forward accounting-start-stop

To proxy accounting start, stop, and update packets generated by any RADIUS clients to the authentication, authorization, and accounting (AAA) server, use the **forward accounting-start-stop** command in SSG-radius-proxy configuration mode. To stop forwarding accounting start, stop, and update packets, use the **no** form of this command.

forward accounting-start-stop

no forward accounting-start-stop

Syntax Description

This command has no arguments or keywords.

Defaults

Forward accounting-start-stop is disabled by default.

Command Modes

SSG-radius-proxy configuration

Command History

Release	Modification
12.2(4)B	This command was introduced.
12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.

Usage Guidelines

Use this command to proxy accounting start, stop, and update packets generated by all RADIUS clients to the AAA server. Disabling this command reduces RADIUS packet traffic and processing for deployments where the billing server is not using these packets for billing purposes.

Note The **forward accounting-start-stop** command does not affect accounting on and off packets, which are forwarded regardless of this command.

Examples

The following example shows how to proxy accounting packets generated by all RADIUS clients to the AAA server:

```
ssg radius-proxy
 server-port auth 1645 acct 1646
 client-address 10.1.2.2 key secret1
 client-address 10.2.25.90 key secret2
 client-address 10.0.0.1 key secret3
 client-address 10.23.3.2 key secret4
 idle-timeout 30
 forward accounting-start-stop
 address-pool 10.1.1.1 10.1.40.250
 address-pool 10.1.5.1 10.1.5.30 domain ssg.com
```

Related Commands

Command	Description
address-pool	Defines local IP pools to be used by SSG to assign IP addresses to users for which SSG is acting as a RADIUS client.
clear ssg radius-proxy client-address	Clears all hosts connected to a specific RADIUS client.
clear ssg radius-proxy nas-address	Clears all hosts connected to a specific NAS.
idle-timeout (SSG)	Configures a host object timeout value.
server-port	Defines the ports for the SSG RADIUS proxy.
show ssg tcp-redirect group	Displays the pool of IP addresses configured for a router or for a specific domain.
ssg enable	Enables SSG.
ssg radius-proxy	Enables SSG RADIUS Proxy.

frame-relay accounting adjust

To enable byte count adjustment at the permanent virtual circuit (PVC) level so that the number of bytes sent and received at the PVC corresponds to the actual number of bytes sent and received on the physical interface, use the **frame-relay accounting adjust** command in interface configuration mode. To disable byte count adjustment, use the **no** form of this command.

frame-relay accounting adjust

no frame-relay accounting adjust [**frf9**]

Syntax Description

frf9	(Optional) Payload compression using the Stacker method.

Note Use the **frf9** keyword only with the **no** form of this command.

Defaults

Byte count adjustment is enabled.

Command Modes

Interface configuration

Command History

Release	Modification
12.2	This command was introduced.
12.2 T	This command was integrated into Cisco IOS Release 12.2 T.
12.2 S	This command was integrated into Cisco IOS Release 12.2 S.
12.3	This command was integrated into Cisco IOS Release 12.3.

Usage Guidelines

Use this command to return the number of bytes shown at the PVC level back to the number of bytes received at the PVC level without any adjustments. This command takes into consideration any dropped packets as well as compression and decompression that may occur after initial processing.

If you use the **no frame-relay accounting adjust frf9** command, then byte count includes dropped packets and traffic shaping, but not compression and decompression savings from FRF.9.

Examples

The following example enables Frame-Relay accounting adjustment:

```
Router# configure terminal
Router(config)# interface serial3/0
Router(config-if) frame-relay accounting adjust
```

The following example disables Frame-Relay accounting adjustment:

```
Router# configure terminal
Router(config)# interface serial3/0
Router(config-if) no frame-relay accounting adjust
```

```
Router(config-if)# end
```

The following example verifies that Frame-Relay accounting adjustment is disabled:

```
Router# show run interface serial3/0

Building configuration...

Current configuration :266 bytes
!
interface Serial3/0
 no ip address
 encapsulation frame-relay
 no frame-relay accounting adjust
end
```

Related Commands

Command	Description
show frame-relay pvc	Displays the total input and output bytes for a PVC and an interface as equal. **Note** In order for the PVC and the interface input and output byte count to be equal, no other PVCs or network traffic can be passing data. Otherwise the interface shows aggregate totals for PVCs, the Local Management Interface (LMI), and other network traffic.

frame-relay adaptive-shaping

To enable Frame Relay adaptive traffic shaping, use the **frame-relay adaptive-shaping** command in map-class configuration mode. To disable adaptive traffic shaping, use the **no** form of this command.

frame-relay adaptive-shaping {**becn** | **foresight** | **interface-congestion** [*queue-depth*]}

no frame-relay adaptive-shaping {**becn** | **foresight** | **interface-congestion**}

Syntax Description

becn	Enables rate adjustment in response to backward explicit congestion notification (BECN).
foresight	Enables rate adjustment in response to ForeSight messages.
interface-congestion	Enables rate adjustment in response to interface congestion.
queue-depth	(Optional) Maximum number of packets that can be in the interface queue before the interface is considered congested. The range is from 0 to 40 packets. The default is 0 packets.

Defaults

Frame Relay adaptive traffic shaping is not enabled.
Queue depth: 0 packets

Command Modes

Map-class configuration

Command History

Release	Modification
11.3	This command was introduced.
12.2(4)T	This command was modified to configure adaptive traffic shaping for interface congestion.

Usage Guidelines

This command replaces the **frame-relay becn-response-enable** command. If you use the **frame-relay becn-response-enable** command in scripts, you should replace it with the **frame-relay adaptive-shaping** command.

The **frame-relay adaptive-shaping** command configures a router to adjust virtual circuit (VC) sending rates in response to BECN or ForeSight backward congestion notification messages or interface congestion.

Include this command in a map-class definition and apply the map class either to the main interface or to a subinterface.

Adaptive traffic shaping for interface congestion can be configured along with BECN or ForeSight. When adaptive shaping for interface congestion is used with BECN or ForeSight, if interface congestion exceeds the queue depth, then the PVC send rate is reduced to minimum committed information rate (minCIR). When interface congestion drops below the queue depth, then the send rate is adjusted in response to BECN or ForeSight.

Note For adaptive traffic shaping for interface congestion to work, the sum of the minCIR values for all PVCs on the interface must be less than the usable interface bandwidth.

Examples

ForeSight Example

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
```

Adaptive Shaping for Interface Congestion Example

In the following example, the queue depth is set at 10 packets. If the number of packets in the interface queue exceeds 10, the rate of traffic destined for PVC 200 will be reduced to the minCIR. When the number of packets in the interface queue drops below 10, then the traffic rate will immediately return to the CIR.

```
interface serial0
 encapsulation frame-relay
 frame-relay traffic-shaping
 frame-relay interface-dlci 200
 class adjust_vc_class_rate
!
map-class frame-relay adjust_vc_class_rate
 frame-relay cir 64000
 frame-relay mincir 32000
 frame-relay adaptive-shaping interface-congestion 10
```

Related Commands

Command	Description
frame-relay traffic-shaping	Enables both traffic shaping and per-VC queueing for all PVCs and SVCs on a Frame Relay interface.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay address registration auto-address

To enable a router to automatically select a management IP address for Enhanced Local Management Interface (ELMI) address registration, use the **frame-relay address registration auto-address** command in global configuration mode. To disable automatic address selection, use the **no** form of this command.

frame-relay address registration auto-address

no frame-relay address registration auto-address

Syntax Description

This command has no arguments or keywords.

Defaults

Auto address selection is enabled.

Command Modes

Global configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

During system initialization, if no management IP address is configured, then the router automatically selects the IP address of one of the interfaces. The router will choose an Ethernet interface first and then serial and other interfaces. If you do not want the router to select a management IP address during system initialization, you can store the **no** form of this command in the configuration.

When automatic address selection is disabled and an IP address has not been configured using the **frame-relay address registration ip** global configuration command, the IP address for ELMI address registration will be set to 0.0.0.0.

The **no frame-relay address registration ip** command will set the IP address to 0.0.0.0, even when Frame Relay automatic address selection is enabled.

If you configure the IP address using the **frame-relay address registration ip** global configuration command, the IP address you configure will overwrite the IP address chosen automatically by the router.

If you enable automatic address selection after configuring the IP address using the **frame-relay address registration ip** global configuration command, the IP address chosen automatically by the router will overwrite the IP address you originally configured.

Examples

The following example shows ELMI enabled on serial interface 0. The automatic IP address selection mechanism is disabled, and no other management IP address has been configured, so the device will share a valid ifIndex and a management IP address of 0.0.0.0.

