Frame Relay Commands

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

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

class (map-list configuration)

To associate a map class with a protocol-and-address combination, use the **class** map-list configuration command.

protocol protocol-address **class** *map-class* [**broadcast**] [**trigger**] [**ietf**]

Syntax Description

protocol	Supported protocol, bridging, or logical link control keywords: **appletalk**, **bridging**, **clns**, **decnet**, **dlsw, ip**, **ipx**, **llc2**, **rsrb**, **vines**, and **xns**.
protocol-address	Protocol address. The **bridge** and **clns** keywords do not use protocol addresses.
class *map-class*	Name of the map class from which to derive quality of service (QOS) information.
broadcast	(Optional) Allows broadcasts on this SVC.
trigger	(Optional) Enables a broadcast packet to trigger an SVC. If an SVC already exists that uses this map class, the SVC will carry the broadcast. This keyword can be configured only if **broadcast** is also configured.
ietf	(Optional) Specifies RFC 1490 encapsulation. The default is Cisco encapsulation.

Default

No protocol, protocol address, and map class are defined. If the **ietf** keyword is not specified, the default is Cisco encapsulation. If the **broadcast** keyword is not specified, no broadcasts are sent.

Command Mode

Map-list configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

This command is used for Frame Relay switched virtual circuits (SVCs); the parameters within the map class are used to negotiate for network resources.

The class is associated with a static map that is configured under a map list.

Example

In the following example, if IP triggers the call, the SVC is set up with the QOS parameters defined within the class *hawaii*. However, if AppleTalk triggers the call, the SVC is set up with the QOS parameters defined in the class *rainbow.* An SVC triggered by either protocol results in two SVC

maps, one for IP and one for AppleTalk. Two maps are set up because these protocol-and-address combinations are heading for the same destination, as defined by the **dest-addr** keyword and the values following it in the **map-list** command.

```
map-list bermuda source-addr E164 14085551212 dest-addr E164 15085551212
ip 131.108.177.100 class hawaii
appletalk 1000.2 class rainbow
```

In the following example, the **trigger** keyword allows AppleTalk broadcast packets to trigger an SVC:

```
ip 172.21.177.1 class jamaica broadcast ietf
appletalk 1000.2 class jamaica broadcast trigger ietf
```

Related Commands

map-class frame-relay
map-list

class (virtual circuit configuration)

To associate a map class with a specified data-link connection identifier (DLCI), use the **class** virtual circuit configuration command. To remove the association between the DLCI and the map class, use the **no** form of this command.

class *name*
no class *name*

Syntax Description

name	Name of map class to associate with this DLCI.

Default

No map class is defined.

Command Mode

Virtual circuit configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

This command applies to DLCIs. The class parameter values are specified with the **map-class frame-relay** command.

Examples

The following example shows how to define map class *slow_vcs* and apply it to DLCI 100:

```
interface serial 0.1 point-to-point
frame-relay interface-dlci 100
  class slow_vcs

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

The following example shows how to apply a map class to a DLCI for which a **frame-relay map** statement exists. The **frame-relay interface-dlci** command must also be used.

```
interface serial 0.2 point-to-multipoint
frame-relay map ip 131.26.13.2 100
frame-relay interface-dlci 100
  class slow_vcs

interface serial 0
frame-relay interface-dlci 100
 class fast_vc

map-class frame-relay fast_vc
 frame-relay traffic-rate 56000 128000
 frame-relay idle-timer 30
```

Related Commands

frame-relay interface-dlci
frame-relay map
map-class frame-relay

clear frame-relay-inarp

To clear dynamically created Frame Relay maps, which are created by the use of Inverse Address Resolution Protocol (ARP), use the **clear frame-relay-inarp** EXEC command.

clear frame-relay-inarp

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Example

The following example clears dynamically created Frame Relay maps:

```
clear frame-relay-inarp
```

Related Commands

frame-relay inverse-arp
show frame-relay map

encapsulation frame-relay

To enable Frame Relay encapsulation, use the **encapsulation frame-relay** interface configuration command. To disable Frame Relay encapsulation, use the **no** form of this command.

encapsulation frame-relay [**cisco** | **ietf**]
no encapsulation frame-relay [**ietf**]

Syntax Description

cisco	(Optional) Uses Cisco's own encapsulation, which is a 4-byte header, with 2 bytes to identify the data-link connection identifier (DLCI) and 2 bytes to identify the packet type. This is the default.
ietf	(Optional) Sets the encapsulation method to comply with the Internet Engineering Task Force (IETF) standard (RFC 1490). Use this keyword when connecting to another vendor's equipment across a Frame Relay network.

Default

Enabled

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Use this command with no keywords to restore the default Cisco encapsulation, which is a 4-byte header with 2 bytes for the DLCI and 2 bytes to identify the packet type.

Examples

The following example configures Cisco Frame Relay encapsulation on interface serial 1:

```
interface serial 1
encapsulation frame-relay
```

Use the **ietf** keyword if your router or access server is connected to another vendor's equipment across a Frame Relay network to conform with RFC 1490:

```
interface serial 1
encapsulation frame-relay ietf
```

frame-relay bc

To specify the incoming or outgoing committed burst size (Bc) for a Frame Relay virtual circuit, use the **frame-relay bc** map-class configuration command. To reset the committed burst size to the default, use the **no** form of this command.

frame-relay bc {**in** | **out**} *bits*
no frame-relay bc {**in** | **out**} *bits*

Syntax Description

in | **out**	Incoming or outgoing; if neither is specified, both in and out values are set.
bits	Committed burst size, in bits. Default is 7000 bits.

Default

7000 bits

Command Mode

Map-class configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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 *Bc* divided by the committed information rate (CIR).

Example

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

frame-relay be
frame-relay cir

frame-relay be

To set the incoming or outgoing excess burst size (Be) for a Frame Relay virtual circuit, use the **frame-relay be** map-class configuration command. To reset the excess burst size to the default, use the **no** form of this command.

frame-relay be {**in** | **out**} *bits*
no frame-relay be {**in** | **out**} *bits*

Syntax Description

in | **out**	Incoming or outgoing.
bits	Excess burst size, in bits. Default is 7000 bits.

Default

7000 bits

Command Mode

Map-class configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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 bytes, an implicit time factor is the sampling interval *Tc* on the switch, which is defined as the burst size *Bc* divided by the committed information rate (CIR).

Example

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

frame-relay bc
frame-relay cir

frame-relay becn-response-enable

To enable backward explicit congestion notification (BECN) feedback to regulate the frame-transmission rate on virtual circuits associated with a map class, use the **frame-relay becn-response-enable** map-class configuration command. To cause received BECNs to have no effect on traffic shaping (though they continue to be counted for statistics purposes), use the **no** form of this command.

frame-relay becn-response-enable
no frame-relay becn-response-enable

Syntax Description

This command has no keywords or arguments.

Default

Enabled when Frame Relay traffic shaping is configured.

Command Mode

Map-class configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

When enabled, BECNs received from the network on this virtual circuit are used to regulate the output rate on the virtual circuit. As the frequency of BECNs increases, the output rate is steadily reduced from *peak* to *average* (the equivalent of CIR). As congestion eases in the network, and the frequency of BECNs decreases, the output rate is allowed to increase gradually to its configured *peak* level.

Because **frame-relay becn-response-enable** is enabled by default, you typically do not have to use this command. In addition, this command is not displayed in output of the **show running-config** command (which replaced the deprecated **write config** command).

Examples

In the following example, **frame-relay becn-response-enable** is enabled by default:

```
interface serial 0
 encapsulation frame-relay
 frame-relay traffic-shaping
 frame-relay interface-dlci 100
  class pri_vc
```

In the following example, **frame-relay becn-response-enable** is enabled by default on all DLCIs under an interface or subinterface:

```
interface serial 0
 encapsulation frame-relay
 frame-relay traffic-shaping
 class pri_vc
 frame-relay class pri_vc

map-class frame-relay pri_vc
```

The following example shows how to disable **frame-relay becn-response-enable** for the second example:

```
map-class frame-relay pri_vc
 no frame-relay becn-response-enable
```

Related Commands

frame-relay class
frame-relay interface-dlci
frame-relay traffic-shaping
map-class frame-relay

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 DLCIs, use the **frame-relay broadcast-queue** interface configuration command.

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

Command Syntax

size	Number of packets to hold in the broadcast queue. The default is 64 packets.
byte-rate	Maximum number of bytes to be transmitted per second. The default is 256000 bytes per second.
packet-rate	Maximum number of packets to be transmitted per second. The default is 36 packets per second.

Defaults

The default values are as follows:

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

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.3.

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. Due to timing sensitivity, bridged broadcasts and spanning-tree packets are also sent through the normal queue.

The Frame Relay broadcast queue is managed independently of the normal interface queue. It has its own buffers and a configurable service rate.

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

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

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

As a general rule, 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. As a general rule, set the packet rate assuming 250-byte packets.

Example

The following example specifies a broadcast queue to hold 80 packets, to have a maximum byte transmission rate of 240,000 bytes per second, and to have a maximum packet transmission rate of 160 packets per second:

```
frame-relay broadcast-queue 80 240000 160
```

frame-relay cir

To specify the incoming or outgoing committed information rate (CIR) for a Frame Relay virtual circuit, use the **frame-relay cir** map-class configuration command. To reset the CIR to the default, use the **no** form of this command.

frame-relay cir {**in** | **out**} ***bps***
no frame-relay cir {**in** | **out**} ***bps***

Syntax Description

in | **out**	Incoming or outgoing.
bps	Committed information rate (CIR), in bits per second. Default is 56000 kps.

Default

56000 bits per second

Command Mode

Map-class configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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.

Example

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

frame-relay bc
frame-relay be

frame-relay class

To associate a map class with an interface or subinterface, use the **frame-relay class** interface configuration command. To remove the association between in 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.

Default

No map class is defined.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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.

Example

In the following example, the map class *slow_vcs* is associated with the serial 0.1 subinterface and the map class *slow_vcs* is defined to have an outbound CIR value of 9600:

```
interface serial 0.1
frame-relay class slow_vcs

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

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

Related Command

map-class frame-relay

frame-relay custom-queue-list

To specify a custom queue to be used for the virtual circuit queuing associated with a specified map class, use the **frame-relay custom-queue-list** map-class configuration command. To remove the specified queuing from the virtual circuit and cause it to revert to the default first-come-first-served queuing, 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	List number.

