults

The default LID is the name of the physical interface.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(17)S	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

The **frame-relay multilink lid** command can be configured only on bundle link interfaces that have been associated with a bundle using the **encapsulation frame-relay** command with the **mfr** keyword.

Note You can enter the **frame-relay multilink lid** command at any time without affecting the current state of the interface; however, the LID will not go into effect until the interface has gone from the down state to the up state. One way to bring the interface down and back up again is by using the **shut** and **no shut** commands in interface configuration mode.

The LID will be used to identify the bundle link to peer devices and to enable the devices to identify which bundle links are associated with which bundles. The LID can also be assigned when the bundle link is created by using the **encapsulation frame-relay** command with the *name* argument. If the LID is not assigned, the default LID is the name of the physical interface.

The local and peer LIDs do not need to be unique.

Examples

The following example shows the LID "BL1" assigned to serial interface 0:

```
interface serial 0
 encapsulation frame-relay mfr0
 frame-relay multilink lid BL1
```

Related Commands

Command	Description
encapsulation frame-relay mfr	Creates a multilink Frame Relay bundle link and associates the link with a bundle.
frame-relay multilink bid	Assigns a BID name to a multilink Frame Relay bundle.
show frame-relay multilink	Displays configuration information and statistics about multilink Frame Relay bundles and bundle links.

frame-relay multilink output-threshold

To configure the number of bytes that a bundle link will transmit before the load-balancing mechanism causes transmission to roll over to the next available link, use the **frame-relay multilink output-threshold** command in interface configuration mode. To reset this value to the default setting, use the **no** form of this command.

frame-relay multilink output-threshold *bytes*

no frame-relay multilink output-threshold

Syntax Description

bytes	Number of bytes that a bundle link will transmit before the load-balancing mechanism causes transmission to roll over to the next link. The range is from 20 to 2147483647. The default is 300.

Defaults

300 bytes

Command Modes

Interface configuration

Command History

Release	Modification
12.2(8)T	This command was introduced.

Usage Guidelines

Multilink Frame Relay enables load balancing across bundle links that are in the same bundle. When a bundle link has reached its output threshold, transmission rolls over to the next available bundle link in the bundle.

The output threshold mechanism applies only when the bundle interface is using FIFO output queueing. When the bundle interface is not using FIFO output queuing, the algorithm for choosing a bundle link interface for output selects the bundle link with the empty or shortest output queue.

The default output threshold is 300 bytes. This default value will work effectively if all the bundle links in the bundle have the same speed. To efficiently use bundle links with varied speeds, use the **frame-relay multilink output-threshold** command to adjust the output threshold of the links as appropriate.

The **frame-relay multilink output-threshold** command can be used on the bundle interface and the bundle links. If the command is used on the bundle interface, the configured output threshold will apply to all bundle links in the bundle. If the command is used on a specific bundle link, the output threshold will overwrite the current setting for that bundle link.

Examples

The following example shows how to configure the bundle link output threshold at 600 bytes. When the bundle link reaches the threshold, transmission will roll over to the next link.

```
interface serial0
 encapsulation frame-relay mfr0
 frame-relay multilink output-threshold 600
```

Related Commands

Command	Description
encapsulation frame-relay mfr	Creates a multilink Frame Relay bundle link and associates the link with a bundle.

frame-relay multilink retry

To configure the maximum number of times a bundle link will resend a hello message while waiting for an acknowledgment, use the **frame-relay multilink retry** command in interface configuration mode. To reset this value to the default setting, use the **no** form of this command.

frame-relay multilink retry *number*

no frame-relay multilink retry

Syntax Description

number	Maximum number of times a bundle link will resend a hello message while waiting for an acknowledgment. The range is from 1 to 5.

Defaults

Number of retries: 2

Command Modes

Interface configuration

Command History

Release	Modification
12.0(17)S	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.

Usage Guidelines

The **frame-relay multilink retry** command can be configured only on bundle link interfaces that have been associated with a bundle using the **encapsulation frame-relay** command with the **mfr** keyword.

If the bundle link sends the maximum number of hello messages without receiving an acknowledgment, the bundle link line protocol is considered down (unoperational).

The maximum number of retries configured on the local router is independent of the maximum number configured on the peer device.