```
interface Serial 0
 no ip address
 encapsulation frame-relay
 frame-relay lmi-type ansi
```

```
 frame-relay qos-autosense
!
no frame-relay address registration auto-address
```

Related Commands

Command	Description
frame-relay address-reg enable	Enables ELMI address registration on an interface.
frame-relay address registration ip	Configures the IP address to be used for ELMI address registration.
frame-relay qos-autosense	Enables ELMI on the Cisco router.

frame-relay address registration ip

To configure the IP address for Enhanced Local Management Interface (ELMI) address registration, use the **frame-relay address registration ip** command in global configuration mode. To set the IP address to 0.0.0.0, use the **no** form of this command.

frame-relay address registration ip *address*

no frame-relay address registration ip

Syntax Description

address	IP address to be used for ELMI address registration.

Defaults

No default behavior or values

Command Modes

Global configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

A management IP address configured by using the **frame-relay address registration ip** command will overwrite the IP address chosen by the router when automatic address selection is enabled.

The **no frame-relay address registration ip** command will disable automatic IP address selection and set the management IP address to 0.0.0.0.

If you enable automatic address selection with the **frame-relay address registration auto-address** global command after configuring the IP address using the **frame-relay address registration ip** global configuration command, the IP address chosen automatically by the router will overwrite the IP address you originally configured.

Examples

The following example shows ELMI enabled on serial interface 0. The IP address to be used for ELMI address registration is configured, so automatic IP address selection is disabled by default.

```
interface Serial 0
 no ip address
 encapsulation frame-relay
 frame-relay lmi-type ansi
 frame-relay qos-autosense
!
frame-relay address registration ip address 10.1.1.1
```

Related Commands

Command	Description
frame-relay address-reg enable	Enables ELMI address registration on an interface.
frame-relay address registration auto-address	Enables a router to automatically select the IP address to be used for ELMI address registration.
frame-relay qos-autosense	Enables ELMI on a Cisco router.

frame-relay address-reg enable

To enable Enhanced Local Management Interface (ELMI) address registration on an interface, use the **frame-relay address-reg enable** command in interface configuration mode. To disable ELMI address registration, use the **no** form of this command.

frame-relay address-reg enable

no frame-relay address-reg enable

Syntax Description

This command has no arguments or keywords.

Defaults

ELMI address registration is enabled.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(3)T	This command was introduced.

Usage Guidelines

ELMI address registration is enabled by default when ELMI is enabled.

Examples

The following example shows ELMI address registration disabled on serial interface 0.

```
interface Serial 0
 no ip address
 encapsulation frame-relay
 frame-relay lmi-type ansi
 frame-relay qos-autosense
 no frame-relay address-reg enable
```

Related Commands

Command	Description
frame-relay address registration auto-address	Enables a router to automatically select the IP address to be used for ELMI address registration.
frame-relay address registration ip	Configures the IP address to be used for ELMI address registration.
frame-relay qos-autosense	Enables ELMI on a Cisco router.

frame-relay bc

To specify the incoming or outgoing committed burst size (Bc) for a Frame Relay virtual circuit, use the **frame-relay bc** command in map-class configuration mode. 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. Range is from 300 to 16000000. Default is 7000.

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 "group1" 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 "class1". Then traffic-shaping parameters are defined for the map class.

```
map-list group1 local-addr X121 31383040703500 dest-addr X121 31383040709000
 ip 172.21.177.26 class class1 ietf
 ipx 123.0000.0c07.d530 class class1 ietf

map-class frame-relay class1
 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** command in map-class configuration mode. 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 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** command in interface configuration mode.

frame-relay broadcast-queue *size byte-rate packet-rate*

Syntax Description

size	Number of packets to hold in the broadcast queue.
byte-rate	Maximum number of bytes to be sent per second.
packet-rate	Maximum number of packets to be sent per second.

Defaults

size: 64 packets
byte-rate: 256000 bytes per second
packet-rate: 36 packets per second

Command Modes

Interface configuration

Command History

Release	Modification
10.3	This command was introduced.

Usage Guidelines

For purposes of the Frame Relay broadcast queue, *broadcast traffic* is defined as packets that have been replicated for transmission on multiple DLCIs. However, the broadcast traffic does not include the original routing packet or service access point (SAP) packet, which passes through the normal queue. Because of timing sensitivity, bridged broadcasts and spanning-tree packets are also sent through the normal queue. The Frame Relay broadcast queue is managed independently of the normal interface queue. It has its own buffers and a configurable service rate.

A broadcast queue is given a maximum transmission rate (throughput) limit measured in bytes per second and packets per second. The queue is serviced to ensure that only this maximum is provided. The broadcast queue has priority when transmitting at a rate below the configured maximum, and hence has a guaranteed minimum bandwidth allocation. The two transmission rate limits are intended to avoid flooding the interface with broadcasts. The actual limit in any second is the first rate limit that is reached.

Given the transmission rate restriction, additional buffering is required to store broadcast packets. The broadcast queue is configurable to store large numbers of broadcast packets.

The queue size should be set to avoid loss of broadcast routing update packets. The exact size will depend on the protocol being used and the number of packets required for each update. To be safe, set the queue size so that one complete routing update from each protocol and for each DLCI can be stored. As a general rule, start with 20 packets per DLCI. Typically, the byte rate should be less than both of the following:

- *N/4* times the minimum remote access rate (measured in *bytes* per second), where *N* is the number of DLCIs to which the broadcast must be replicated.
- 1/4 the local access rate (measured in *bytes* per second).

The packet rate is not critical if you set the byte rate conservatively. Set the packet rate at 250-byte packets.

Examples

The following example specifies a broadcast queue to hold 80 packets, to have a maximum byte transmission rate of 240000 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** command in map-class configuration mode. 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** command in interface configuration mode. 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 defines the slow_vcs map class to have an outbound CIR value of 9600:

```
interface serial 0.1
 frame-relay class slow_vcs

map-class frame-relay slow_vcs
 frame-relay cir out 9600
```

If a virtual circuit exists on the serial 0.1 interface and is associated with some other map class, the parameter values of the second map class override those defined in the slow_vc map class for that virtual circuit.

Related Commands

Command	Description
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay congestion threshold de

To configure the threshold at which discard-eligible (DE)-marked packets will be discarded from the traffic-shaping queue of a switched permanent virtual circuit (PVC), use the **frame-relay congestion threshold de** command in map-class configuration mode. To reconfigure the threshold, use the **no** form of this command.

frame-relay congestion threshold de *percentage*

no frame-relay congestion threshold de *percentage*

Syntax Description

percentage	Threshold at which DE-marked packets will be discarded, specified as a percentage of the maximum queue size.

Defaults

100%

Command Modes

Map-class configuration

Command History

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

Usage Guidelines

The **frame-relay congestion threshold de** command applies only to default FIFO traffic-shaping queues.

You must enable Frame Relay switching using the **frame-relay switching** global command before Frame Relay congestion management parameters will be effective on switched PVCs.

Examples

The following example illustrates the configuration of the DE congestion threshold in the Frame Relay map class called “perpvc_congestion”:

```
map-class frame-relay perpvc_congestion
 frame-relay congestion threshold de 50
```

Related Commands

Command	Description
frame-relay congestion-management	Enables Frame Relay congestion management functions on all switched PVCs on an interface, and enters congestion management configuration mode.
frame-relay congestion threshold ecn	Configures the threshold at which ECN bits are set on packets in the traffic-shaping queue of a switched PVC.

Command	Description
threshold de	Configures the threshold at which DE-marked packets are discarded from switched PVCs on the output interface.
threshold ecn	Configures the threshold at which ECN bits are set on packets in switched PVCs on the output interface.

frame-relay congestion threshold ecn

To configure the threshold at which explicit congestion notice (ECN) bits will be set on packets in the traffic-shaping queue of a switched permanent virtual circuit (PVC), use the **frame-relay congestion threshold ecn** command in map-class configuration mode. To reconfigure the threshold, use the **no** form of this command.

frame-relay congestion threshold ecn *percentage*

no frame-relay congestion threshold ecn *percentage*

Syntax Description

percentage	Threshold at which ECN bits will be set on packets, specified as a percentage of the maximum queue size.

Defaults

100%

Command Modes

Map-class configuration

Command History

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

Usage Guidelines

The **frame-relay congestion threshold ecn** command applies only to default FIFO traffic-shaping queues.

