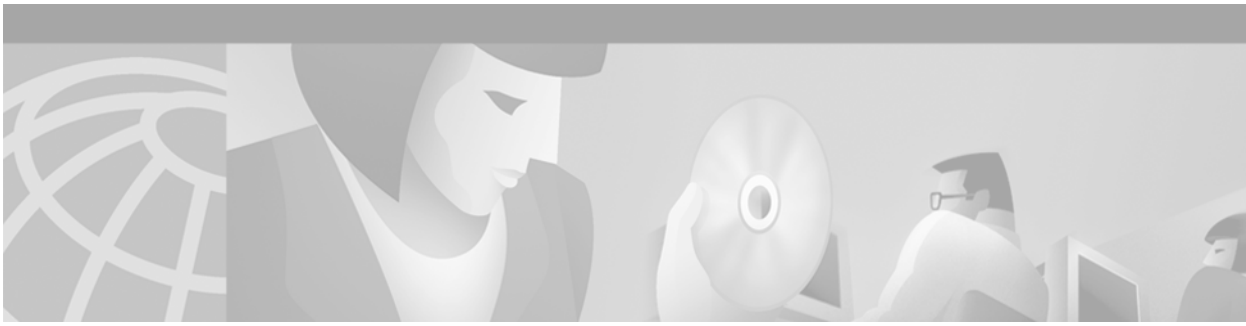

Frame Relay Commands

Use the commands described in this chapter to configure access to Frame Relay networks.

The following are either new commands or newly introduced from the *Cisco IOS 12.0 Voice, Video, and Home Applications Command Reference* publication:

- **frame-relay end-to-end keepalive error-threshold**
- **frame-relay end-to-end keepalive event-window**
- **frame-relay end-to-end keepalive mode**
- **frame-relay end-to-end keepalive success-events**
- **frame-relay end-to-end keepalive timer**
- **frame-relay fair-queue**
- **frame-relay fragment**
- **show frame-relay end-to-end keepalive**
- **show frame-relay fragment**

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

For configuration of FRF.5 Frame Relay-ATM Network Interworking and FRF.8 Frame Relay-ATM Service Interworking on the Cisco MC3810, refer to the "Configuring Frame Relay-ATM Interworking" chapter 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.

class *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.
class *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.

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

Enabled

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* | [*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	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 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 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, which will be removed in a future Cisco IOS release. 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 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 command has been replaced by the **frame-relay adaptive-shaping** command. If you use the **frame-relay becn-response-enable** command in scripts, you should replace it with the **frame-relay adaptive-shaping** command. This command will be removed from the product in a future release. See the description of the **frame-relay adaptive-shaping** command earlier in this chapter.

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 any broadcast packet sent over the frame-relay interface. However, the broadcast traffic does not include the original routing packet or service access point (SAP) packet, which passes through the normal queue. Due to 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 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 software 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. **tcp** *port*—TCP packets to or from a specified port. **udp** *port*—User Datagram Protocol (UDP) packets to or from a specified port. **list** *access-list-number*—Previously defined access list number. **gt** *bytes*—Sets the DE bit for packets larger than the specified number of bytes (including the 4 byte Frame Relay Encapsulation). **lt** *bytes*—Sets the DE bit for packets smaller than the specified number of bytes (including the 4 byte Frame Relay Encapsulation).

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 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

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 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.

displays parameter values for send- and receive-sides in bidirectional mode.

Table 18 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 19 displays parameter values for send- and receive-sides in request mode.

Table 19 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 20 displays parameter values for send- and receive-sides in reply mode.

Table 20 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.
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 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 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 DLCI, 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:

```
router(config)# interface serial 1/1
router(config-if)# frame-relay interface-dlci 100
router(config-fr-dlci)# class vofr
router(config-fr-dlci)# exit
router(config)# map-class frame-relay vofr
router(config-map-class)# frame-relay fair-queue
router(config-map-class)#
```

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:

```
router(config)# interface serial 1/1
router(config-if)# frame-relay interface-dlci 100
router(config-fr-dlci)# class vofr
router(config-fr-dlci)# exit
router(config)# map-class frame-relay vofr
router(config-map-class)# frame-relay fair-queue 255
router(config-map-class)#
```

The following example shows how to enable weighted fair queueing and set the Number of 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:

```
router(config)# interface serial 1/1
router(config-if)# frame-relay interface-dlci 100
router(config-fr-dlci)# class vofr
router(config-fr-dlci)# exit
router(config)# map-class frame-relay vofr
router(config-map-class)# frame-relay fair-queue 64 256 25
router(config-map-class)#
```

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*

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.