Examples

The following example shows how to configure a bundle link to resend a hello message a maximum of 3 times while waiting for an acknowledgment:

```
interface serial0
 encapsulation frame-relay mfr0
 frame-relay multilink retry 3
```

Related Commands

Command	Description
encapsulation frame-relay mfr	Creates a multilink Frame Relay bundle link and associates the link with a bundle.

Command	Description
frame-relay multilink ack	Configures the number of seconds that a bundle link will wait for a hello message acknowledgment before resending the hello message.
frame-relay multilink hello	Configures the interval at which a bundle link will send out hello messages.

frame-relay payload-compression

To enable Stacker payload compression on a specified point-to-point interface or subinterface, use the **frame-relay payload-compression** command in interface configuration mode. To disable payload compression on a specified point-to-point interface or subinterface, use the **no** form of this command.

frame-relay payload-compression {**packet-by-packet** | **frf9 stac** [**one-way-negotiation**] [**ratio** *level*] [**skip-zero-sync**] [**software** | *hardware-options*] | **data-stream stac** [**one-way-negotiation**] [**ratio** *level*] [**software** | *hardware-options*]}

no frame-relay payload-compression {**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).
one-way-negotiation	(Optional) Enables one-way negotiation. Use this keyword if your router will be negotiating compression with another device that is running Cisco IOS Release 12.1(9) or earlier releases. Later Cisco IOS releases use a two-way handshake by default to negotiate compression.
ratio *level*	(Optional) Sets throughput versus compression ratio. This option is available only with hardware compression. Possible values for the *level* argument are as follows: **high**—high compression versus low throughput **medium**—medium compression versus medium throughput **low**—low compression versus high throughput (default)
skip-zero-sync	(Optional) Causes compression frames to be numbered starting from 1 rather than 0. Use this keyword if your router will be interoperating with a device that conforms to IBM partner conventions.
software	(Optional) Specifies that compression is implemented in the Cisco IOS software installed in the main processor of the router.

hardware-options	(Optional) Choose one of the following hardware options: **caim** *element-number*—Enables the CAIM[3] to perform compression. **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. **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
3. CAIM = Compression Advanced Interface Module

Defaults

Payload compression is not enabled.

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.
12.2(4)T	The **skip-zero-sync** keyword was added.
12.2(13)T	The **one-way-negotiation** keyword was added.

Usage Guidelines

Use the **frame-relay payload-compression** 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-compression frf9 stac
```

Data-Stream Compression Example

The following example shows the configuration of data-stream compression using the **frame-relay payload-compression** 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-compression 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** command in interface configuration mode. 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** command in map-class configuration mode. 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

Use the **priority-list** commands to define the priority queue. 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** command in interface configuration mode. 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 (ELMI) on the Cisco router, use the **frame-relay qos-autosense** command in interface configuration mode. 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

ELMI is not enabled.

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** command in interface configuration mode. 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** keyword is specified on one interface, 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 Serial 2 200
```

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 Serial 2 200
 frame-relay route 101 interface Serial 2 201
 clockrate 2000000
```

frame-relay svc

To enable Frame Relay switched virtual circuit (SVC) operation on the specified interface, use the **frame-relay svc** command in interface configuration mode. 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

SVC operation is not enabled.

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 signaling 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** command in global configuration mode. 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

Switching is not enabled.

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 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** command in map-class configuration mode. 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** command in interface configuration mode. 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

Frame Relay traffic shaping is not enabled.

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-lass 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.

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.

frame-relay traps-maximum dlci-status-change

To change the maximum number of frDLCIStatusChange traps that Frame Relay generates at linkup or when receiving LMI Full Status messages, use the **frame-relay traps-maximum dlci-status-change** command in interface configuration mode. To disable any limit on the number of traps, use the **no** form of this command.

frame-relay traps-maximum dlci-status-change *traps*

no frame-relay traps-maximum dlci-status-change

Syntax Description

traps	Number of traps. The range is 0 to 1024.

Command Default

Enabled (and the maximum number of traps is equal to the maximum number of trap events specified for the SNMP server message queue).

Command Modes

Interface configuration

Command History

Release	Modification
11.1(33)CC	This command was introduced.
11.1(33)CV	This command was integrated into Cisco IOS Release 11.1(33)CV.
12.1(8)	This command was integrated into Cisco IOS Release 12.1(8).

Usage Guidelines

You should set the maximum number of traps based on the number of PVCs on the interface as well as on the SNMP server message queue length. A low number on an interface with many PVCs can be reached quickly, which can cause a large number of traps to be dropped. Also, you should set this number smaller than the SNMP server message queue length (which is specified by the **snmp-server queue-length** command, which has a default of 10 traps).

The traps counter for this command is reset when a keepalive message is exchanged on the Frame Relay interface.

Note Frame Relay frDLCIStatusChange traps are not generated when the line status or line protocol status of an interface changes to down.

This command does not restrict traps caused by individual circuit status changes.

Examples

The following example sets a maximum of 256 traps on serial interface 3/3:

```
Router> enable
Password:
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface serial 3/3
Router(config-if)# encapsulation frame-relay
Router(config-if)# frame-relay traps-maximum 256
Router(config-if)# end
```

Related Commands

Command	Description
snmp-server enable traps frame-relay	Enables Frame Relay SNMP notifications.
snmp-server host	Specifies the recipient of an SNMP notification operation.
snmp-server queue-length	Establishes the message queue length for each trap host.
snmp-server trap link	Enables linkUp/linkDown SNMP traps, which are compliant with RFC 2233.
snmp-server trap-source	Specifies the interface (and hence the corresponding IP address) from which an SNMP trap should originate.
snmp-server trap-timeout	Defines how often to try resending trap messages on the retransmission queue.

frame-relay vc-bundle

To create a Frame Relay permanent virtual circuit (PVC) bundle if it does not already exist, and to enter Frame Relay VC-bundle configuration mode, use the **frame-relay vc-bundle** command in interface configuration mode. To remove a Frame Relay PVC bundle, use the **no** form of this command.

frame-relay vc-bundle *vc-bundle-name*

no frame-relay vc-bundle *vc-bundle-name*

Syntax Description

vc-bundle-name	User-defined name of this Frame Relay PVC bundle.

Defaults

A bundle is not created.

Command Modes

Interface configuration

Command History

Release	Modification
12.2(13)T	This command was introduced.

Usage Guidelines

Use this command to create a unique Frame Relay PVC bundle if one has not already been created using the **frame-relay map** command. Also use this command to enter Frame Relay VC-bundle configuration mode so you can configure PVC bundle attributes and PVC bundle members.

Examples

The following example creates a PVC bundle named “MAIN-1”:

```
interface serial 0
 frame-relay vc-bundle MAIN-1
```

Related Commands

Command	Description
frame-relay map	Defines mapping between a destination protocol address and the DLCI or Frame Relay PVC bundle that connects to the destination address.

framer-type

To set the framer type of supported circuit emulation service (CES) multiservice interchange (MIX) connections to T1 or E1, use the **framer-type** command in CES configuration mode.

framer-type {**t1** | **e1**}

Syntax Description

t1	Sets the framer type of supported CES connections to T1.
e1	Sets the framer type of supported CES connections to E1.

Defaults

T1

Command Modes

CES configuration

Command History

Release	Modification
12.1(5)XM	This command was introduced for the Cisco 3660.
12.2(4)T	This command was integrated into Cisco IOS Release 12.2(4)T.

Usage Guidelines

This command is needed only with CES-enabled network modules (ATM OC-3 CES network modules) that do *not* contain Cisco T1/E1 multiflex voice/WAN interface cards (VWICs) on the Cisco 3660. Other network modules set their framer type automatically and therefore do not require use of this command. It is also not necessary to use this command for T1 connections, because **t1** is the default argument.

To reach CES configuration mode for a particular slot, enter **ces** and the slot number and port number while in global configuration mode. Note that the port value is always 0, as the interface configuration applies to all ports in the slot.

Examples

The following example sets the framer type of the CES card in slot 1 to E1:

```
Router(config)# ces 1/0
Router(config-ces)# framer-type e1
```

Related Commands

Command	Description
ces	Configures CES on a router port and enters controller configuration mode.

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 available only for the Cisco MC3810), 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* | [*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* | [*vpi/*]*vci*] [**clp-bit** {**map-de** | **0** | **1**}] [**de-bit** {**no-map-clp** | **map-clp**}]

Syntax Description

dlci	Frame Relay DLCI number.
atm-interface	ATM interface connected to the DLCI.
pvc *name*	(Optional) ATM PVC name.
vpi/vci	(Optional) 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.