One ECN threshold applies to all traffic on a traffic-shaping queue. You cannot configure separate thresholds for committed and excess traffic.

You must enable Frame Relay switching using the **frame-relay switching** global command before the **frame-relay congestion threshold ecn** command will be effective on switched PVCs.

Examples

The following example illustrates the configuration of the ECN congestion threshold in the Frame Relay map class called "perpvc_congestion":

```
map-class frame-relay perpvc_congestion
 frame-relay congestion threshold ecn 50
```

Related Commands

Command	Description
frame-relay congestion-management	Enables Frame Relay congestion management functions on all switched PVCs on an interface, and enters congestion management configuration mode.
frame-relay congestion threshold de	Configures the threshold at which DE-marked packets are discarded from the traffic-shaping queue of a switched PVC.

Command	Description
threshold de	Configures the threshold at which DE-marked packets are discarded from switched PVCs on the output interface.
threshold ecn	Configures the threshold at which ECN bits are set on packets in switched PVCs on the output interface.

frame-relay congestion-management

To enable Frame Relay congestion management functions on all switched permanent virtual circuits (PVCs) on an interface and to enter Frame Relay congestion management configuration mode, use the **frame-relay congestion-management** command in interface configuration mode. To disable Frame Relay congestion management, use the **no** form of this command.

frame-relay congestion-management

no frame-relay congestion-management

Syntax Description

This command has no arguments or keywords.

Defaults

Frame Relay congestion management is not enabled on switched PVCs.

Command Modes

Interface configuration

Command History

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

Usage Guidelines

You must enable Frame Relay switching using the **frame-relay switching** global command before you can configure Frame Relay congestion management.

Frame Relay congestion management is supported only when the interface is configured with FIFO queueing, weighted fair queueing (WFQ), or PVC interface priority queueing (PIPQ).

Examples

In the following example, the **frame-relay congestion-management** command enables Frame Relay congestion management on serial interface 1. The command also enters Frame Relay congestion management configuration mode so that congestion threshold parameters can be configured.

```
interface serial1
 encapsulation frame-relay
 frame-relay intf-type dce
 frame-relay congestion-management
  threshold ecn be 0
  threshold ecn bc 20
  threshold de 40
```

Related Commands

Command	Description
frame-relay congestion threshold de	Configures the threshold at which DE-marked packets are discarded from the traffic-shaping queue of a switched PVC.
frame-relay congestion threshold ecn	Configures the threshold at which ECN bits are set on packets in the traffic-shaping queue of a switched PVC.
threshold de	Configures the threshold at which DE-marked packets are discarded from switched PVCs on the output interface.
threshold ecn	Configures the threshold at which ECN bits are set on packets in switched PVCs on the output interface.

frame-relay 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** command in map-class configuration mode. To remove the specified queueing from the virtual circuit and cause it to revert to the default first-come, first-served queueing, use the **no** form of this command.

frame-relay 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

Use the **queue-list** commands to define the custom queue.

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** command in interface configuration mode. To disable a previously defined group number assigned to a specified DLCI, use the **no** form of this 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, from 1 to 10.
dlci	DLCI number.

Defaults

No DE group is defined.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

To disable all previously defined group numbers, use the **no** form of this command with no arguments.

This command requires that Frame Relay be enabled.

Frame Relay DE group functionality is supported 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.

Note Frame Relay DE group functionality is being replaced by the Modular QoS CLI (MQC) DE marking functionality. For information about the MQC commands that are used to configure Frame Relay DE marking, refer to the *Cisco IOS Quality of Service Configuration Guide* and *Cisco IOS Quality of Service Command Reference*.

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 occurs on the Frame Relay switch, use the **frame-relay de-list** command in global configuration mode. 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 values corresponding to a supported protocol or device: **arp**—Address Resolution Protocol. **appletalk**—AppleTalk. **bridge**—bridging device. **clns**—ISO Connectionless Network Service. **clns_es**—CLNS end systems. **clns_is**—CLNS intermediate systems. **compressedtcp**—Compressed 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.
interface *type*	One of the following interface types: **serial**, **null**, or **ethernet**.
number	Interface number.
characteristic	One of the following values: **fragments**—Fragmented IP packets **gt** *bytes*—Sets the DE bit for packets larger than the specified number of bytes (including the 4-byte Frame Relay encapsulation). **list** *access-list-number*—Previously defined access list number. **lt** *bytes*—Sets the DE bit for packets smaller than the specified number of bytes (including the 4-byte Frame Relay encapsulation). **tcp** *port*—TCP packets to or from a specified port. **udp** *port*—User Datagram Protocol (UDP) packets to or from a specified port.

Defaults

Discard eligibility is not defined.

Command Modes

Global configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(13)T	The **apollo**, **vines**, and **xns** arguments were removed because Apollo Domain, Banyan VINES, and Xerox Network Systems are no longer available in the Cisco IOS software.

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** command in map-class configuration mode. 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 be configured only in bidirectional and request modes. The receive-side value can be configured only in bidirectional and reply modes. See the **frame-relay end-to-end keepalive mode** command. When you configure the error threshold, also 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** command in map-class configuration mode. To reset the event window size to the default, 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	Send-side event window for which size is being configured.
receive	Receive-side event window for which size is being configured.
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 be configured only in bidirectional and request modes. The receive-side value can be configured only in bidirectional and reply modes. See the **frame-relay end-to-end keepalive mode** command. When you configure the event window, also 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** command in map-class configurationmode. To disable Frame Relay end-to-end keepalives, use the **no** form of this command.

frame-relay end-to-end keepalive mode {**bidirectional** | **request** | **reply** | **passive-reply**}

no frame-relay end-to-end keepalive mode

Syntax Description

bidirectional	Enables bidirectional mode.
request	Enables request mode.
reply	Enables reply mode.
passive-reply	Enables passive reply mode.

Defaults

When a Frame Relay end-to-end keepalive mode is enabled, default values depend on which mode is selected. For the meaning of the parameters, see the **frame-relay end-to-end keepalive timer**, **frame-relay end-to-end keepalive event-window**, **frame-relay end-to-end keepalive error-threshold**, and **frame-relay end-to-end keepalive success-events** commands.

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.

Usage Guidelines

In bidirectional mode, both ends of a virtual circuit (VC) send keepalive requests and respond to keepalive requests. If one end of the VC is configured in the bidirectional mode, the other end must also be configured in the bidirectional mode.

In request mode, the router sends keepalive requests and expects replies from the other end of the VC. If one end of a VC is configured in the request mode, the other end must be configured in the reply or passive-reply mode.

In reply mode, the router does not send keepalive requests, but waits for keepalive requests from the other end of the VC and replies to them. If no keepalive request has arrived within the timer interval, the router times out and increments the error counter by 1. If one end of a VC is configured in the reply mode, the other end must be configured in the request mode.

In passive-reply mode, the router does not send keepalive requests, but waits for keepalive requests from the other end of the VC and replies to them. No timer is set when in this mode, and the error counter is not incremented. If one end of a VC is configured in the passive-reply mode, the other end must be configured in the request mode.

Table 2 displays parameter values for send and receive sides in bidirectional mode.

Table 2 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 3 displays parameter values for send- and receive-sides in request mode.

Table 3 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 4 displays parameter values for send- and receive-sides in reply mode.

Table 4 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 to send keepalive requests and respond to keepalive requests from the other end of the VC:

```
map-class frame-relay vcgrp1
 frame-relay end-to-end keepalive 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:

```
map-class frame-relay oro34
 frame-relay end-to-end keepalive reply
 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** command in map-class configuration mode. 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 be configured only in bidirectional and request modes. The receive-side value can be configured only in the bidirectional and reply modes. See the **frame-relay end-to-end keepalive mode** command.

If the success events value is set low at the same time that a low value is set for the error threshold value of the **frame-relay end-to-end keepalive error-threshold** command, the keepalive state of the VC may flap from state to state.

Examples

The following example shows how to increase the success events value:

```
map-class frame-relay vcgrp4
 frame-relay end-to-end keepalive request
 frame-relay end-to-end keepalive success-events send 4
```

Related Commands

Command	Description
frame-relay end-to-end keepalive error-threshold	Modifies the keepalive error threshold value.
frame-relay end-to-end keepalive event-window	Modifies the keepalive event window value.
frame-relay end-to-end keepalive mode	Enables Frame Relay end-to-end keepalives.