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.

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), 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

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 VoFR traffic.

In pure end-to-end FRF.12 fragmentation, Frame Relay frames with 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 triggered when **vofr** is configured on that PVC; Cisco proprietary format is triggered 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 21 shows the recommended fragmentation sizes for a serialization delay of 10 ms.

Table 21 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

The following example shows how to enable pure end-to-end FRF.12 fragmentation for the “frag” 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 160 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 1000
router(config-map-class)# frame-relay fragment 160
router(config-map-class)# frame-relay fair-queue
router(config-map-class)#
```

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 160 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 1000
router(config-map-class)# frame-relay fragment 160
router(config-map-class)# frame-relay fair-queue
router(config-map-class)#
```

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 160 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 1000
router(config-map-class)# frame-relay fragment 160
router(config-map-class)# frame-relay fair-queue
router(config-map-class)#
```

Related Commands

Command	Description
class (virtual circuit)	Associates a map class with a specified DLCI.
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 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 define a specific permanent virtual circuit (PVC) to a DLCI and 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-encap** *size*] [**voice-cir** *cir*] [**ppp** *virtual-template-name*]

no frame-relay interface-dlci *dlci* [**ietf** | **cisco**] [**voice-encap** *size*] [**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. The following DLCI ranges are based on LMI protocol: ANSI: 16 - 991 CISCO: 16 - 1007 Q933a: 16 - 991
ietf | **cisco**	(Optional) Encapsulation type: Internet Engineering Task Force (IETF) Frame Relay encapsulation or Cisco Frame Relay encapsulation.
voice-encap *size*	(Supported on the Cisco MC3810 only.) Specifies that data segmentation will be used to support Voice over Frame Relay. The voice encapsulation size denotes the data segmentation size. For a list of recommended data segmentation sizes, see the "Usage Guidelines" section.
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 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.
12.0(4)T	Usage guidelines for the Cisco MC3810 were added.

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.

When configuring the **voice-encap** option on the Cisco MC3810 to enable Voice over Frame Relay, set the data fragmentation size based on the port access rate. Table 22 lists recommended data fragmentation sizes for different port access rates. Note also that when the **voice-encap** option is configured on the Cisco MC3810, voice traffic is not shaped, and all priority queueing, custom queueing, and weighted fair queueing is disabled on the interface.

Note On the Cisco MC3810 only, the **voice-encap** option performs the same function as the **vofr cisco** interface configuration command introduced in Cisco IOS Release 12.0(3)XG. Either command is required to enable Voice over Frame Relay. The **voice-encap** option and the **vofr cisco** command are mutually exclusive on the same interface; you must

choose which command to use. The **voice-encap** option does not support any priority queueing function, which provides greater throughput. The **vofr cisco** command uses weighted fair queueing, which reduces throughput but provides a means of prioritizing traffic flows.

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 that voice traffic is not shaped when the **voice-encap** option is configured; thus, in this case the **frame-relay mincir** command is irrelevant.

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.

Table 22 Recommended Data Segmentation Sizes for Port Access Rates

Port Access Rate	Recommended Data Segmentation Size[1]
64 kbps	80 bytes
128 kbps	160 bytes
256 kbps	320 bytes
512 kbps	640 bytes
1536 kbps (full T1)	1600 bytes
2048 kbps (full E1)	1600 bytes

1. The data segmentation size is based for back-to-back Frame Relay. If sending traffic through an IGX with standard Frame Relay, add an extra 15 bytes to the recommended data segmentation size.

For more information about automatically installing router configuration files over a Frame Relay network, see the "Loading System Images and Microcode" 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)#
```