Default

If this command is not entered, the default queuing is first come first served.

Command Mode

Map-class configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

Definition of the custom queue takes place in the existing manner (through **queue-list** commands).

Only one form of queuing can be associated with a particular map class; subsequent definitions overwrite previous ones.

Example

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 Command

map-class frame-relay

frame-relay de-group

To specify the discard eligibility (DE) group number to be used for a specified DLCI, use the **frame-relay de-group** interface configuration command. To disable a previously defined group number assigned to a specified DLCI, use the **no** form of the command with the relevant keyword and arguments.

frame-relay de-group *group-number dlci*
no frame-relay de-group [*group-number*] [*dlci*]

Syntax Description

group-number	DE group number to apply to the specified DLCI number, in the range from 1 through 10.
dlci	DLCI number.

Default

No DE group is defined.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

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

This command requires that Frame Relay software be enabled.

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.

Example

The following example specifies that group number 3 will be used for DLCI 170:

```
frame-relay de-group 3 170
```

Related Command

frame-relay de-list

frame-relay de-list

To define a discard eligibility (DE) list specifying the packets that have the DE bit set and thus are eligible for discarding when congestion is experienced on the Frame Relay switch, use the **frame-relay de-list** global configuration command. To delete a portion of a previously defined DE list, use the **no** form of this command.

frame-relay de-list *list-number* {**protocol** *protocol* | **interface** *type number*} *characteristic*
no frame-relay de-list *list-number* {**protocol** *protocol* | **interface** *type number*} *characteristic*

Syntax Description

list-number	Number of the DE list.
protocol *protocol*	One of the following keywords corresponding to a supported protocol or device: **arp**—Address Resolution Protocol. **apollo**—Apollo Domain. **appletalk**—AppleTalk. **bridge**—bridging device. **clns**—ISO Connectionless Network Service. **clns_es**—CLNS end systems. **clns_is**—CLNS intermediate systems. **compressedtcp**—Compressed Transmission Control Protocol (TCP). **decnet**—DECnet. **decnet_node**—DECnet end node. **decnet_router-L1**—DECnet Level 1 (intra-area) router. **decnet_router-L2**—DECnet Level 2 (interarea) router. **ip**—Internet Protocol. **ipx**—Novell Internet Packet Exchange Protocol. **vines**—Banyan VINES. **xns**—Xerox Network Systems.
interface *type*	One of the following interface types: **serial**, **null**, or **ethernet**.
number	Interface number.
characteristic	One of the following: **fragments**—Fragmented IP packets. **tcp** *port*—TCP packets to or from a specified port. **udp** *port*—User Datagram Protocol (UDP) packets to or from a specified port. **list** *access-list-number*—Previously defined access list number. **gt** *bytes*—Sets the DE bit for packets larger than the specified number of bytes. **lt** *bytes*—Sets the DE bit for packets smaller than the specified number of bytes.

Default

Discard eligibility is not defined.

Command Mode

Global configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

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.

Example

The following example specifies that IP packets larger than 512 bytes will have the DE bit set:

```
frame-relay de-list 1 protocol ip gt 512
```

frame-relay idle-timer

To specify the idle timeout interval for a switched virtual circuit, use the **frame-relay idle-timer** map-class configuration command. To reset the idle timer to its default interval, use the **no** form of this command.

frame-relay idle-timer *seconds*
no frame-relay idle-timer *seconds*

Syntax Description

seconds	Time interval, in seconds, with no frames exchanged on a switched virtual circuit, after which the SVC is released. Default is 120 seconds.

Default

120 seconds

Command Mode

Map-class configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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.

Example

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 Command

map-class frame-relay

frame-relay interface-dlci

To assign a data link connection identifier (DLCI) to a specified Frame Relay subinterface on the router or access server, use the **frame-relay interface-dlci** interface configuration command. To remove this assignment, use the **no** form of this command.

frame-relay interface-dlci *dlci* [**ietf** | **cisco**]
no frame-relay interface-dlci *dlci* [**ietf** | **cisco**]

frame-relay interface-dlci *dlci* [**protocol ip** *ip-address*] (for a BOOTP server only)

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.
protocol ip *ip-address*	(Optional) Indicates the IP address of the serial 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.

Default

No DLCI is assigned.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Use this command only for subinterfaces on a router or access server. Use of the command on an interface, rather than a subinterface, prevents the device from forwarding packets intended for that DLCI.

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 “Example” section for the sequence of commands.

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

Use the **protocol ip** *ip-address* option only when this router or access server will act as the BOOTP server for autoinstallation over Frame Relay.

For more information about automatically installing router configuration files over a Frame Relay network, see the “Loading Images and Configuration Files” chapter in the *Configuration Fundamentals Configuration Guide*.

Example

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
```

Related Command

frame-relay class

frame-relay intf-type

Use the **frame-relay intf-type** interface configuration command to configure a Frame Relay switch type. Use the **no** form of this command to disable the switch.

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. This is the default.
nni	(Optional) Router or access server functions as a switch connected to a switch—supports Network-to-Network Interface (NNI) connections.

Default

dte

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

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

Example

The following example configures a data terminal equipment (DTE) switch type:

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

frame-relay inverse-arp

If the Inverse Address Resolution Protocol (Inverse ARP) was previously disabled on a router or access server configured for Frame Relay, use the **frame-relay inverse-arp** interface configuration command to reenable Inverse ARP on a specified interface or subinterface. Use the **no** form of this command to disable this feature.

frame-relay inverse-arp [*protocol*] [*dlci*]
no frame-relay inverse-arp [*protocol*] [*dlci*]

Syntax Description

protocol	Supported protocols: **appletalk**, **decnet**, **ip**, **ipx**, **vines**, and **xns**.
dlci	One of the DLCI numbers used on the interface. Acceptable numbers are integers in the range 16 through 1007.

Default

Enabled

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

To enable Inverse ARP for all protocols that were enabled before the prior **no frame-relay inverse-arp** command was issued, use the **frame-relay inverse-arp** command without arguments. To disable Inverse ARP for all protocols of an interface, use the **no frame-relay inverse-arp** command without arguments.

To enable or disable Inverse ARP for a specific protocol and DLCI pair, use both the *protocol* and *dlci* arguments. To enable or disable Inverse ARP for all protocols on a DLCI, use only the *dlci* argument. To enable or disable Inverse ARP for a protocol for all DLCIs on the specified interface or subinterface, use only the *protocol* argument.

This implementation of Inverse ARP is based on RFC 1293. It allows a router or access server running Frame Relay to discover the protocol address of a device associated with the virtual circuit.

In Frame Relay, permanent virtual circuits (PVCs) are identified by a DLCI, which is the equivalent of a hardware address. By exchanging signaling messages, a network announces a new virtual circuit, and with Inverse ARP, the protocol address at the other side of the circuit can be discovered.

The **show frame-relay map** command displays the word “dynamic” to flag virtual circuits that are created dynamically by Inverse ARP.

Example

The following example sets Inverse ARP on an interface running AppleTalk:

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

Related Commands

clear frame-relay-inarp
show frame-relay map

frame-relay ip tcp header-compression

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

frame-relay ip tcp header-compression [**passive**]
no frame-relay ip tcp header-compression

Syntax Description

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

Default

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

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

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

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

TCP/IP header compression and IETF encapsulation are mutually exclusive. If an interface is changed to IETF encapsulation, all encapsulation and compression characteristics are lost.

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

Example

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 Command

frame-relay map ip tcp header-compression

frame-relay lapf frmr

To resume the default setting of sending the Frame Reject (FRMR) frame at the LAPF Frame Reject procedure after having set the option of not sending the frame, use the **frame-relay frmr** command. To set the option of *not* sending the Frame Reject (FRMR) frame at the LAPF Frame Reject procedure, use the **no frame-relay lapf frmr** interface configuration command.

frame-relay frmr
no frame-relay lapf frmr

Syntax Description

This command has no keywords and arguments.

Default

Send FRMR during the Frame Reject procedure.

Command Mode

Interface configuration command

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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

Example

The following example suppresses the transmission of FRMR frames:

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

frame-relay lapf k

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

frame-relay lapf k *number*
no frame-relay lapf k [*number*]

Syntax Description

number	Maximum number of Information frames that are either outstanding for transmission or are transmitted but unacknowledged, in the range 1 through 127. Default is 7 frames.

Default

7 frames

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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.

Example

The following example resets the LAPF window size *k* to the default value:

```
no frame-relay lapf k
```

Related Command

frame-relay lapf t203

frame-relay lapf n200

To set the LAPF maximum retransmission count *N200*, use the **frame-relay lapf n200** interface configuration command. To reset the maximum retransmission count to the default of 3, use the **no** form of this command.

frame-relay lapf n200 *retries*
no frame-relay lapf n200 [*retries*]

Syntax Description

retries	Maximum number of retransmissions of a frame. Default is 3 retransmissions.

Default

3 retransmissions

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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.

Example

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 LAPF N201 value (the maximum length of the Information field of the LAPF I frame), use the **frame-relay lapf n201** interface configuration command. To reset the maximum length of the Information field to the default of 260 bytes (octets), use the **no** form of this command.

frame-relay lapf n201 *bytes*
no frame-relay lapf n201 [*bytes*]

Syntax Description

bytes	Maximum number of bytes in the Information field of the LAPF I frame, in the range 1 through 16384. Default is 260 bytes.

Default

260 bytes

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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.

Example

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 LAPF retransmission timer value T200, use the **frame-relay lapf t200** interface configuration command. To reset the T200 timer to the default value of 15, use the **no** form of this command.

frame-relay lapf t200 *tenths-of-a-second*
no frame-relay lapf t200

Syntax Description

tenths-of-a-second	Time, in tenths of a second, in the range 1 through 100. Default is 15 tenths of a second (1.5 seconds).

Default

15 tenths of a second (1.5 seconds)

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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.

Example

The following example resets the T200 timer to the default value:

```
no frame-relay lapf t200
```

Related Command

frame-relay lapf t203

frame-relay lapf t203

To set the LAPF link idle timer value T203 of DLCI 0, use the **frame-relay lapf t203** interface configuration command. To reset the link idle timer to the default value, use the **no** form of this command.

frame-relay lapf t203 *seconds*
no frame-relay lapf t203

Syntax Description

seconds	Maximum time allowed with no frames exchanged, in the range 1 through 65535 seconds. Default is 30 seconds.

Default

30 seconds

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

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.

Example

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

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

Related Commands

frame-relay lapf k
frame-relay lapf t200

frame-relay lmi-n391dte

To set a full status polling interval, use the **frame-relay lmi-n391dte** interface configuration command. To restore the default interval value, assuming an LMI has been configured, use the **no** form of this command.

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

Syntax Description

keep-exchanges	Number of keep exchanges to be done before requesting a full status message. Acceptable value is a positive integer in the range 1 through 255.

Default

6 keep exchanges

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

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.

Example

In the following example, one out of every four status inquiries generated will request a full status response from the switch. The other three status inquiries will request keepalive exchanges only.

```
interface serial 0
frame-relay intf-type DTE
frame-relay lmi-n391dte 4
```

frame-relay lmi-n392dce

To set the DCE and the Network-to-Network Interface (NNI) error threshold, use the **frame-relay lmi-n392dce** interface configuration command. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n392dce *threshold*
no frame-relay lmi-n392dce *threshold*

Syntax Description

threshold	Error threshold value. Acceptable value is a positive integer in the range 1 through 10. Default is 2 errors.

Default

2 errors

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

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.

Example

In the following example, the LMI failure threshold is set 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 Command

frame-relay lmi-n393dce

frame-relay lmi-n392dte

To set the error threshold on a DTE or NNI interface, use the **frame-relay lmi-n392dte** interface configuration command. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n392dte *threshold*
no frame-relay lmi-n392dte *threshold*

Syntax Description

threshold	Error threshold value. Acceptable value is a positive integer in the range 1 through 10. Default is 3 errors.

Default

3 errors

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Example

In the following example, the LMI failure threshold is set 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 NNI monitored events count, use the **frame-relay lmi-n393dce** interface configuration command. To remove the current setting, use the **no** form of this command.

frame-relay lmi-n393dce *events*
no frame-relay lmi-n393dce *events*

Syntax Description

events	Monitored events count value. Acceptable value is a positive integer in the range 1 through 10. Default is 2 events.

Default

2 events

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

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* 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.

Example

In the following example, the LMI monitored events count is set 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 Command

frame-relay lmi-n392dce

frame-relay lmi-n393dte

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

frame-relay lmi-n393dte *events*
no frame-relay lmi-n393dte *events*

Syntax Description

events	Monitored events count value. Acceptable value is a positive integer in the range 1 through 10. Default is 4 events.

Default

4 events

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Example

In the following example, the LMI monitored events count is set 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 NNI interface, use the **frame-relay lmi-t392dce** interface configuration command. To remove the current setting, use the **no** form of this command.

frame-relay lmi-t392dce *seconds*
no frame-relay lmi-t392dce *seconds*

Syntax Description

seconds	Polling verification timer value, in seconds. Acceptable value is a positive integer in the range 5 through 30. Default is 15 seconds.

Default

15 seconds

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

The value for the timer must be greater than the DTE or NNI keepalive timer.

Example

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 Command

keepalive

frame-relay lmi-type

To select the Local Management Interface (LMI) type, use the **frame-relay lmi-type** interface configuration command. To return to the default LMI type, use the **no** form of this command.

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

Syntax Description

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

Note The International Telecommunication Union Telecommunication Standardization Sector (ITU-T) carries out the functions of the former Consultative Committee for International Telegraph and Telephone (CCITT).

Default

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

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

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, see the "Configuring Frame Relay" chapter in the *Wide-Area Networking Configuration Guide*.

Example

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

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

frame-relay local-dlci

To set the source DLCI for use when the LMI is not supported, use the **frame-relay local-dlci** interface configuration command. To remove the DLCI number, use the **no** form of this command.

frame-relay local-dlci *number*
no frame-relay local-dlci

Syntax Description

number	Local (source) DLCI number to be used.

Default

No source DLCI is set.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

If LMI is supported and the multicast information element is present, the network server sets its local DLCI based on information provided via the LMI.

Note The **frame-relay local-dlci** command is provided mainly to allow testing of the Frame Relay encapsulation in a setting where two servers are connected back-to-back. This command is not required in a live Frame Relay network.

Example

The following example specifies 100 as the local DLCI:

```
interface serial 4
frame-relay local-dlci 100
```

frame-relay map

To define the mapping between a destination protocol address and the DLCI used to connect to the destination address, use the **frame-relay map** interface configuration command. Use the **no** form of this command to delete the map entry.

frame-relay map *protocol protocol-address dlci* [**broadcast**] [**ietf** | **cisco** | **payload-compress packet-by-packet**]
no frame-relay map *protocol protocol-address*

Syntax Description

protocol	Supported protocol, bridging, or logical link control keywords: **appletalk**, **decnet**, **dlsw, ip**, **ipx**, **llc2**, **rsrb**, **vines** and **xns**.
protocol-address	Destination protocol address.
dlci	DLCI number used to connect to the specified protocol address on the interface.
broadcast	(Optional) Forwards broadcasts to this address when multicast is not enabled (see the **frame-relay multicast-dlci** command for more information about multicasts). This keyword also simplifies the configuration of OSPF (see the "Usage Guidelines" section for more detail).
ietf	(Optional) IETF form of Frame Relay encapsulation. Use when the router or access server is connected to another vendor's equipment across a Frame Relay network.
cisco	(Optional) Cisco encapsulation method.
payload-compress packet-by-packet	(Optional) Packet-by-packet payload compression, using the Stacker method.

Default

No mapping is defined.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

There can be many DLCIs known by a router or access server that can send data to many different places, but they are all multiplexed over one physical link. The Frame Relay map tells the Cisco IOS software how to get from a specific protocol and address pair to the correct DLCI.

The optional **ietf** and **cisco** keywords allow flexibility in the configuration. If no keywords are specified in the configuration, the map inherits the attributes set with the **encapsulation frame-relay** command. You can also use the encapsulation options to specify that, for example, all interfaces use IETF encapsulation except one, which needs the original Cisco encapsulation method, and it can be defined through use of the **cisco** keyword with the **frame-relay map** command.

Payload compression is Cisco-proprietary and will not interoperate with routers of other manufacturers.

You can disable payload compression by entering the **no frame-relay map payload** command and then entering the **frame-relay map** command again with one of the other encapsulation keywords: **cisco** or **ietf**.

Use the **frame-relay map** command to enable or disable payload compression on multipoint interfaces. Use the **frame-relay payload-compress packet-by-packet** command to enable or disable payload compression on point-to-point interfaces.

The **broadcast** keyword provides two functions: It forwards broadcasts when multicasting is not enabled, and it simplifies the configuration of OSPF for nonbroadcast networks that will use Frame Relay.

The **broadcast** keyword might also be required for some routing protocols—for example, AppleTalk—that depend on regular routing table updates, especially when the router at the remote end is waiting for a routing update packet to arrive before adding the route.

By requiring selection of a designated router, OSPF treats a nonbroadcast, multiaccess network such as Frame Relay in much the same way as it treats a broadcast network. In previous releases, this required manual assignment in the OSPF configuration using the **neighbor interface** router command. When the **frame-relay map** command is included in the configuration with the **broadcast**, and **the ip ospf network** command (with the **broadcast** keyword) is configured, there is no need to configure any neighbors manually. OSPF will now automatically run over the Frame Relay network as a broadcast network. (Refer to the **ip ospf network** interface command for more detail.)

Note The OSPF broadcast mechanism assumes that IP class D addresses are never used for regular traffic over Frame Relay.

Example

The following example maps the destination IP address 131.108.123.1 to DLCI 100:

```
interface serial 0
frame-relay map IP 131.108.123.1 100 broadcast
```

OSPF will use DLCI 100 to broadcast updates.

Related Command

frame-relay payload-compress packet-by-packet

frame-relay map bridge

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

frame-relay map bridge *dlci* [**broadcast**] [**ietf**]
no frame-relay map bridge *dlci*

Syntax Description

dlci	DLCI number to be used for bridging on the specified interface or subinterface.
broadcast	(Optional) Broadcasts are forwarded when multicast is not enabled.
ietf	(Optional) IETF form of Frame Relay encapsulation. Use when the router or access server is connected to another vendor's equipment across a Frame Relay network.

Default

No broadcasts are forwarded.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Examples

The following example uses DLCI 144 for bridging:

```
interface serial 0
frame-relay map bridge 144 broadcast
```

The following example sets up separate point-to-point links over a subinterface and runs transparent bridging over it:

```
interface serial 0
bridge-group 1
encapsulation frame-relay
interface serial 0.1
bridge-group 1
frame-relay map bridge 42 broadcast
interface serial 0.2
bridge-group 1
frame-relay map bridge 64 broadcast
interface serial 0.3
bridge-group 1
frame-relay map bridge 73 broadcast
```

DLCI 42 is used as the link; see the section “Frame Relay Configuration Examples” in the *Wide-Area Networking Configuration Guide* for more examples of subinterfaces.

frame-relay map clns

To forward broadcasts when ISO CLNS is used for routing, use the **frame-relay map clns** interface configuration command. Use the **no** form of this interface configuration command to delete the map entry.

frame-relay map clns *dlci* [**broadcast**]
no frame-relay map clns *dlci*

Syntax Description

dlci	DLCI number to which CLNS broadcasts are forwarded on the specified interface.
broadcast	(Optional) Broadcasts are forwarded when multicast is not enabled.

Default

No broadcasts are forwarded.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Example

The following example uses DLCI 125 for ISO CLNS routing:

```
interface serial 0
frame-relay map clns 125 broadcast
```

frame-relay map ip tcp header-compression

To assign header compression characteristics to an IP map that differ from the compression characteristics of the interface with which the IP map is associated, use the **frame-relay map ip tcp header-compression** interface configuration command. To remove the IP map, use the **no** form of this command.

frame-relay map ip *ip-address dlci* [**broadcast**] [**cisco** | **ietf**] [**nocompress**]
tcp header-compression {**active** | **passive**}
no frame-relay map ip *ip-address dlci*

Syntax Description

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

Default

The default encapsulation is **cisco**.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

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

IP maps inherit the compression characteristics of the associated interface unless this command is used to provide different characteristics. This command can also reconfigure an IP map that existed before TCP header compression was configured on the associated interface.

When IP maps at both ends of a connection inherit passive compression, the connection will never transfer compressed traffic because neither side will generate a packet with a compressed header.

If you change the encapsulation characteristics of the interface to IETF, you lose the TCP header compression configuration of the associated IP map.

The command **frame-relay map ip** *ip-address dlci* **tcp header-compression active** can also be entered as **frame-relay map ip** *ip-address dlci* **active tcp header-compression**.

Example

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

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

Related Command

frame-relay ip tcp header-compression

frame-relay mincir

To specify the minimum acceptable incoming or outgoing committed information rate (CIR) for a Frame Relay virtual circuit, use the **frame-relay mincir** map-class configuration command. To reset the minimum acceptable CIR to the default, use the **no** form of this command.

frame-relay mincir {**in** | **out**} ***bps***

Syntax Description

in | **out**	Incoming or outgoing.
bps	Committed information rate, in bits per second. Default is 56000 bps.

Default

56000 bps

Command Mode

Map-class configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

Rate values greater than 2048 must be entered with trailing zeros. For example, 2048000 and 5120000.

The network uses the **mincir** value when allocating resources for the SVC. If the **mincir** value cannot be supported, the call is cleared.

Example

The following example defines the peak and average traffic rate, the minimum CIR, and the idle timer for the *fast_vcs* map class and applies those values to DLCI 100, which is associated with that map class:

```
interface serial 0
frame-relay interface-dlci 100
 class fast_vc

map-class frame-relay fast_vc
 frame-relay traffic-rate 56000 128000
 frame-relay idle-timer 30
 frame-relay mincir out 48000
```

Related Command

map-class frame-relay

frame-relay multicast-dlci

Use the **frame-relay multicast-dlci** interface configuration command to define the DLCI to be used for multicasts. Use the **no** form of this command to remove the multicast group.

frame-relay multicast-dlci *number*
no frame-relay multicast-dlci

Syntax Description

number	Multicast DLCI.

Default

No DLCI is defined.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Use this command when the multicast facility is not supported. Network transmissions (packets) sent to a multicast DLCI are delivered to all network servers defined as members of the multicast group.

Note The **frame-relay multicast-dlci** command is provided mainly to allow testing of the Frame Relay encapsulation in a setting where two servers are connected back-to-back. This command is not required in a live Frame Relay network.

Example

The following example specifies 1022 as the multicast DLCI:

```
interface serial 0
frame-relay multicast-dlci 1022
```

frame-relay payload-compress packet-by-packet

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

frame-relay payload-compress packet-by-packet
no frame-relay payload-compress packet-by-packet

Syntax Description

This command has no keywords or arguments.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

The **frame-relay payload-compress** command first appeared in Cisco IOS Release 11.0.
The **frame-relay payload-compress packet-by-packet** command first appeared in Cisco IOS Release 11.2.

Use the **frame-relay payload-compress packet-by-packet** command to enable or disable payload compression on a point-to-point interface or subinterface. Use the **frame-relay map** command to enable or disable payload compression on a multipoint interface or subinterface.

Related Command

frame-relay map

frame-relay priority-dlci-group

To enable multiple parallel DLCIs for different types of Frame Relay traffic, associate specified DLCIs with the same group, and define their levels, use the **frame-relay priority-dlci-group** subinterface configuration command.

frame-relay priority-dlci-group *group-number high-dlci medium-dlci normal-dlci low-dlci*

Syntax Description

group-number	Specific group number.
high-dlci	DLCI that is to have highest level.
medium-dlci	DLCI that is to have medium level.
normal-dlci	DLCI that is to have normal level.
low-dlci	DLCI that is to have lowest level.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.0.

This command applies at the subinterface level.

Levels in descending order are high, medium, normal, and low.

This command defines different DLCIs for different categories of traffic. It does not itself define priority queueing but can be used in association with it.

A global priority list must be defined before this command is used. In addition, the DLCIs mentioned in this command must be defined before this command is used.

If you do not explicitly specify a DLCI for each of the levels, the last DLCI specified in the command line is used as the value of the remaining arguments. For example, the following two commands are equivalent:

```
frame-relay priority-dlci-group 1 40 50
frame-relay priority-dlci-group 1 40 50 50 50
```

When you configure **frame-relay map** commands or use Inverse ARP, the high-level DLCI is the only one that is mapped. If you enter one of the commands in the example, you configure DLCI 40, but not DLCI 50, in a **frame-relay map** command.

Related Commands

A dagger (†) indicates that the command is documented outside this chapter.

frame-relay map
priority-list †

frame-relay priority-group

To assign a priority queue to virtual circuits associated with a map class, use the **frame-relay priority-group** map-class configuration command. To remove the specified queuing from the virtual circuit and cause it to revert to the default first-come-first-served queuing, use the **no** form of this command.

frame-relay priority-group *list-number*
no frame-relay priority-group *list-number*

Syntax Description

list-number	Priority-list number to be associated with the specified map class.

Default

If this command is not entered, the default is first-come-first-served queuing.

Command Mode

Map-class configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

Definition of the priority queue takes place in the existing manner (through **priority-list** commands).

Because only one form of queuing can be associated with a particular map class, subsequent definitions overwrite previous ones.

Example

The following example configures a map class for a specified DLCI, specifies a priority list for the map class, and then defines the priority list:

```
interface serial 0
encapsulation frame-relay
frame-relay interface-dlci 100
 class pri_vc

map-class frame-relay pri_vc
 frame-relay priority-group 1

priority-list 1 protocol ip high
```

Related Commands

A dagger (†) indicates that the command is documented outside this chapter.

class (virtual circuit configuration)
frame-relay interface-dlci
map-class frame-relay
priority-list †

frame-relay route

Use the **frame-relay route** interface configuration command to specify the static route for PVC switching. Use the **no** form of this command to remove a static route.

frame-relay route *in-dlci out-interface out-dlci*
no frame-relay route *in-dlci out-interface out-dlci*

Syntax Description

in-dlci	DLCI on which the packet is received on the interface.
out-interface	Interface that the router or access server uses to transmit the packet.
out-dlci	DLCI that the router or access server uses to transmit the packet over the specified *out-interface*.

Default

No static route is specified.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Examples

The following example configures a static route that allows packets in DLCI 100 and transmits packets out over DLCI 200 on interface serial 2:

```
frame-relay route 100 interface Serial2 200
```

The following example illustrates the commands you enter for a complete configuration that includes two static routes for PVC switching between interface serial 1 and interface serial 2:

```
interface Serial1
no ip address
encapsulation frame-relay
keepalive 15
frame-relay lmi-type ansi
frame-relay intf-type dce
frame-relay route 100 interface Serial2 200
frame-relay route 101 interface Serial2 201
clockrate 2000000
```

frame-relay svc

To enable Frame Relay SVC operation on the specified interface, use the **frame-relay svc** interface configuration command. To disable SVC operation on the specified interface, use the **no** form of this command

frame-relay svc
no frame-relay svc

Syntax Description

This command has no keywords and arguments.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

SVC operation can be enabled at the interface level only. Once it is enabled at the interface level, it is enabled on all subinterfaces on the interface. One signaling channel, DLCI 0, is set up for the interface, and all SVCs are controlled from the physical interface.

The first use of this command on the router starts all SVC-related processes on the router. If they are already up and running because SVCs are enabled on another interface, no additional action is taken. These processes are not removed once they are created.

Example

The following example enables Frame Relay SVC operation on serial interface 0 and starts SVC-related processes on the router:

```
interface serial 0
ip address 172.68.3.5 255.255.255.0
encapsulation frame-relay
frame-relay lmi-type q933a
frame-relay svc
```

Related Commands

A dagger (†) indicates that the command is documented outside this chapter.

interface serial †
ip address †
encapsulation frame-relay
frame-relay lmi-type

frame-relay switching

Use the **frame-relay switching** global configuration command to enable PVC switching on a Frame Relay DCE or an NNI. Use the **no** form of this command to disable switching.

frame-relay switching
no frame-relay switching

Syntax Description

This command has no arguments or keywords.

Default

Disabled

Command Mode

Global configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

You must add this command to the configuration file before configuring the routes.

Example

The following example shows the simple command that is entered in the configuration file before the Frame Relay configuration commands to enable switching:

```
frame-relay switching
```

frame-relay traffic-rate

To configure all the traffic shaping characteristics of a virtual circuit in a single command, use the **frame-relay traffic-rate** map-class configuration command. To remove the specified traffic shaping from the map class, use the **no** form of this command.

frame-relay traffic-rate *average* [*peak*]
no frame-relay traffic-rate *average* [*peak*]

Syntax Description

average	Average rate, in bits per second; equivalent to specifying the contracted CIR.
peak	(Optional) Peak rate, in bits per second; equivalent to CIR + Be/Tc = CIR (1 + Be/Bc) = CIR + EIR.

Default

If the peak rate is omitted, the default value used is the line rate, which is derived from the **bandwidth** command.

Command Mode

Map-class configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

For SVCs, the configured *peak* and *average* rates are converted to the equivalent CIR, excess burst size (*Be*), and committed burst size (*Bc*) values for use by SVC signaling.

This command lets you configure all the traffic shaping characteristics of a virtual circuit in a single command. Using it is simpler than the alternative of entering the three subcommands **frame-relay cir out**, **frame-relay be out** and **frame-relay bc out**, but offers slightly less flexibility.

Example

The following example associates a map class with specified DLCI and then sets a traffic rate for the map-class (and thus for the DLCI):

```
interface serial 0
frame-relay interface-dlci 100
 class fast_vc

map-class frame-relay fast_vc
 frame-relay traffic-rate 56000 128000
```

Related Commands

frame-relay bc out
frame-relay be out
frame-relay cir out

frame-relay traffic-shaping

To enable both traffic shaping and per-virtual circuit queuing for all PVCs and SVCs on a Frame Relay interface, use the **frame-relay traffic-shaping** interface configuration command. To disable traffic shaping and per-virtual circuit queuing, use the **no** form of this command.

frame-relay traffic-shaping
no frame-relay traffic-shaping

Syntax Description

This command has no keywords and arguments.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

For virtual circuits for which no specific traffic shaping or queuing parameters are specified, a set of default values are used. The default queuing is performed on a first-come-first-served basis.

Example

The following example enables both traffic shaping and per-virtual circuit queuing:

```
frame-relay traffic-shaping
```

Related Commands

frame-relay class
frame-relay custom-queue-list
frame-relay priority-group
frame-relay traffic-rate
map-class frame-relay

keepalive

To enable the Local Management Interface (LMI) mechanism for serial lines using Frame Relay encapsulation, use the **keepalive** interface configuration command. Use the **no** form of this command to disable this capability.

keepalive *number*
no keepalive

Syntax Description

number	Number of seconds that defines the keepalive interval. The interval must be set as a positive integer that is less than the interval set on the switch; see the **frame-relay lmi-t392dce** command description. Default is 10 seconds.

Default

10 seconds

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

The **keepalive** command enables the keepalive sequence, which is part of the Local Management Interface (LMI) protocol.

Note When booting from a network server over Frame Relay, you might need to disable keepalives.

Example

The following example sets the keepalive timer on the server for a period that is two or three seconds faster (shorter interval) than the interval set on the keepalive timer of the Frame Relay switch. The difference in keepalive intervals ensures proper synchronization between the Cisco server and the Frame Relay switch.

```
interface serial 3
keepalive 8
```

Related Command

frame-relay lmi-t392dce

map-class frame-relay

To specify a map class to define quality of service (QOS) values for an SVC, use the **map-class frame-relay** global configuration command.

map-class frame-relay *map-class-name*

Syntax Description

frame-relay	Keyword specifying the type of map class.
map-class-name	Name of this map class.

Default

Disabled. No default name is defined.

Command Mode

Global configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

After you specify the named map class, you can specify the QOS parameters—such as incoming and outgoing CIR, committed burst rate, excess burst rate, and the idle timer—for the map class.

To specify the protocol-and-address combination to which the QOS parameters are to be applied, associate this map class with the static maps under a map list.

Example

The following example specifies a map class called *hawaii* and defines three QOS parameters for it. The *hawaii* map class is associated with a protocol-and-address static map defined under the **map-list** command.

```
map-list bermuda source-addr E164 123456 dest-addr E164 654321
 ip 131.108.177.100 class hawaii
 appletalk 1000.2 class hawaii

map-class frame-relay hawaii
 frame-relay cir in 2000000
 frame-relay cir out 56000
 frame-relay be out 9000
```

Related Commands

frame-relay bc
frame-relay be
frame-relay cir
frame-relay idle-timer

map-group

To associate a map list with a specific interface, use the **map-group** interface configuration command.

map-group *group-name*

Syntax Description

group-name	Name used in a **map-list** command.

Default

Disabled. No map group name is defined.

Command Mode

Interface configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

A map-group association with an interface is required for SVC operation. In addition, a map list must be configured.

The **map-group** command applies to the interface or subinterface on which it is configured. The associated E.164 or X.121 address is defined by the **map-list** command, and the associated protocol addresses are defined by using the **class** command under the **map-list** command.

Example

The following example configures a physical interface, applies a map group to the physical interface, and then defines the map group:

```
interface serial 0
ip address 172.10.8.6
encapsulation frame-relay
map-group bermuda
frame-relay lmi-type q933a
frame-relay svc

map-list bermuda source-addr E164 123456 dest-addr E164 654321
ip 131.108.177.100 class hawaii
appletalk 1000.2 class rainbow
```

Related Commands

class (map-list configuration)
map-list

map-list

To specify a map group and link it to a local E.164 or X.121 source address and a remote E.164 or X.121 destination address for Frame Relay SVCs, use the **map-list** global configuration command. To delete a previous map-group link, use the **no** form of this command.

map-list *map-group-name* **source-addr** {**e164** | **x121**} *source-address* **dest-addr** {**e164** | **x121**} *destination-address*
no map-list *map-group-name* **source-addr** {**e164** | **x121**} *source-address* **dest-addr** {**e164** | **x121**} *destination-address*

Syntax Description

map-group-name	Name of the map group. This map group must be associated with a physical interface.
source-addr {**e164** | **x121**}	Type of source address.
source-address	Address of the type specified (E.164 or X.121).
dest-addr {**e164** | **x121**}	Type of destination address.
destination-address	Address of the type specified (E.164 or X.121).

Default

Disabled. No default list name and no default address type are defined.

Command Mode

Global configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

Use the **map-class** command and its subcommands to define quality of service (QOS) parameters—such as incoming and outgoing CIR, committed burst rate, excess burst rate, and the idle timer—for the static maps defined under a map list.

Each SVC needs to use a source and destination number, in much the same way that a public telephone network needs to use source and destination numbers. These numbers allow the network to route calls from a specific source to a specific destination. This specification is done through map lists.

Based on switch configuration, addressing can take either of two forms: E.164 or X.121.

An X.121 number is 14 digits long and has the following form:

```
Z CC P NNNNNNNNNN
```

Table 17 describes the codes in an X.121 number form.

Table 17 X.121 Numbers

Code	Meaning	Value
Z	Zone code	3 for North America
C	Country code	10–16 for the United States
P	Public data network (PDN) code	Provided by the PDN
N	10-digit number	Set by the network for the specific destination

An E.164 number has a variable length; the maximum length is 15 digits. An E.164 number has the fields shown in Figure 2 and described in Table 18.

Figure 2 E.164 Address Format

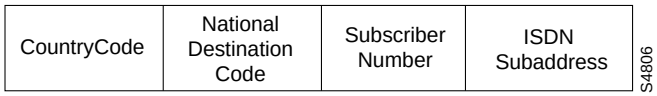

Table 18 E.164 Address Field Descriptions

Field	Description
Country Code	Can be 1, 2, or 3 digits long. Some current values are the following: • Code 1—United States of America • Code 44—United Kingdom • Code 61—Australia
National Destination Code + Subscriber Number	Referred to as the National ISDN number; the maximum length is 12, 13, or 14 based on the country code.
ISDN Subaddress	Identifies one of many devices at the termination point. An ISDN subaddress is similar to an extension on a PBX.

Example

In the following SVC example, if IP or AppleTalk triggers the call, the SVC is set up with the QOS parameters defined within the class *hawaii*. An SVC triggered by either protocol results in two SVC maps, one for IP and one for AppleTalk. Two maps are set up because these protocol-and-address combinations are heading for the same destination, as defined by the **dest-addr** keyword and the values following it in the **map-list** command.

```
map-list bermuda source-addr E164 123456 dest-addr E164 654321
ip 131.108.177.100 class hawaii
appletalk 1000.2 class hawaii
```

Related Commands

class (map-list configuration)
map-class frame-relay

show frame-relay ip tcp header-compression

To display statistics and TCP/IP header compression information for the interface, use the **show frame-relay ip tcp header-compression** EXEC command.

show frame-relay ip tcp header-compression

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 10.3.

Sample Display

The following is sample output from the **show frame-relay ip tcp header-compression** command:

```
DLCI 200          Link/Destination info: ip 131.108.177.200
Interface Serial0:
Rcvd:     40 total, 36 compressed, 0 errors
          0 dropped, 0 buffer copies, 0 buffer failures
Sent:     0 total, 0 compressed
          0 bytes saved, 0 bytes sent
Connect:  16 rx slots, 16 tx slots, 0 long searches, 0 misses, 0% hit ratio
          Five minute miss rate 0 misses/sec, 0 max misses/sec
```

Table 19 describes the fields shown in the display.

Table 19 Show Frame-Relay IP TCP Header-Compression Field Descriptions

Field	Description
Rcvd	
total	Sum of compressed and uncompressed packets received.
compressed	Number of compressed packets received.
errors	Number of errors caused by errors in the header fields (version, total length, or IP checksum).
dropped	Number of packets discarded. Seen only after line errors.
buffer copies	Number of times that a new buffer was needed to put the uncompressed packet in.
buffer failures	Number of times that a new buffer was needed but was not obtained.
Sent	
total	Sum of compressed and uncompressed packets sent.
compressed	Number of compressed packets sent.
bytes saved	Number of bytes reduced because of the compression.

Table 19 Show Frame-Relay IP TCP Header-Compression Field Descriptions (Continued)

Field	Description
bytes sent	Actual number of bytes transmitted.

Table 19 Show Frame-Relay IP TCP Header-Compression Field Descriptions (Continued)

Field	Description
Connect	
rx slots, tx slots	Number of states allowed over one TCP connection. A state is recognized by a source address, a destination address, and an IP header length.
long searches	Number of times that the connection ID in the incoming packet was not the same as the previous one that was processed.
misses	Number of times that a matching entry was not found within the connection table and a new entry had to be entered.
hit ratio	Percentage of times that a matching entry was found in the compression tables and the header was compressed.
Five minute miss rate	Miss rate computed over the most recent 5 minutes and the maximum per-second miss rate during that period.

show frame-relay lapf

To display information about the status of the internals of Frame Relay Layer 2 (LAPF) if SVCs are configured, use the **show frame-relay lapf** EXEC command.

show frame-relay lapf

Syntax Description

This command has no keywords and arguments.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

Sample Display

The following is sample output from the **show frame-relay lapf** command.

```
raven# show frame-relay lapf

Interface = Serial1 (up),  LAPF state = TEI_ASSIGNED (down)
SVC disabled, link down cause = LMI down,  #link-reset = 0
T200 = 1.5 sec.,  T203 = 30 sec.,  N200 = 3,  k = 7,  N201 = 260
I xmt = 0, I rcv = 0, I reXmt = 0, I queued = 0
I xmt dropped = 0,  I rcv dropped = 0,  Rcv pak dropped = 0
RR xmt = 0,  RR rcv = 0,  RNR xmt = 0,  RNR rcv = 0
REJ xmt = 0,  REJ rcv = 0,  FRMR xmt = 0,  FRMR rcv = 0
DM xmt = 0,  DM rcv = 0,  DISC xmt = 0,  DISC rcv = 0
SABME xmt = 0,  SABME rcv = 0,  UA xmt = 0,  UA rcv = 0
V(S) = 0,  V(A) = 0,  V(R) = 0,  N(S) = 0,  N(R) = 0
Xmt FRMR at Frame Reject
```

Table 20 describes significant fields in this output.

Table 20 Show Frame-Relay Lapf Field Descriptions

Field	Description
Interface =	Identifies the interface and indicates the line status (up, down, administratively down)
LAPF state =	A LAPF state of MULTIPLE FRAME ESTABLISHED or RIMER_RECOVERY indicates that Layer 2 is functional. Others, including TEI_ASSIGNED, AWAITING_ESTABLISHMENT, and AWAITING_RELEASE indicate that Layer 2 is not functional.
SVC disabled	Indicates whether SCVs are enabled or disabled.
link down cause =	Indicates the reason that the link is down. For example, N200 error, memory out, peer disconnect, LMI down, line down, and SVC disabled. Many other causes are described in the Q.922 specification.
#link-reset =	Number of times the Layer 2 link has been reset.

Table 20 Show Frame-Relay Lapf Field Descriptions (Continued)

Field	Description
T200 = , T203 = , N200 = , k = , N201 =	Values of Layer 2 parameters.
I xmt = , I rcv = , I reXmt = , I queued =	Number of I frames transmitted, received, retransmitted, and queued for transmission, respectively.
I xmt dropped =	Number of transmitted I frames that were dropped.
I rcv dropped =	Number of I frames received over DLCI 0 that were dropped.
Rcv pak dropped =	Number of received packets that were dropped.
RR xmt = , RR rcv =	Number of RR frames transmitted; number of RR frames received.
RNR xmt = , RNR rcv =	Number of RNR frames transmitted; number of RNR frames received.
REJ xmt = , REJ rcv =	Number of REJ frames transmitted; number of REJ frames received.
FRMR xmt = , FRMR rcv =	Number of FRMR frames transmitted; number of FRMR frames received.
DM xmt = , DM rcv =	Number of DM frames transmitted; number of DM frames received.
DISC xmt = , DISC rcv =	Number of DISC frames transmitted; number of DISC frames received.
SABME xmt = , SABME rcv =	Number of SABME frames transmitted; number of SABME frames received.
UA xmt = , UA rcv =	Number of UA frames transmitted; number of UA frames received.
V(S) = 0, V(A) = 0, V(R) = 0, N(S) = 0, N(R) = 0	Layer 2 sequence numbers.
Xmt FRMR at Frame Reject	Indicates whether the FRMR frame is transmitted at Frame Reject.

show frame-relay lmi

To display statistics about the Local Management Interface (LMI), use the **show frame-relay lmi** EXEC command.

show frame-relay lmi [*type number*]

Syntax Description

type	(Optional) Interface type; it must be serial.
number	(Optional) Interface number.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Enter the command without arguments to obtain statistics about all Frame Relay interfaces.

Sample Displays

The following is sample output from the **show frame-relay lmi** command when the interface is a DTE:

```
Router# show frame-relay lmi

LMI Statistics for interface Serial1 (Frame Relay DTE) LMI TYPE = ANSI
  Invalid Unnumbered info 0             Invalid Prot Disc 0
  Invalid dummy Call Ref 0              Invalid Msg Type 0
  Invalid Status Message 0              Invalid Lock Shift 0
  Invalid Information ID 0              Invalid Report IE Len 0
  Invalid Report Request 0              Invalid Keep IE Len 0
  Num Status Enq. Sent 9                Num Status msgs Rcvd 0
  Num Update Status Rcvd 0              Num Status Timeouts 9
```

The following is sample output from the **show frame-relay lmi** command when the interface is an NNI:

```
Router# show frame-relay lmi

LMI Statistics for interface Serial3 (Frame Relay NNI) LMI TYPE = CISCO
  Invalid Unnumbered info 0             Invalid Prot Disc 0
  Invalid dummy Call Ref 0              Invalid Msg Type 0
  Invalid Status Message 0              Invalid Lock Shift 0
  Invalid Information ID 0              Invalid Report IE Len 0
  Invalid Report Request 0              Invalid Keep IE Len 0
  Num Status Enq. Rcvd 11               Num Status msgs Sent 11
  Num Update Status Rcvd 0              Num St Enq. Timeouts 0
  Num Status Enq. Sent 10               Num Status msgs Rcvd 10
  Num Update Status Sent 0              Num Status Timeouts 0
```

Table 21 describes significant fields shown in the output.

Table 21 Show Frame-Relay LMI Field Descriptions

Field	Description
LMI TYPE =	Signaling or LMI specification: CISCO, ANSI, or ITU-T.
Invalid Unnumbered info	Number of received LMI messages with invalid unnumbered information field.
Invalid Prot Disc	Number of received LMI messages with invalid protocol discriminator.
Invalid dummy Call Ref	Number of received LMI messages with invalid dummy call references.
Invalid Msg Type	Number of received LMI messages with invalid message type.
Invalid Status Message	Number of received LMI messages with invalid status message.
Invalid Lock Shift	Number of received LMI messages with invalid lock shift type.
Invalid Information ID	Number of received LMI messages with invalid information identifier.
Invalid Report IE Len	Number of received LMI messages with invalid Report IE Length.
Invalid Report Request	Number of received LMI messages with invalid Report Request.
Invalid Keep IE Len	Number of received LMI messages with invalid Keep IE Length.
Num Status Enq. Rcvd	Number of LMI status inquiry messages received.
Num Status msgs Sent	Number of LMI status messages sent.
Num Status Update Sent	Number of LMI update status messages sent.
Num Status Enq. Sent	Number of LMI status inquiry messages sent.
Num Status msgs Received	Number of LMI status messages received.
Num Status Update Rcvd	Number of LMI asynchronous update status messages received.
Num Status Timeouts	Number of times the status message was not received within the keepalive timer.
Num Status Enq. Timeouts	Number of times the status enquiry message was not received within the T392 DCE timer.

show frame-relay map

To display the current map entries and information about the connections, use the **show frame-relay map** EXEC command.

show frame-relay map

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Sample Display

The following is sample output from the **show frame-relay map** command:

```
Router# show frame-relay map

Serial 1 (administratively down): ip 131.108.177.177
dlci 177 (0xB1,0x2C10), static,
broadcast,
CISCO
TCP/IP Header Compression (inherited), passive (inherited)
```

Table 22 describes significant fields shown in the display.

Table 22 Show Frame-Relay Map Field Descriptions

Field	Description
Serial 1 (administratively down)	Identifies a Frame Relay interface and its status (up or down).
ip 131.108.177.177	Destination IP address.
dlci 177 (0xB1,0x2C10)	DLCI that identifies the logical connection being used to reach this interface. This value is displayed in three ways: its decimal value (177), its hexadecimal value (0xB1), and its value as it would appear on the wire (0x2C10).
static	Indicates whether this is a static or dynamic entry.
CISCO	Indicates the encapsulation type for this map; either CISCO or IETF.
TCP/IP Header Compression (inherited), passive (inherited)	Indicates whether the TCP/IP header compression characteristics were inherited from the interface or were explicitly configured for the IP map.

Related Command

show frame-relay pvc

show frame-relay pvc

To display statistics about PVCs for Frame Relay interfaces, use the **show frame-relay pvc** EXEC command.

show frame-relay pvc [*type number* [*dlci*]]

Syntax Description

type	(Optional) Interface type.
number	(Optional) Interface number.
dlci	(Optional) One of the specific DLCI numbers used on the interface. Statistics for the specified PVC display when a DLCI is also specified.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

To obtain statistics about PVCs on all Frame Relay interfaces, use this command with no arguments.

When the interface is configured as a DCE and the DLCI usage is SWITCHED, the value displayed in the PVC STATUS field is determined by the status of outgoing interfaces (up or down) and the status of the outgoing PVC. The status of the outgoing PVC is updated in the Local Management Interface (LMI) message exchange. PVCs terminated on a DCE interface use the status of the interface to set the PVC STATUS.

If the outgoing interface is a tunnel, the PVC status is determined by what is learned from the tunnel.

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

In the case of a hybrid DTE switch, the PVC status on the DTE side is determined by the PVC status reported by the external Frame Relay network through the LMI.

Congestion control mechanisms are currently not supported, but the switch passes forward explicit congestion notification (FECN) bits, backward explicit congestion notification (BECN) bits, and discard eligibility (DE) bits unchanged from entry to exit points in the network.

Sample Displays

The following is sample output from the **show frame-relay pvc** command:

```
Router# show frame-relay pvc

   PVC Statistics for interface Serial1 (Frame Relay DCE)

   DLCI = 100, DLCI USAGE = SWITCHED, PVC STATUS = ACTIVE

     input pkts 0             output pkts 0            in bytes 0
     out bytes 0              dropped pkts 0           in FECN pkts 0
     in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
     in DE pkts 0             out DE pkts 0
```

```
  pvc create time 0:03:03 last time pvc status changed 0:03:03
  Num Pkts Switched 0

DLCI = 101, DLCI USAGE = SWITCHED, PVC STATUS = INACTIVE

  input pkts 0             output pkts 0            in bytes 0
  out bytes 0              dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  pvc create time 0:02:58 last time pvc status changed 0:02:58
  Num Pkts Switched 0

DLCI = 102, DLCI USAGE = SWITCHED, PVC STATUS = DELETED
  input pkts 0             output pkts 0            in bytes 0
  out bytes 0              dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  pvc create time 0:02:58 last time pvc status changed 0:02:58
  Num Pkts Switched 0
```

The following is sample output from the **show frame-relay pvc** command for multipoint subinterfaces. The output displays both the subinterface number and the DLCI. This display is the same whether the PVC is configured for static or dynamic addressing.

```
DLCI = 300, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.103

 input pkts 10            output pkts 7            in bytes 6222
 out bytes 6034           dropped pkts 0           in FECN pkts 0
 in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
 in DE pkts 0             out DE pkts 0
 pvc create time 0:13:11  last time pvc status changed 0:11:46

DLCI = 400, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.104

 input pkts 20            output pkts 8            in bytes 5624
 out bytes 5222           dropped pkts 0           in FECN pkts 0
 in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
 in DE pkts 0             out DE pkts 0
 pvc create time 0:03:57  last time pvc status changed 0:03:48
```

Table 23 describes the fields shown in the displays.

Table 23 Show Frame-Relay PVC Field Descriptions

Field	Description
DLCI	One of the data link connection identifier (DLCI) numbers for the PVC.
DLCI USAGE	Lists SWITCHED when the router or access server is used as a switch, or LOCAL when the router or access server is used as a DTE.
PVC STATUS	Status of the PVC: ACTIVE, INACTIVE, or DELETED.
INTERFACE = Serial0.103	Specific subinterface associated with this DLCI.
input pkts	Number of packets received on this PVC.
output pkts	Number of packets sent on this PVC.
in bytes	Number of bytes received.
out bytes	Number of bytes sent.
dropped pkts	Number of packets dropped by the router or access server.
in FECN pkts	Number of packets received with the FECN bit set.

Table 23 Show Frame-Relay PVC Field Descriptions (Continued)

Field	Description
in BECN pkts	Number of packets received with the BECN bit set.
out FECN pkts	Number of packets sent with the FECN bit set.
out BECN pkts	Number of packets sent with the BECN bit set.
in DE pkts	Number of DE packets received.
out DE pkts	Number of DE packets sent.
pvc create time	Time the PVC was created.
last time pvc status changed	Time the PVC changed status (active to inactive).
Num Pkts Switched	Number of packets switched within the router or access server; this PVC is the source PVC.

The following is output from the **show frame-relay pvc** command when traffic shaping is in effect:

```
Router# show frame-relay pvc

PVC Statistics for interface Serial1 (Frame Relay DTE)

DLCI = 100, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial1

  input pkts 0             output pkts 0            in bytes 0
  out bytes 0              dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  CIR 9600                 BC 8000                  BE 1600
  pvc create time 11:59:29, last time pvc status changed 11:59:29

List   Queue  Args
1      4      byte-count 100
  Output queues: (queue #: size/max/drops)
     0: 0/20/0 1: 0/20/0 2: 0/20/0 3: 0/20/0 4: 0/20/0
     5: 0/20/0 6: 0/20/0 7: 0/20/0 8: 0/20/0 9: 0/20/0
     10: 0/20/0 11: 0/20/0 12: 0/20/0 13: 0/20/0 14: 0/20/0
     15: 0/20/0 16: 0/20/0
```

Table 24 describes the new fields shown in the display when traffic shaping is in effect.

Table 24 Show Frame-Relay PVC Field Descriptions with Traffic Shaping in Effect

Field	Description
CIR	Current committed information rate (CIR), in bits per second.
BC	Current committed burst size, in bytes.
BE	Current excess burst size, in bytes.
List Queue Ags	Identifier and parameter values for a custom queue list defined for the PVC. These identifiers and values correspond to the command **queue-list 1 queue 4 byte-count 100**.
Output queues	Output queues used for the PVC, with the current size, the maximum size, and the number of dropped frames shown for each queue.

show frame-relay route

Use the **show frame-relay route** EXEC command to display all configured Frame Relay routes, along with their status.

show frame-relay route

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Sample Display

The following is sample output from the **show frame-relay route** command:

```
Router# show frame-relay route

    Input Intf      Input Dlci      Output Intf     Output Dlci  Status
    Serial1         100             Serial2         200          active
    Serial1         101             Serial2         201          active
    Serial1         102             Serial2         202          active
    Serial1         103             Serial3         203          inactive
    Serial2         200             Serial1         100          active
    Serial2         201             Serial1         101          active
    Serial2         202             Serial1         102          active
    Serial3         203             Serial1         103          inactive
```

Table 25 describes significant fields shown in the output.

Table 25 Show Frame-Relay Route Field Descriptions

Field	Description
Input Intf	Input interface and unit.
Input Dlci	Input DLCI number.
Output Intf	Output interface and unit.
Output Dlci	Output DLCI number.
Status	Status of the connection: active or inactive.

show frame-relay svc maplist

To display all the SVCs under a specified map list, use the **show frame-relay svc maplist** EXEC command.

show frame-relay svc maplist *name*

Syntax Description

name	Name of the map list.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.2.

Sample Output

The following example shows, first, the configuration of the map-list *shank* and, second, the corresponding output of the **show frame-relay svc maplist** command. The following lines show the configuration:

```
map-list shank local-addr X121 87654321 dest-addr X121 12345678
 ip 172.21.177.26 class shank ietf
 ipx 123.0000.0c07.d530 class shank ietf
!
map-class frame-relay shank
 frame-relay incir 192000
 frame-relay min-incir 19200
 frame-relay outcir 192000
 frame-relay min-outcir 19200
 frame-relay incbr(bytes) 15000
 frame-relay outcbr(bytes) 15000
```

The following lines show the output of the **show frame-relay svc maplist** command for the preceding configuration.

```
Router# show frame-relay svc maplist shank
Map List : shank
Local Address : 87654321            Type: X121
Destination Address: 12345678       Type: X121

Protocol : ip 172.21.177.26
Protocol : ipx 123.0000.0c07.d530
Encapsulation : IETF
Call Reference : 1              DLCI : 501

Configured Frame Mode Information Field Size :
Incoming : 1500         Outgoing : 1500
Frame Mode Information Field Size :
Incoming : 1500         Outgoing : 1500
Configured Committed Information Rate (CIR) :
Incoming : 192 * (10**3)                Outgoing : 192 * (10**3)
Committed Information Rate (CIR) :
Incoming : 192 * (10**3)                Outgoing : 192 * (10**3)
Configured Minimum Acceptable CIR :
```

```
Incoming : 192 * (10**2)                Outgoing : 192 * (10**2)
Minimum Acceptable CIR :
Incoming : 0 * (10**0)          Outgoing : 0 * (10**0)
Configured Committed Burst Rate (bytes) :
Incoming : 15000                Outgoing : 15000
Committed Burst Rate (bytes) :
Incoming : 15000                Outgoing : 15000
Configured Excess Burst Rate (bytes) :
Incoming : 16000                Outgoing : 1200
Excess Burst Rate (bytes) :
Incoming : 16000                Outgoing : 1200
```

Table 26 describes signigicant fields in the output.

Table 26 Show Frame-Relay SVC Maplist Field Descriptions

Field	Description
Map List	Name of the configured map-list.
Local Address...Type	Configured source address type (E.164 or X.121) for the call.
Destination Address...Type	Configured destination address type (E.164 or X.121) for the call.
Protocol : ip ... Protocol : ipx ...	Destination protocol addresses configured for the map-list.
Encapsulation	Configured encapsulation type (CISCO or IETF) for the specified destination protocol address.
Call Reference	**Call identifier.**
DLCI : 501	Number assigned by the switch as the DLCI for the call.
Configured Frame Mode Information Field Size: Incoming : Outgoing : Frame Mode Information Field Size : Incoming : 1500 Outgoing : 1500	Lines that contrast the configured and actual frame mode information field size settings used for the calls.
Configured Committed Information Rate (CIR) : Incoming : 192 * (10**3) Outgoing : 192 * (10**3) Committed Information Rate (CIR) : Incoming : 192 * (10**3) Outgoing : 192 * (10**3)	Lines that contrast the configured and actual committed information rate (CIR) settings used for the calls.
Configured Minimum Acceptable CIR : Incoming : 192 * (10**2) Outgoing : 192 * (10**2) Minimum Acceptable CIR : Incoming : 0 * (10**0) Outgoing : 0 * (10**0)	Lines that contrast the configured and actual minimum acceptable CIR settings used for the calls.
Configured Committed Burst Rate (bytes) : Incoming : 15000 Outgoing : 15000 Committed Burst Rate (bytes) : Incoming : 15000 Outgoing : 15000	Lines that contrast the configured and actual committed burst rate (bytes) settings used for the calls.

Table 26 Show Frame-Relay SVC Maplist Field Descriptions (Continued)

Field	Description
Configured Excess Burst Rate (bytes) : Incoming : 16000 Outgoing : 1200 Excess Burst Rate (bytes) : Incoming : 16000 Outgoing : 1200	Lines that contrast the configured and actual excess burst rate (bytes) settings used for the calls.

Related Commands

class (map-list configuration)
frame-relay bc
frame-relay cir
frame-relay mincir
map-class frame-relay
map-list

show frame-relay traffic

To display the global Frame Relay statistics since the last reload, use the **show frame-relay traffic** EXEC command.

show frame-relay traffic

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Sample Display

The following is sample output from the **show frame-relay traffic** command:

```
Router# show frame-relay traffic

Frame Relay statistics:
ARP requests sent 14, ARP replies sent 0
ARP request recvd 0, ARP replies recvd 10
```

Information shown in the display is self-explanatory.

show interfaces serial

Use the **show interfaces serial** EXEC command to display information about a serial interface. When using the Frame Relay encapsulation, use the **show interfaces serial** command to display information about the multicast DLCI, the DLCIs used on the interface, and the DLCI used for the Local Management Interface (LMI).

show interfaces serial *number*

Syntax Description

number	Interface number.

Command Mode

EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 10.0.

Use this command to determine the status of the Frame Relay link. This display also indicates Layer 2 status if SVCs are configured.

Sample Displays

The following is sample output from the **show interfaces serial** command for a serial interface with the CISCO LMI enabled:

```
Router# show interface serial 1

Serial1 is up, line protocol is down
  Hardware is MCI Serial
  Internet address is 131.108.174.48, subnet mask is 255.255.255.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 246/255, load 1/255
  Encapsulation FRAME-RELAY, loopback not set, keepalive set (10 sec)
  LMI enq sent  2, LMI stat recvd 0, LMI upd recvd 0, DTE LMI down
  LMI enq recvd 266, LMI stat sent  264, LMI upd sent  0
  LMI DLCI 1023  LMI type is CISCO  frame relay DTE
  Last input 0:00:04, output 0:00:02, output hang never
  Last clearing of "show interface" counters 0:44:32
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  Five minute input rate 0 bits/sec, 0 packets/sec
  Five minute output rate 0 bits/sec, 0 packets/sec
     307 packets input, 6615 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 input packets with dribble condition detected
     266 packets output, 3810 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets, 0 restarts
     178 carrier transitions
```

The display shows the statistics for the LMI as the number of status inquiry messages sent (*LMI enq* and *LMI stat sent*), the number of status messages received (*LMI enq* and *LMI stat recvd*), and the number of status updates received (*LMI upd recvd*). See the *Frame Relay Interface* specification for additional explanations of this output.

The following is sample output from the **show interfaces serial** command for a serial interface with the ANSI LMI enabled:

```
Router# show interface serial 1
Serial1 is up, line protocol is down
  Hardware is MCI Serial
  Internet address is 131.108.174.48, subnet mask is 255.255.255.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 249/255, load 1/255
  Encapsulation FRAME-RELAY, loopback not set, keepalive set (10 sec)
  LMI enq sent  4, LMI stat recvd 0, LMI upd recvd 0, DTE LMI down
  LMI enq recvd 268, LMI stat sent  264, LMI upd sent  0
  LMI DLCI 0  LMI type is ANSI Annex D  frame relay DTE
  Last input 0:00:09, output 0:00:07, output hang never
  Last clearing of "show interface" counters 0:44:57
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  Five minute input rate 0 bits/sec, 0 packets/sec
Five minute output rate 0 bits/sec, 0 packets/sec
     309 packets input, 6641 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     0 input packets with dribble condition detected
     268 packets output, 3836 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets, 0 restarts
     180 carrier transitions
```

Each display provides statistics and information about the type of LMI configured, either *CISCO* for the Cisco LMI type, *ANSI* for the ANSI T1.617 Annex D LMI type, or *ITU-T* for the ITU-T Q.933 Annex A LMI type. See the **show interfaces** command for a description of the other fields displayed by this command.

Related Command

A dagger (†) indicates that the command is documented outside this chapter.

show interfaces †