Command	Description
frame-relay end-to-end keepalive timer	Modifies the keepalive timer.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.
show frame-relay end-to-end keepalive	Displays statistics about Frame Relay end-to-end keepalive.

frame-relay end-to-end keepalive timer

To modify the keepalive timer value, use the **frame-relay end-to-end keepalive timer** command in map-class configuration mode. To reset the timer value to its default, use the **no** form of this command.

frame-relay end-to-end keepalive timer {**send** | **receive**} *number*

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.
number	Number, in seconds, for the timer to expire.

Defaults

Send timer: 10 seconds
Receive timer: 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 be configured only in bidirectional and request modes. The receive-side value can be configured only 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 *number* seconds after a request is sent. The receive-side timer expires if a request has not been received *number* seconds after the previous request.

Examples

The following example shows how to set up one end of a virtual circuit (VC) to send a keepalive request every 15 seconds and increment the error counter if more than 22 seconds elapse between receiving keepalive responses:

```
map-class frame-relay vcgrp1
 frame-relay end-to-end keepalive bidirectional
 frame-relay end-to-end keepalive timer send 15
 frame-relay end-to-end keepalive timer receive 22
```

Related Commands

Command	Description
frame-relay end-to-end keepalive error-threshold	Modifies the keepalive error threshold value.
frame-relay end-to-end keepalive event-window	Modifies the keepalive event window value.
frame-relay end-to-end keepalive mode	Enables Frame Relay end-to-end keepalives.
frame-relay end-to-end keepalive success-events	Modifies the keepalive success events value.

Command	Description
map-class frame-relay	Specifies a map class to define QoS values for an SVC.
show frame-relay end-to-end keepalive	Displays statistics about Frame Relay end-to-end keepalive.

frame-relay fair-queue

To enable weighted fair queueing for one or more Frame Relay permanent virtual circuits (PVCs), use the **frame-relay fair-queue** command in map-class configuration mode. To disable weighted fair queueing for a Frame Relay map class, use the **no** form of this command.

frame-relay fair-queue [*congestive_discard_threshold* [*number_dynamic_conversation_queues* [*number_reservable_conversation_queues* [*max_buffer_size_for_fair_queues*]]]]

no frame-relay fair-queue [*congestive_discard_threshold* [*number_dynamic_conversation_queues* [*number_reservable_conversation_queues* [*max_buffer_size_for_fair_queues*]]]]

Syntax Description

congestive_discard_threshold	(Optional) Specifies the number of messages allowed in each queue. The range is from 1 to 4096 messages; the default is 64.
number_dynamic_conversation_ queues	(Optional) Specifies the number of dynamic queues to be used for best-effort conversations—normal conversations not requiring any special network services. Valid values are 16, 32, 64, 128, 256, 512, 1024, 2048, and 4096; the default is 16.
number_reservable_conversation_queues	(Optional) Specifies the number of reserved queues to be used for carrying voice traffic. The range is from 0 to 100; the default is 0. (The command-line interface (CLI) will not allow a value of less than 2 if fragmentation is configured for the Frame Relay map-class.)
max_buffer_size_for_fair_queues	(Optional) Specifies the maximum buffer size in bytes for all of the fair queues. The range is from 0 to 4096 bytes; the default is 600.

Defaults

Weighted fair queueing is not enabled.

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(3)XG	This command was introduced.
12.0(4)T	This command was integrated into Cisco IOS Release 12.0(4)T.

Usage Guidelines

To use this command, you must first associate a Frame Relay map class with a specific data-link connection identifier (DLCI), and then enter map-class configuration mode and enable or disable weighted fair queueing for that map class.

When Frame Relay fragmentation is enabled, weighted fair queueing is the only queueing strategy allowed.

If this command is entered without any accompanying numbers, the default values for each of the four parameters will be set. If you desire to alter only the value of the first parameter (*congestive_discard_threshold*), you only need to enter the desired value for that parameter. If you desire to alter only the value of the second, third, or fourth parameters, you must enter values for the preceding parameters as well as for the parameter you wish to change.

Examples

The following example shows how to enable weighted fair queueing and set the default parameter values for the "vofr" Frame Relay map class on a Cisco 2600 series, 3600 series, or 7200 series router or on a Cisco MC3810:

```
interface serial 1/1
 frame-relay interface-dlci 100
  class vofr
  exit
map-class frame-relay vofr
 frame-relay fair-queue
```

The following example shows how to enable weighted fair queueing and set the *congestive_discard_threshold* parameter to a value other than the default value for the "vofr" Frame Relay map class on a Cisco 2600 series, 3600 series, or 7200 series router or on an MC3810 concentrator:

```
interface serial 1/1
 frame-relay interface-dlci 100
  class vofr
  exit
map-class frame-relay vofr
 frame-relay fair-queue 255
```

The following example shows how to enable weighted fair queueing and set the *number_reservable_conversation_queues* to a value of 25 for the "vofr" Frame Relay map class on a Cisco 2600 series, 3600 series, or 7200 series router or on a Cisco MC3810:

```
interface serial 1/1
 frame-relay interface-dlci 100
  class vofr
  exit
map-class frame-relay vofr
 frame-relay fair-queue 64 256 25
```

Related Commands

Command	Description
class (virtual circuit)	Associates a map class with a specified DLCI.
frame-relay fragment	Enables fragmentation for a Frame Relay map class.
frame-relay interface-dlci	Assigns a DLCI to a specified Frame Relay subinterface on the router or access server.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay fragment

To enable fragmentation of Frame Relay frames for a Frame Relay map class, use the **frame-relay fragment** command in map-class configuration mode. To disable Frame Relay fragmentation, use the **no** form of this command.

frame-relay fragment *fragment_size* [**switched**]

no frame-relay fragment

Syntax Description

fragment_size	Specifies the number of payload bytes from the original Frame Relay frame that will go into each fragment. This number excludes the Frame Relay header of the original frame. All the fragments of a Frame Relay frame except the last will have a payload size equal to *fragment_size*; the last fragment will have a payload less than or equal to *fragment_size*. Valid values are from 16 to 1600 bytes; the default is 53.
switched	(Optional) Specifies that fragmentation will be enabled on a switched permanent virtual circuit (PVC).

Defaults

Fragmentation is disabled.

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(3)XG	This command was introduced.
12.0(4)T	This command was implemented in Cisco IOS Release 12.0 T.
12.1(2)T	This command was modified to extend end-to-end FRF.12 fragmentation support to additional platforms and to switched Frame Relay PVCs.
12.1(2)E	This command was implemented on the Cisco 7500 series routers with a Versatile Interface Processor.
12.1(5)T	This command was implemented on the Cisco 7500 series routers with a Versatile Interface Processor running Cisco IOS Release 12.1(5)T.

Usage Guidelines

You should enable fragmentation for low-speed links (meaning those operating at less than 768 kbps).

Frame Relay fragmentation is enabled on a per-PVC basis. Before enabling Frame Relay fragmentation, you must first associate a Frame Relay map class with a specific data-link connection identifier (DLCI), and then enter map-class configuration mode and enable or disable fragmentation for that map class. In addition, you must enable Frame Relay traffic shaping on the interface in order for fragmentation to work.

Selecting a Fragmentation Format

Frame Relay frames are fragmented using one of the following formats, depending on how the PVC is configured:

- Pure end-to-end FRF.12 format
- FRF.11 Annex C format
- Cisco proprietary format

Only pure end-to-end FRF.12 fragmentation can be configured on switched PVCs.

Cisco recommends pure end-to-end FRF.12 fragmentation on PVCs that are carrying VoIP packets and on PVCs that are sharing the link with other PVCs carrying Voice over Frame Relay (VoFR) traffic.

In pure end-to-end FRF.12 fragmentation, Frame Relay frames having a payload less than the fragment size configured for that PVC are transmitted without the fragmentation header.

FRF.11 Annex C and Cisco proprietary fragmentation are used when VoFR frames are transmitted on a PVC. When fragmentation is enabled on a PVC, FRF.11 Annex C format is implemented when **vofr** is configured on that PVC; Cisco proprietary format is implemented when **vofr cisco** is configured.

In FRF.11 Annex C and Cisco proprietary fragmentation, VoFR frames are never fragmented, and all data packets (including VoIP packets) contain the fragmentation header regardless of the payload size.

Selecting a Fragment Size

You should set the fragment size based on the lowest port speed between the routers. For example, for a hub-and-spoke Frame Relay topology where the hub has a T1 speed and the remote routers have 64 kbps port speeds, the fragmentation size must be set for the 64 kbps speed on both routers. Any other PVCs that share the same physical interface must use the same fragmentation size used by the voice PVC.

With pure end-to-end FRF.12 fragmentation, you should select a fragment size that is larger than the voice packet size.