The following example enables Voice over Frame Relay on DLCI 100 on a Cisco MC3810 and sets the data fragmentation size to 80 bytes:

```
router(config)# interface serial0
router(config-if)# frame-relay interface-dlci 100 voice-encap 80
router(config-fr-dlci)#
```

The following example enables Voice over Frame Relay on DLCI 100 on a Cisco MC3810, sets the data fragmentation size to 80 bytes, and sets the voice CIR to 24000 bps:

```
router(config)# interface serial0
router(config-if)# frame-relay interface-dlci 100 voice-encap 80 voice-cir 24000
router(config-fr-dlci)#
```

Related Commands

Command	Description
frag-pre-queuing	Sets the queueing on a Frame Relay or HDLC interface to occur after fragmentation.
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 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 use 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 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 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 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 to 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 frame-relay lapf frmr** interface configuration 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 are either outstanding for transmission or are transmitted but unacknowledged, in the range 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 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 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
```

Related Commands

Command	Description
frame-relay lapf k	Sets the LAPF window size k.
frame-relay lapf t200	Sets the LAPF retransmission timer value T200.

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 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 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 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 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 DTE or 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 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 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 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 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 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 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 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 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 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 "Configuring Frame Relay" chapter 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*]}]

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 packet-by-packet	(Optional) Packet-by-packet payload compression using the Stacker method.
payload-compress frf9 stac	(Optional) Enables 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 VIP2 is not available, compression is performed in the router's main processor (software compression).

hardware-options	• **distributed** (Optional) 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 router's main processor (software compression). This option applies only to the Cisco 7500 series. • **software** (Optional) Specifies that compression is implemented in the Cisco IOS software installed in the router's main processor. • **csa** *csa_number* (Optional) 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.

Usage Guidelines

There can be many DLCIs known by a router or access server that 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 use the **frame-relay map** command to specify bridging that uses a CISCO encapsulation. 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.

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 (**cisco** or **ietf**).

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 prior to changing encapsulation types. Although this is not required, shutting down the interface ensures 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, this required manual assignment in the OSPF configuration using the **neighbor interface** router command. When the **frame-relay map** command is included in the configuration with the **broadcast** keyword, and the **ip ospf network** command (with the **broadcast** keyword) is 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

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.

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
!
```

The following example configuration shows IETF encapsulation on the interface, and stun traffic configured to use CISCO encapsulation:

```
!
interface Serial0
 no ip address
 no ip mroute-cache
 encapsulation frame-relay IETF
 no ip route-cache
 no keepalive
 no fair-queue
 clockrate 64000
 no frame-relay inverse-arp IP 100
 no frame-relay inverse-arp NOVELL 100
 no frame-relay inverse-arp APPLETALK 100
 no frame-relay inverse-arp XNS 100
 no frame-relay inverse-arp DECNET 100
 no frame-relay inverse-arp VINES 100
 frame-relay local-dlci 100
 frame-relay map stun 100 CISCO
!
interface Serial1
 no ip address
 no ip mroute-cache
 encapsulation stun
 no ip route-cache
 stun group 123
 stun sdlc-role primary
 sdlc address 62
 stun route address 62 interface Serial0 dlci 100 4 local-ack
```

Related Commands

Command	Description
frame-relay payload-compress	Enables Stacker payload compression on a specified point-to-point interface or subinterface.

frame-relay map bridge

To specify that broadcasts are to be forwarded during bridging, use the **frame-relay map bridge** interface configuration command. Use the **no** form of this command to delete the map entry.

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 header compression characteristics to an IP map 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. To remove the IP map, use the **no** form of this command.

frame-relay map ip *ip-address dlci* [**broadcast**] [**cisco** | **ietf**] [**nocompress**] **tcp header-compression** {**active** | **passive**}

no frame-relay map ip *ip-address dlci*

Syntax Description

ip-address	IP address.
dlci	DLCI number.
broadcast	(Optional) Forwards broadcasts to the specified IP address.
cisco	(Optional) Uses Cisco's proprietary encapsulation.
ietf	(Optional) Uses RFC 1490 encapsulation. No TCP/IP header compression is done if IETF encapsulation is chosen for the IP map or the associated interface.
nocompress	(Optional) Disables TCP/IP header compression for this map.
active	Compresses the header of every outgoing TCP/IP packet.
passive	Compresses the header of an outgoing TCP/IP packet only if an incoming TCP/IP packet had a compressed header.