Table 5 shows the recommended fragmentation sizes for a serialization delay of 10 ms.

Table 5 Recommended Fragment Size for 10 ms Serialization Delay

Lowest Link Speed in Path	Recommended Fragment Size
56 kbps	70 bytes
64 kbps	80 bytes
128 kbps	160 bytes
256 kbps	320 bytes
512 kbps	640 bytes
768 kbps	1000 bytes
1536 kbps	1600 bytes

Examples

FRF.12 Fragmentation on a Switched PVC Example

The following example shows how to configure pure end-to-end FRF.12 fragmentation in the map class "data." The map class is associated with switched PVC 20 on serial interface 3/3.

```
Router(config)# frame-relay switching
!
Router(config)# interface Serial3/2
Router(config-if)# encapsulation frame-relay
```

```
Router(config-if)# frame-relay intf-type dce
!
Router(config)# interface Serial3/3
Router(config-if)# encapsulation frame-relay
Router(config-if)# frame-relay traffic-shaping
Router(config-if)# frame-relay interface-dlci 20 switched
Router(config-fr-dlci)# class data
Router(config-if)# frame-relay intf-type dce
!
Router(config)# map-class frame-relay data
Router(config-map-class)# frame-relay fragment 80 switched
Router(config-map-class)# frame-relay cir 64000
Router(config-map-class)# frame-relay bc 640
!
Router(config)# connect data Serial3/2 16 Serial3/3 20
```

End-to-End FRF.12 Fragmentation Examples

The following example shows how to enable pure end-to-end FRF.12 fragmentation for the "frag" map class. The fragment payload size is set to 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 1280
Router(config-map-class)# frame-relay fragment 160
Router(config-map-class)# frame-relay fair-queue
```

The following example is for the same configuration on a VIP-enabled Cisco 7500 series router:

```
Router(config)# class-map frf
Router(config-cmap)# match protocol vofr
Router(config-cmap)# exit
Router(config)# policy-map llq
Router(config-pmap)# class frf
Router(config-pmap-c)# priority 2000
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# policy-map llq-shape
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 1000 128000
Router(config-pmap-c)# service-policy llq
Router(config-pmap-c)# exit
Router(config-pmap)# exit

Router(config)# interface serial 1/0/0.1
Router(config-if)# frame-relay interface-dlci 100
Router(config-fr-dlci)# class frag
Router(config-fr-dlci)# exit

Router(config)# map-class frame-relay frag
Router(config-map-class)# frame-relay fragment 40
Router(config-map-class)# service-policy llq-shape
```

FRF.11 Annex C Fragmentation Configuration Examples

The following example shows how to enable FRF.11 Annex C fragmentation for data on a Cisco MC3810 PVC configured for VoFR. Note that fragmentation must be configured if a VoFR PVC is to carry data. The fragment payload size is set to 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 1280
Router(config-map-class)# frame-relay fragment 160
Router(config-map-class)# frame-relay fair-queue
Router(config-map-class)#
```

The following example is for the same configuration on a VIP-enabled Cisco 7500 series router:

```
Router(config)# class-map frf
Router(config-cmap)# match protocol vofr
Router(config-cmap)# exit
Router(config)# policy-map llq
Router(config-pmap)# class frf
Router(config-pmap-c)# priority 2000
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# policy-map llq-shape
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 1000 128000
Router(config-pmap-c)# service-policy llq
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface serial 1/1/0.1
Router(config-if)# frame-relay interface-dlci 101
Router(config-fr-dlci)# class frag
Router(config-fr-dlci)# exit

Router(config)# map-class frame-relay frag
Router(config-map-class)# frame-relay fragment 40
Router(config-map-class)# service-policy llq-shape
Router(config-map-class)#
```

Cisco-Proprietary Fragmentation Examples

The following example shows how to enable Cisco-proprietary Frame Relay fragmentation for the "frag" Frame Relay map class on a Cisco 2600 series, 3600 series, or 7200 series router, starting from global configuration mode. The fragment payload size is set to 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 1280
Router(config-map-class)# frame-relay fragment 160
Router(config-map-class)# frame-relay fair-queue
```

The following example is for the same configuration on a VIP-enabled Cisco 7500 series router:

```
Router(config)# class-map frf
Router(config-cmap)# match protocol vofr
Router(config-cmap)# exit
Router(config)# policy-map llq
Router(config-pmap)# class frf
Router(config-pmap-c)# priority 2000
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# policy-map llq-shape
Router(config-pmap)# class class-default
Router(config-pmap-c)# shape average 1000 128000
Router(config-pmap-c)# service-policy llq
Router(config-pmap-c)# exit
Router(config-pmap)# exit

Router(config)# interface serial 2/0/0.1
Router(config-if)# frame-relay interface-dlci 102
Router(config-fr-dlci)# class frag
Router(config-fr-dlci)# exit

Router(config)# map-class frame-relay frag
Router(config-map-class)# frame-relay fragment 40
Router(config-map-class)# service-policy llq-shape
```

Related Commands

Command	Description
class (virtual circuit)	Associates a map class with a specified DLCI.
debug frame-relay fragment	Displays information related to Frame Relay fragmentation on a PVC.
frame-relay fair-queue	Enables weighted fair queueing for one or more Frame Relay PVCs.
frame-relay interface-dlci	Assigns a DLCI to a specified Frame Relay subinterface on the router or access server.
frame-relay traffic-shaping	Enables traffic shaping and per-virtual circuit queueing for all PVCs and SVCs on a Frame Relay interface.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

frame-relay fragment end-to-end

To enable fragmentation of Frame Relay frames on an interface, use the **frame-relay fragment end-to-end** command in interface configuration mode. To disable Frame Relay fragmentation, use the **no** form of this command.

frame-relay fragment *fragment-size* **end-to-end**

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. Valid values range from 16 to 1600; the default is 53.

Defaults

Fragmentation is disabled.
fragment-size: 53

Command Modes

Interface configuration

Command History

Release	Modification
12.2(14)S	This command was introduced to enable fragmentation on a Frame Relay interface.
12.2(13)T	This command was integrated into Cisco IOS Release 12.2(13)T.

Usage Guidelines

Interface fragmentation and class-based fragmentation cannot be configured at the same time. To configure class-based fragmentation that can be applied to individual permanent virtual circuits (PVCs), use the **frame-relay fragment** command in map-class configuration mode.

Interface fragmentation supports the following types of fragment formats:

- End-to-end FRF.12 format
- FRF.11 Annex C format
- Cisco proprietary format

When fragmentation is enabled on an interface, all PVCs on the main interface and its subinterfaces will have fragmentation enabled with the same configured fragment size.

All the fragments of a Frame Relay frame except the last will have a payload size equal to the configured *fragment-size* value; the last fragment will have a payload less than or equal to *fragment-size*.

When configuring fragmentation on an interface that has low-latency queueing, configure the fragment size to be greater than the largest high-priority frame that would be expected. This configuration will prevent higher-priority traffic from being fragmented and queued up behind lower priority fragmented frames. If the size of a priority frame is larger than the configured fragment size, the priority frame will be fragmented.

Local Management Interface (LMI) traffic will not be fragmented.

Note the following interface fragmentation restrictions:

- Interface fragmentation and Frame Relay traffic shaping cannot be configured at the same time.
- Interface fragmentation and class-based fragmentation cannot be configured at the same time.

Examples

The following example shows the configuration of low-latency queueing, FRF.12 fragmentation, and shaping on serial interface 3/2. Note that traffic from the priority queue will not be interleaved with fragments from the class-default queue because shaping is configured.

```
class-map voice
 match access-group 101

policy-map llq
 class voice
  priority 64

policy-map shaper
 class class-default
  shape average 96000
  service-policy llq

interface serial 3/2
 ip address 10.0.0.1 255.0.0.0
 encapsulation frame-relay
 bandwidth 128
 clock rate 128000
 service-policy output shaper
 frame-relay fragment 80 end-to-end

 access-list 101 match ip any host 10.0.0.2
```

Related Commands

Command	Description
class (policy-map)	Specifies the name of the class whose policy you want to create or change or specifies the default class before you configure its policy.
debug frame-relay fragment	Displays information related to Frame Relay fragmentation on a PVC.

frame-relay fragmentation voice-adaptive

To enable voice-adaptive Frame Relay fragmentation, use the **frame-relay fragmentation voice-adaptive** command in interface configuration mode. To disable voice-adaptive Frame Relay fragmentation, use the **no** form of this command.

frame-relay fragmentation voice-adaptive [**deactivation** *seconds*]

no frame-relay fragmentation voice-adaptive

Syntax Description

deactivation *seconds*	(Optional) Number of seconds that must elapse after the last voice packet is transmitted before fragmentation is deactivated. The range is from 1 to 10000.

Defaults

Voice-adaptive Frame Relay fragmentation is not enabled.
Seconds: 30

Command Modes

Interface configuration

Command History

Release	Modification
12.2(15)T	This command was introduced.

Usage Guidelines

Frame Relay voice-adaptive fragmentation can be used in conjunction with Frame Relay voice-adaptive traffic shaping to reduce network congestion and improve voice transmission quality.

The **frame-relay fragmentation voice-adaptive** command can be used only on main interfaces. This command is not supported on subinterfaces.

Frame Relay voice-adaptive fragmentation enables a router to fragment large packets whenever packets (usually voice) are detected in the low latency queueing priority queue or H.323 call setup signaling packets are present. When there are no packets in the priority queue for a configured period of time and signaling packets are not present, fragmentation is stopped.

Note Although the priority queue is generally used for voice traffic, Frame Relay voice-adaptive fragmentation will respond to any packets (voice or data) in the priority queue.

Note the following prerequisites for Frame Relay voice-adaptive fragmentation:

- End-to-end fragmentation must be configured in a map class by using the **frame-relay fragment** command or on the interface by using the **frame-relay fragment end-to-end** command.
- Frame Relay traffic shaping or traffic shaping using the Modular QoS CLI (MQC) must be configured. If end-to-end fragmentation is configured on the interface, traffic shaping using the MQC must be configured.
- Low latency queueing must be configured.

Frame Relay voice-adaptive fragmentation supports FRF.12 fragmentation only. Neither FRF.11 Annex C nor Cisco proprietary fragmentation is supported.

Examples

The following examples show the configuration of Frame Relay voice-adaptive traffic shaping and fragmentation. The first example shows end-to-end fragmentation configured in a map class that is associated with PVC 100. In the second example, end-to-end fragmentation is configured directly on the interface.

With both example configurations, priority-queue packets or H.323 call setup signaling packets destined for PVC 100 will result in the reduction of the sending rate from the committed information rate (CIR) to the minimum CIR and the activation of FRF.12 end-to-end fragmentation. If signaling packets and priority-queue packets are not detected for 50 seconds, the sending rate will increase to CIR and fragmentation will be deactivated.

Frame Relay Voice-Adaptive Fragmentation with End-to-End Fragmentation Configured in a Map Class

```
interface serial0
 encapsulation frame-relay
 frame-relay fragmentation voice-adaptive deactivation 50
 frame-relay interface-dlci 100
  class voice_adaptive_class
!
map-class frame-relay voice_adaptive_class
 frame-relay fair-queue
 frame-relay fragment 80
 service-policy output shape
```

Frame Relay Voice-Adaptive Fragmentation with End-to-End Fragmentation Configured on the Interface

```
interface serial0
 encapsulation frame-relay
 frame-relay fragmentation voice-adaptive deactivation 50
 frame-relay fragment 80 end-to-end
 frame-relay interface-dlci 100
  class voice_adaptive_class
```

Related Commands

Command	Description
frame-relay fragment	Enables fragmentation of Frame Relay frames for a Frame Relay map class.
frame-relay fragment end-to-end	Enables fragmentation of Frame Relay frames on an interface.
shape fr-voice-adapt	Enables Frame Relay voice-adaptive traffic shaping.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.

frame-relay holdq

To configure the maximum size of a traffic-shaping queue on a switched permanent virtual circuit (PVC), use the **frame-relay holdq** command in map-class configuration mode. To reconfigure the size of the queue, use the **no** form of this command.

frame-relay holdq *queue-size*

no frame-relay holdq *queue-size*

Syntax Description

queue-size	Size of the traffic-shaping queue, as specified in maximum number of packets. The range is from 1 to 512.

Defaults

40 packets

Command Modes

Map-class configuration

Command History

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

Usage Guidelines

You must enable Frame Relay traffic shaping, using the **frame-relay traffic-shaping** interface command, before **frame-relay holdq** and other traffic-shaping map-class commands will be effective.

You must enable Frame Relay switching, using the **frame-relay switching** global command, before the **frame-relay holdq** command will be effective on switched PVCs.

The **frame-relay holdq** command can be applied to switched PVCs that use FIFO default queueing.

Examples

The following example illustrates the configuration of the maximum size of the traffic-shaping queue on a switched PVC. The queue size is configured in a map class called “perpvc_congestion”:

```
map-class frame-relay perpvc_congestion
 frame-relay holdq 100
```

Related Commands

Command	Description
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
frame-relay traffic-shaping	Enables both traffic shaping and per-PVC queueing for all PVCs and SVCs on a Frame Relay interface.

frame-relay idle-timer

To specify the idle timeout interval for a switched virtual circuit (SVC), use the **frame-relay idle-timer** command in map-class configuration mode. 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 Cisco IOS Release 11.3, if **in** and **out** are not specified in the command, the timeout interval applies to both timers. In Cisco IOS 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 switched

To indicate that a Frame Relay data-link connection identifier (DLCI) is switched, use the **frame-relay interface-dlci switched** command in interface configuration mode. To remove this assignment, use the **no** form of this command.

frame-relay interface-dlci *dlci* **switched**

no frame-relay interface-dlci *dlci* **switched**

Syntax Description

dlci	DLCI number to be used on the specified interface or subinterface.

Defaults

No DLCI is assigned.
The default PVC type is terminated.

Command Modes

Interface configuration

Command History

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

Usage Guidelines

Use the **frame-relay interface-dlci switched** command to allow a map class to be associated with a switched permanent virtual circuit (PVC).

You cannot change an existing PVC from terminated to switched or vice versa. You must delete the PVC and recreate it in order to change the type.

Use the **frame-relay interface-dlci switched** command to create switched PVCs for configuring Frame Relay-ATM network interworking (FRF.5) and Frame Relay-ATM service interworking (FRF.8).

By issuing the **frame-relay interface-dlci switched** interface configuration command, you enter Frame Relay DLCI interface configuration mode (see the example below).

Examples

In the following example, DLCI 16 on serial interface 0 is identified as a switched PVC and is associated with a map class called “shape256K.”