Defaults

cisco

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

To disable TCP/IP header compression on the IP map, use the **nocompress** form of the command.

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 with a compressed header.

If you change the encapsulation characteristics of the interface to IETF, 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 prior to changing encapsulation types. Although this is not required, shutting down the interface ensures that the interface is reset for the new encapsulation.

Examples

The following example illustrates a command sequence configuring an IP map associated with serial interface 1 to enable active TCP/IP header compression:

```
interface serial 1
encapsulation frame-relay
ip address 131.108.177.170 255.255.255.0
 frame-relay map ip 131.108.177.180 190 cisco tcp header-compression active
```

Related Commands

Command	Description
frame-relay ip tcp header-compression	Configures an interface to ensure that the associated PVC always carries outgoing TCP/IP headers in compressed form.

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*

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

Use the **frame-relay multicast-dlci** interface configuration command to define the data-link connection identifier (DLCI) to be used for multicasts. 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*]}

no frame-relay payload-compress {**packet-by-packet** | **frf9 stac**}

Syntax Description

packet-by-packet	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 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 VIP2 is not available, compression is performed in the router's main processor (software compression).
hardware-options	• **distributed** (Optional) 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 router's main processor (software compression). This option applies only to the Cisco 7500 series. • **software** (Optional) Specifies that compression is implemented in the Cisco IOS software installed in the router's main processor. • **csa** *csa_number* (Optional) Specifies the CSA to use for a particular interface. This option applies only to Cisco 7200 series routers.

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.

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 prior to changing encapsulation types. Although this is not required, shutting down the interface ensures that the interface is reset for the new encapsulation.

Examples

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
!
```

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-dlci-group

To prioritize multiple data-link connection identifiers (DLCIs) based on 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 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 syntax description shown 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 only applies 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.

Frame-relay switching between two DTE interfaces is not supported.

Note Frame Relay routing cannot be configured over tunnel interfaces on the Cisco 800 series, 1600 series, and 1700 series platforms. Frame Relay routing can only be configured over tunnel interfaces on platforms that have the Enterprise feature set.

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 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 enter 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.

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 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 131.108.177.100 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 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 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 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.

Based 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 23 describes the codes in an X.121 address number form.

Table 23 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 24.

Figure 2 E.164 Address Format

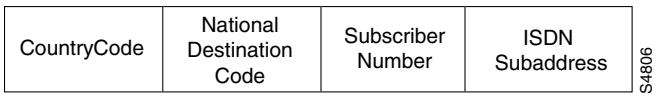

Table 24 E.164 Address Field Descriptions

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 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 taking place in your Cisco router, 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

Usage Guidelines

When no parameters are specified with this command, the output displays a summary of each 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.

Note This command will not produce any output for Cisco MC3810s configured with the **frame-relay interface-dlci voice-encap** command.

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 25 provides a listing of the fields in this output and a description of each field.

Table 25 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	The 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 25 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
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 (DLCI) 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 131.108.177.200
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 26 describes the fields shown in the display.

Table 26 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 26 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 27 describes significant fields in this output.

Table 27 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 27 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 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 an 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 28 describes significant fields shown in the output.

Table 28 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 131.108.177.177
dlci 177 (0xB1,0x2C10), static,
broadcast,
CISCO
TCP/IP Header Compression (inherited), passive (inherited)
```

Table 29 describes significant fields shown in the display.

Table 29 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** command in privileged EXEC mode.

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 DLCIs for which you wish to display PVC information.
dlci	(Optional) A specific DLCI number used on the interface. Statistics for the specified PVC display 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.

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" have 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.

Per VC counters are not incremented at all when either autonomous or 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, but the switch passes forward explicit congestion notification (FECN) bits, backward explicit congestion notification (BECN) bits, and discard eligibility (DE) bits unchanged from entry to exit points in the network.

If an LMI status report indicates that a PVC is not active, then it is marked as inactive. A PVC is marked as deleted if it is not listed in a periodic LMI status message.