```
Router(config) # interface serial0
Router(config-if) # encapsulation frame-relay
Router(config-if) # frame-relay interface-dlci 16 switched
Router(config-fr-dlci) # class shape256K
```

Related Commands

Command	Description
connect (Frame Relay)	Defines connections between Frame Relay PVCs.
frame-relay class	Associates a map class with an interface or subinterface.

Command	Description
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.

frame-relay interface-dlci

To assign a data-link connection identifier (DLCI) to a specified Frame Relay subinterface on the router or access server, to assign a specific permanent virtual circuit (PVC) to a DLCI, or to apply a virtual template configuration for a PPP session, use the **frame-relay interface-dlci** command in interface configuration mode. To remove this assignment, use the **no** form of this command.

frame-relay interface-dlci *dlci* [**ietf** | **cisco**] [**voice-cir** *cir*] [**ppp** *virtual-template-name*]

no frame-relay interface-dlci *dlci* [**ietf** | **cisco**] [**voice-cir** *cir*] [**ppp** *virtual-template-name*]

BOOTP Server Only

frame-relay interface-dlci *dlci* [**protocol ip** *ip-address*]

Syntax Description

dlci	DLCI number to be used on the specified subinterface.
ietf | **cisco**	(Optional) Encapsulation type: Internet Engineering Task Force (IETF) Frame Relay encapsulation or Cisco Frame Relay encapsulation.
voice-cir *cir*	(Optional; supported on the Cisco MC3810 only.) Specifies the upper limit on the voice bandwidth that may be reserved for this DLCI. The default is the committed information rate (CIR) configured for the Frame Relay map class. For more information, see the "Usage Guidelines" section.
ppp	(Optional) Enables the circuit to use the PPP in Frame Relay encapsulation.
virtual-template-name	(Optional) Specifies which virtual template interface to apply the PPP connection to.
protocol ip *ip-address*	(Optional) Indicates the IP address of the main interface of a new router or access server onto which a router configuration file is to be automatically installed over a Frame Relay network. Use this option only when this device will act as the BOOTP server for automatic installation over Frame Relay.

Defaults

No DLCI is assigned.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3(1)MA	The **voice-encap** option was added for the Cisco MC3810.
12.0(1)T	The **ppp** keyword and *virtual-template-name* argument were introduced.
12.0(2)T	The **voice-cir** option was added for the Cisco MC3810.
12.0(3)T	The keyword **x25 profile** was introduced.

Release	Modification
12.0(4)T	Usage guidelines for the Cisco MC3810 were added.
12.0(7)XK	The **voice-encap** keyword for the Cisco MC3810 was removed. This keyword is no longer supported.
12.1(2)T	The **voice-encap** keyword for the Cisco MC3810 was removed. This keyword is no longer supported.

Usage Guidelines

This command is typically used for subinterfaces; however, it can also be used on main interfaces. Using the **frame-relay interface-dlci** command on main interfaces will enable the use of routing protocols on interfaces that use Inverse ARP. The **frame-relay interface-dlci** command on a main interface is also valuable for assigning a specific class to a single PVC where special characteristics are desired. Subinterfaces are logical interfaces associated with a physical interface. You must specify the interface and subinterface before you can use this command to assign any DLCIs and any encapsulation or broadcast options. See the "Examples" section for the sequence of commands.

This command is required for all point-to-point subinterfaces; it is also required for multipoint subinterfaces for which dynamic address resolution is enabled. It is not required for multipoint subinterfaces configured with static address mappings.

Use the **protocol ip** *ip-address* option only when this router or access server will act as the BOOTP server for auto installation 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 map class to a DLCI.
- **default**—Sets a command to its defaults.
- **no** {**class** *name* | **x25-profile** *name*}—Cancels the relevant class or X.25 profile.
- **x25-profile** *name*—Assigns an X.25 profile to a DLCI. (Annex G).

A Frame Relay DLCI configured for Annex G can be thought of as a single logical X.25/LAPB interface. Therefore, any number of X.25 routes may be configured to route X.25 calls to that logical interface.

The **voice-cir** option on the Cisco MC3810 provides call admission control; it does not provide traffic shaping. A call setup will be refused if the unallocated bandwidth available at the time of the request is not at least equal to the value of the **voice-cir** option.

When configuring the **voice-cir** option on the Cisco MC3810 for Voice over Frame Relay, do not set the value of this option to be higher than the physical link speed. If Frame Relay traffic shaping is enabled for a PVC sharing voice and data, do not configure the **voice-cir** option to be higher than the value set with the **frame-relay mincir** command.

Note On the Cisco MC3810 only, the **voice-cir** option performs the same function as the **frame-relay voice bandwidth** map-class configuration command introduced in Cisco IOS Release 12.0(3)XG.

For more information about automatically installing router configuration files over a Frame Relay network, see the "Loading and Maintaining System Images" chapter in the *Cisco IOS Configuration Fundamentals and Network Management Configuration Guide*.

Examples

The following example assigns DLCI 100 to serial subinterface 5.17:

```
! Enter interface configuration and begin assignments on interface serial 5
interface serial 5
! Enter subinterface configuration by assigning subinterface 17
interface serial 5.17
! Now assign a DLCI number to subinterface 5.17
frame-relay interface-dlci 100
```

The following example specifies DLCI 26 over subinterface serial 1.1 and assigns the characteristics under virtual-template 2 to this PPP connection:

```
Router(config)# interface serial1.1 point-to-point
Router(config-if)# frame-relay interface-dlci 26 ppp virtual-template2
```

The following example shows an Annex G connection being created by assigning the X.25 profile "NetworkNodeA" to the Frame Relay DLCI interface 20 on interface serial 1 (having enabled Frame Relay encapsulation on that interface):

```
Router(config)# interface serial1
Router(config-if)# encapsulation frame-relay
Router(config-if)# frame-relay interface-dlci 20
Router(config-fr-dlci)# x25-profile NetworkNodeA
```

The following example assigns DLCI 100 to serial subinterface 5.17:

```
Router(config)# interface serial 5
Router(config-if)# interface serial 5.17
Router(config-if)# frame-relay interface-dlci 100
```

The following example assigns DLCI 100 to a serial interface, starting from global configuration mode:

```
router(config)# interface serial 1/1
router(config-if)# frame-relay interface-dlci 100
router(config-fr-dlci)#
```

Related Commands

Command	Description
frame-relay class	Associates a map class with an interface or subinterface.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.
show interface	Displays P1024B/C information.
vofr	Configures subchannels and enables Voice over Frame Relay for a specific DLCI.

frame-relay intf-type

To configure a Frame Relay switch type, use the **frame-relay intf-type** command in interface configuration mode. To disable the switch, use the **no** form of this command.

frame-relay intf-type [**dce** | **dte** | **nni**]

no frame-relay intf-type [**dce** | **dte** | **nni**]

Syntax Description

dce	(Optional) Router or access server functions as a switch connected to a router.
dte	(Optional) Router or access server is connected to a Frame Relay network.
nni	(Optional) Router or access server functions as a switch connected to a switch—supports Network-to-Network Interface (NNI) connections.

Defaults

dte

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command can be used only if Frame Relay switching has previously been enabled globally by means of the **frame-relay switching** command.

Examples

The following example configures a DTE switch type:

```
frame-relay switching
!
interface serial 2
 frame-relay intf-type dte
```

frame-relay inverse-arp

To reenable Inverse Address Resolution Protocol (Inverse ARP) on a specified interface, subinterface, data-link connection identifier (DLCI), or Frame Relay permanent virtual circuit (PVC) bundle if Inverse ARP was previously disabled, use the **frame-relay inverse-arp** command in interface configuration mode. To disable Inverse ARP, use the **no** form of this command.

frame-relay inverse-arp [*protocol*] [*dlci* | **vc-bundle** *vc-bundle-name*]

no frame-relay inverse-arp [*protocol*] [*dlci* | **vc-bundle** *vc-bundle-name*]

Syntax Description

protocol	(Optional) One of the following values: **appletalk**, **decnet**, **ip**, and **ipx**.
dlci	(Optional) One of the DLCI numbers used on the interface. Acceptable values are integers from 16 through 1007, inclusive.
vc-bundle *vc-bundle-name*	(Optional) A specific Frame Relay PVC bundle configured on the interface.

Defaults

Inverse ARP is enabled.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
12.2(13)T	The **vc-bundle** *vc-bundle-name* keyword and argument pair was added. The **apollo**, **vines**, and **xns** keywords were removed because Apollo Domain, Banyan VINES, and Xerox Network Systems are no longer available in the Cisco IOS software.

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 supported on 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 a specific protocol and Frame Relay PVC bundle (consisting of up to eight DLCIs), use both the *protocol* and **vc-bundle** *vc-bundle-name* elements.

To enable or disable Inverse ARP for all protocols on a DLCI or Frame Relay PVC bundle, use either the *dlci* argument by itself or the **vc-bundle** *vc-bundle-name* keyword and argument pair by itself. To enable or disable Inverse ARP for a specific protocol for all DLCIs on the specified interface or subinterface, use only the *protocol* argument.

When a Frame Relay PVC bundle is specified, only one member of the PVC bundle will handle Inverse ARP packets. By default, the bundle member PVC that handles precedence or EXP level 6 or DSCP level 63 handles Inverse ARP packets. Use the **inarp** command to configure a different PVC bundle member to handle Inverse ARP packets.

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 at the other side of a virtual circuit.

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 DLCI 100 on an interface running IPX:

```
interface serial 0
 frame-relay inverse-arp ipx 100
```

Related Commands

Command	Description
clear frame-relay-inarp	Clears dynamically created Frame Relay maps, which are created by the use of Inverse ARP.
inarp	Specifies the PVC bundle member used to handle the Inverse ARP packets.
show frame-relay map	Displays the current map entries and information about the connections.

frame-relay ip tcp compression-connections

To specify the maximum number of TCP header compression connections that can exist on a Frame Relay interface, use the **frame-relay ip tcp compression-connections** command in interface configuration mode. To restore the default, use the **no** form of this command.

frame-relay ip tcp compression-connections *number*

no frame-relay ip tcp compression-connections

Syntax Description

number	Maximum number of TCP header compression connections. The range is from 3 to 256.

Defaults

No default behavior or values

Command Modes

Interface configuration

Command History

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

Usage Guidelines

Before you can configure the maximum number of connections, TCP header compression must be configured on the interface using the **frame-relay ip tcp header-compression** command.

The number of TCP header compression connections must be set to the same value at each end of the connection.

Examples

The following example shows the configuration of a maximum of 150 TCP header compression connections on serial interface 0:

```
interface serial 0
 encapsulation frame-relay
 frame-relay ip tcp header-compression
 frame-relay ip tcp compression-connections 150
```

Related Commands

Command	Description
frame-relay ip tcp header-compression	Enables TCP header compression for all Frame Relay maps on a physical interface.
frame-relay map ip compress	Enables both RTP and TCP header compression on a link.

Command	Description
frame-relay map ip tcp header-compression	Assigns header compression characteristics to an IP map that differ from the compression characteristics of the interface with which the IP map is associated.
show frame-relay ip tcp header-compression	Displays statistics and TCP/IP header compression information for the interface.

frame-relay ip tcp header-compression

To configure an interface to ensure that the associated permanent virtual circuit (PVC) will always carry outgoing TCP/IP headers in compressed form, use the **frame-relay ip tcp header-compression** command in interface configuration mode. To disable compression of TCP/IP packet headers on the interface, use the **no** form of this command.

frame-relay ip tcp header-compression [**passive**]

no frame-relay ip tcp header-compression

Syntax Description

passive	(Optional) Compresses the outgoing TCP/IP packet header only if an incoming packet had a compressed header.

Defaults

Active TCP/IP header compression; all outgoing TCP/IP packets are subjected to header compression.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command applies to interfaces that support Frame Relay encapsulation, specifically serial ports and High-Speed Serial Interface (HSSI).

Frame Relay must be configured on the interface before this command can be used.

TCP/IP header compression and Internet Engineering Task Force (IETF) encapsulation are mutually exclusive. If an interface is changed to IETF encapsulation, all encapsulation and compression characteristics are lost.

When you use this command to enable TCP/IP header compression, every IP map inherits the compression characteristics of the interface, unless header compression is explicitly rejected or modified by use of the **frame-relay map ip tcp header compression** command.

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

Examples

The following example configures serial interface 1 to use the default encapsulation (cisco) and passive TCP header compression:

```
interface serial 1
 encapsulation frame-relay
 frame-relay ip tcp header-compression passive
```

Related Commands

Command	Description
frame-relay map ip tcp header-compression	Assigns header compression characteristics to an IP map different from the compression characteristics of the interface with which the IP map is associated.

frame-relay lapf frmr

To resume the default setting of sending the Frame Reject (FRMR) frame at the Link Access Procedure for Frame Relay (LAPF) Frame Reject procedure after having set the option of not sending the frame, use the **frame-relay lapf frmr** command in interface configuration mode. To set the option of *not* sending the Frame Reject (FRMR) frame at the LAPF Frame Reject procedure, use the **no** form of this command.

frame-relay lapf frmr

no frame-relay lapf frmr

Syntax Description

This command has no arguments or keywords.

Defaults

Send FRMR during the Frame Reject procedure.

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

If the Frame Relay switch does not support FRMR, use the **no** form of this command to suppress the transmission of FRMR frames.

Examples

The following example suppresses the transmission of FRMR frames:

```
no frame-relay lapf frmr
```

frame-relay lapf k

To set the Link Access Procedure for Frame Relay (LAPF) window size *k*, use the **frame-relay lapf k** command in interface configuration mode. To reset the maximum window size *k* to the default value, use the **no** form of this command.

frame-relay lapf k *number*

no frame-relay lapf k [*number*]

Syntax Description

number	Maximum number of Information frames that either are outstanding for transmission or are transmitted but unacknowledged, in the range from 1 to 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** command in interface configuration mode. 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** command in interface configuration mode. 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. Range is from 1 to 16384. Default is 260.

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** command in interface configuration mode. 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. Range is from 1 to 100. Default is 15.

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** command in interface configuration mode. 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. Range is from 1 to 65535 seconds. Default is 30.

Defaults

30 seconds

Command Modes

Interface configuration

Command History

Release	Modification
11.2	This command was introduced.

Usage Guidelines

The **frame-relay lapf t203** command applies to the link; that is, it applies to DLCI 0. Circuits other than DLCI 0 are not affected.

The link idle timer value T203 should be greater than the retransmission timer value T200 (using the same time unit).

This command is used to tune Layer 2 system parameters to work well with the Frame Relay switch. Normally, you do not need to change the default setting.

Manipulation of Layer 2 parameters is not recommended if you do not know well the resulting functional change. For more information, refer to the ITU-T Q.922 specification for LAPF.

Examples

The following example resets the T203 idle link timer to the default value:

```
no frame-relay lapf t203
```

frame-relay lmi-n391dte

To set a full status polling interval, use the **frame-relay lmi-n391dte** command in interface configuration mode. To restore the default interval value, assuming that a Local Management Interface (LMI) has been configured, use the **no** form of this command.

frame-relay lmi-n391dte *keep-exchanges*

no frame-relay lmi-n391dte *keep-exchanges*

Syntax Description

keep-exchanges	Number of keep exchanges to be done before requesting a full status message. Acceptable value is a positive integer in the range from 1 to 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** command in interface configuration mode. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n392dce *threshold*

no frame-relay lmi-n392dce *threshold*

Syntax Description

threshold	Error threshold value. Acceptable value is a positive integer in the range from 1 to 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 network-to-network interface (NNI) interface, use the **frame-relay lmi-n392dte** command in interface configuration mode. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n392dte *threshold*

no frame-relay lmi-n392dte *threshold*

Syntax Description

threshold	Error threshold value. Acceptable value is a positive integer in the range from 1 to 10.

Defaults

3 errors

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the Local Management Interface (LMI) failure threshold to 3. The router acts as a Frame Relay DTE or NNI switch.

```
interface serial 0
 frame-relay intf-type DTE
 frame-relay lmi-n392dte 3
```

frame-relay lmi-n393dce

To set the DCE and Network-to-Network Interface (NNI) monitored events count, use the **frame-relay lmi-n393dce** command in interface configuration mode. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n393dce *events*

no frame-relay lmi-n393dce *events*

Syntax Description

events	Value of monitored events count. Acceptable value is a positive integer in the range from 1 to 10.

Defaults

2 events

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

This command and the **frame-relay lmi-n392dce** command define the condition that causes the link to be declared down. In Cisco's implementation, N392 errors must occur within the *events* argument count in order for the link to be declared down. Therefore, the *events* value defined in this command must be greater than the threshold value defined in the **frame-relay lmi-n392dce** command.

Examples

The following example sets the Local Management Interface (LMI) monitored events count to 3. The router acts as a Frame Relay DCE or NNI switch.

```
interface serial 0
 frame-relay intf-type DCE
 frame-relay lmi-n393dce 3
```

Related Commands

Command	Description
frame-relay lmi-n392dce	Sets the DCE and the NNI error threshold.

frame-relay lmi-n393dte

To set the monitored event count on a DTE or Network-to-Network Interface (NNI) interface, use the **frame-relay lmi-n393dte** command ininterface configuration mode. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n393dte *events*

no frame-relay lmi-n393dte *events*

Syntax Description

events	Value of monitored events count. Acceptable value is a positive integer in the range from 1 to 10.

Defaults

4 events

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Examples

The following example sets the Local Management Interface (LMI) monitored events count to 3. The router acts as a Frame Relay DTE or NNI switch.

```
interface serial 0
 frame-relay intf-type DTE
 frame-relay lmi-n393dte 3
```

frame-relay lmi-t392dce

To set the polling verification timer on a DCE or Network-to-Network Interface (NNI) interface, use the **frame-relay lmi-t392dce** command in interface configuration mode. 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** command in interface configuration mode. To return to the default LMI type, use the **no** form of this command.

frame-relay lmi-type {**ansi** | **cisco** | **q933a**}

no frame-relay lmi-type {**ansi** | **q933a**}

Syntax Description

ansi	Annex D defined by American National Standards Institute (ANSI) standard T1.617.
cisco	LMI type defined jointly by Cisco and three other companies.
q933a	ITU-T Q.933 Annex A.

Defaults

LMI autosense is active and determines the LMI type by communicating with the switch.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.

Usage Guidelines

Cisco's implementation of Frame Relay supports three LMI types: Cisco, ANSI Annex D, and ITU-T Q.933 Annex A.

The LMI type is set on a per-interface basis and is shown in the output of the **show interfaces** EXEC command.

If you want to deactivate LMI autosense, use this command and the **keepalive** command to configure the LMI. For more information about LMI autosense and configuring the LMI, refer to the chapter "Configuring Frame Relay" in the *Cisco IOS Wide-Area Networking Configuration Guide*.

Examples

The following is an example of the commands you might enter to configure an interface for the ANSI Annex D LMI type:

```
interface Serial1
 encapsulation frame-relay
 frame-relay lmi-type ansi
 keepalive 15
```