Examples

The various displays in this section show sample output for a variety of different PVCs. Some of the PVCs carry data only; some carry a combination of voice and data.

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--
```

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 is 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)
```

The following is sample output from the **show frame-relay pvc** command for a PVC carrying Voice over Frame Relay 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 Cisco proprietary.

A sample configuration for this scenario is shown first; then 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
```

Note that the “fragment type” field in the **show frame-relay pvc** display can have the following entries:

- VoFR-cisco—Indicates that fragmented packets will contain the Cisco proprietary header
- VoFR—Indicates that fragmented packets will contain the FRF.11 Annex C header
- end-to-end—Indicates that pure FRF.12 fragmentation is carried on this virtual circuit

Below 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; then 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.

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 30 provides a listing of the fields in these displays and a description of each field.

Table 30 show frame-relay pvc Field Descriptions

Field	Description
Local	Number of local PVCs in each of the following states: active, inactive, deleted, and static.
Switched	Number of switched PVCs in each of the following states: active, inactive, deleted, and static.
Unused	Number of unused PVCs in each of the following states: active, inactive, deleted, and static.
DLCI	One of the data-link connection identifier (DLCI) numbers for the PVC.
DLCI USAGE	One of the following values: • SWITCHED—the router or access server is used as a switch. • LOCAL—the router or access server is used as a DTE. • UNUSED—the DLCI is not referenced by an user-entered configuration commands on the router.
PVC STATUS	Status of the PVC: ACTIVE, INACTIVE, or DELETED.
INTERFACE	Specific subinterface associated with this DLCI.
input pkts	Number of packets received on this PVC.
output pkts	Number of packets sent on this PVC.

Table 30 show frame-relay pvc Field Descriptions (continued)

Field	Description
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 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.
pvc create time	Time the PVC was created.
last time pvc status changed	Time the PVC changed status (active to inactive).
Service-type	Type of service performed by this PVC. Can be VoFR or VoFR-cisco.
configured voice bandwidth	Amount of bandwidth in bits per second reserved for voice traffic on this PVC.
used voice bandwidth	Amount of bandwidth in bits per second currently being used for voice traffic.
voice reserved queues	Queue numbers reserved for voice traffic on this PVC. This field was removed in Cisco IOS Release 12.0(5)T.
fragment type	Type of fragmentation configured for this PVC. Possible types are: • VoFR-cisco—Fragmented packets contain the Cisco proprietary header • VoFR—Fragmented packets contain the FRF.11 Annex C header • end-to-end—Fragmented packets contain the standard FRF.12 header
fragment size	Size of the fragment payload in bytes.
cir	Current committed information rate (CIR), in bits per second.
bc	Current committed burst size, in bits.
be	Current excess burst size, in bits.
limit	Maximum number of bytes transmitted 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 committed information rate (CIR) for the PVC.
byte increment	Number of bytes that will be sustained per internal interval.
BECN response	Frame Relay has BECN Adaptation configured.
pkts	Number of packets associated with this PVC that have gone through the traffic shaping system.

Table 30 show frame-relay pvc Field Descriptions (continued)

Field	Description
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.
bytes delayed	Number of bytes associated with this PVC that have been delayed by the traffic shaping system.
shaping	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.
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. If additional packets are received after a queue is full, they 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.

Related Commands

Command	Description
frame-relay pvc	Configures Frame Relay PVCs for FRF.8 Frame Relay-ATM Service Interworking.
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 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 (DLCI) level.

show frame-relay qos-autosense

To show the 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.

Examples

The following is sample output from the **show frame-relay qos-autosense** command when Enhanced Local Management Interface is 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 31 describes the significant fields in the output display.

Table 31 show frame-relay qos-autosense Field Descriptions

Field	Description
ELMI information for interface Serial1	Label indicating the port for which the status is being displayed. It also displays the name, platform, and vendor information about the switch.
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 32 describes significant fields shown in the output.

Table 32 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 33 describes significant fields in the output.

Table 33 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.

Table 33 show frame-relay svc maplist Field Descriptions (continued)

Field	Description
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.
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 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 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
```