CHAPTER 9

Frame Relay Commands

Use the commands described in this chapter to configure Frame Relay. Frame Relay was conceived as a protocol for use over serial interfaces and was designed for those networks with large T1 installations.

For Frame Relay configuration information and examples, refer to the "Configuring Frame Relay" chapter in the *Access and Communication Servers Configuration Guide*.

clear frame-relay-inarp

To clear dynamically created Frame Relay maps, which are created by the use of Inverse Address Resolution Protocol (Inverse 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

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

Use the **encapsulation frame-relay** interface configuration command to enable Frame Relay encapsulation. The **no** form of the command to disable Frame Relay.

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

Syntax Description

cisco	(Optional) Uses Cisco's own encapsulation, which is a four-byte header, with two bytes to identify the DLCI and two bytes to identify the packet type. This is the default.
ietf	(Optional) Sets the encapsulation method to comply with the IETF standard (RFCs 1294 and 1490). Use this keyword when connecting to another vendor's equipment across a Frame Relay network.

Default

Enabled

Command Mode

Interface configuration

Usage Guidelines

If the optional keyword is omitted, the access server uses Cisco's own encryption, 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 serial interface 1:

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

Use the **ietf** keyword if your access server is connected to another vendor's equipment across a Frame Relay network to conform with RFCs 1294 and 1490:

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

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*

Syntax Description

size	Number of packets to be held 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.

Default

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

For purposes of the Frame Relay broadcast queue, broadcast traffic is defined as packets that have been replicated for transmission on multiple DLCIs, but not including the original routing packet or SAP packet, which passes through the normal queue. Due to timing sensitivity, bridged broadcasts and spanning tree packets are 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 will be 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 upon 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 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

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 dlci 170
```

Related Command

frame-relay de-list

frame-relay de-list

To define a Discard Eligibility (DE) list specifying which packets will have the DE bit set and thus will be 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* | *type number*} *characteristic*
no frame-relay de-list *list-number* {*protocol* | *type number*} *characteristic*

Syntax Description

list-number	Number of the DE list
protocol	Protocol keyword.
protocol	One of the following keywords corresponding to a supported protocol or device: **arp**—Address Resolution Protocol **appletalk**—AppleTalk **clns**—ISO Connectionless Network Service **clns_es**—CLNS end systems **compressedtcp**—Compressed TCP **ip**—Internet Protocol **ipx**—Novell Internet Packet Exchange
type number	Any valid interface type and unit number, such as serial 0.
characteristic	You must supply one of the following: **fragments**—Classify fragmented IP packets. **tcp** *port*—TCP packets to or from a specified port. **udp** *port*—UDP packets to or from a specified port. **list** *access-list-number*—Previously defined access list number **gt** *bytes*—Packets larger than the specified number of bytes will have the DE bit set. **lt** *bytes*—Packets smaller than the specified number of bytes will have the DE bit set.

Default

Discard eligibility is not defined.

Command Mode

Global configuration

Usage Guidelines

To remove an entire DE list, use the **no** form of this command with no options and arguments.

This prioritization 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 ip gt 512
```

frame-relay interface-dlci

To assign a DLCI to a specified Frame Relay subinterface on the 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* [*option*]
no frame-relay interface-dlci *dlci* [*option*]

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

Syntax Description

dlci	DLCI number to be used on the specified subinterface.
option	(Optional) Broadcast or encapsulation keyword, as defined in the "Frame Relay Interface-DLCI Option Keywords" table.
protocol ip *ip-address*	Indicates the IP address of the serial interface of a new access server onto which an access server configuration file is to be autoinstalled over a Frame Relay network. See the "Usage Guidelines" section for information about when to use this option.

Default

No DLCI is assigned.

Command Mode

Interface configuration

Usage Guidelines

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

Subinterfaces are logical interfaces associated with a physical interface. To use this command, you must be in subinterface configuration mode. This requires making the logical subinterface assignment before assigning any DLCIs and any encapsulation or broadcast options. See the following example.

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

Table 1 lists the **frame-relay interface-dlci** option keywords.

Table 1 Frame Relay Interface-DLCI Option Keywords

Keyword	Option
broadcast	Broadcasts should be forwarded out through this interface.
ietf	IETF Frame Relay encapsulation.
cisco	Cisco Frame Relay encapsulation.

Example

The following example assigns DLCI 100 to subinterface serial 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
```

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 the command to disable the switch.

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

Syntax Description

dce	(Optional) Access server functions as a switch connected to a access server.
dte	(Optional) Access server is connected to a Frame Relay network.
nni	(Optional) Access server functions as a switch connected to a switch (supports NNI connections).

Default

dte

Command Mode

Interface configuration

Example

The following example configures a DTE switch type:

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

frame-relay inverse-arp

Use the **frame-relay inverse-arp** interface configuration command to enable the Inverse Address Resolution Protocol (Inverse ARP) on the access server configured for Frame Relay. Use the **no** form of the command to disable this feature.

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

Syntax Description

protocol	Supported protocols: **appletalk**, **ip**, **ipx**, and **vines**.
dlci	DLCI number for the interface. Acceptable numbers are integers in the range 16 to 1007.

Default

Enabled

Command Mode

Interface configuration

Usage Guidelines

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

In Frame Relay, permanent virtual circuits 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 flags dynamically created virtual circuits created by Inverse ARP with the word dynamic.

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 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) Compress the outgoing TCP/IP packet header only if the incoming packet has 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 applies to interfaces that support Frame Relay encapsulation, specifically serial ports.

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 will inherit the compression characteristics of the interface, unless header compression is explicitly rejected or modified by using the **frame-relay map ip header compression** command.

Example

The following example configures interface serial 1 to use IETF encapsulation and passive TCP header compression:

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

Related Command

frame-relay ip tcp header-compression

frame-relay keepalive

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

frame-relay keepalive *seconds*
no frame-relay keepalive

Syntax Description

seconds	An integer that defines the keepalive interval in seconds. The interval must be set and must be less than the interval set on the switch; see the **frame-relay lmi-t392dce** command description.

Default

10 seconds

Command Mode

Interface configuration

Usage Guidelines

The **frame-relay keepalive** and **keepalive** commands perform the same function; both commands enable the keepalive sequence. The keepalive sequence is part of the LMI protocol, so these commands also control the enabling and disabling of the LMI.

When viewing the configuration information using the **show configuration** command, only the **keepalive** command setting is included; you will not see the **frame-relay keepalive** setting.

Note When booting from a network (TFTP) server over Frame Relay, it might be necessary to disable keepalives.

Example

The following example sets the keepalive timer on the server for a period that is 2 or 3 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
frame-relay keepalive 8
```

Related Commands

A dagger (†) indicates that the command is documented in another chapter.

keepalive †
frame-relay lmi-t392dce

frame-relay lmi-n391dte

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

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

Use this command when the interface is configured as data terminal equipment (DTE) or 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 by the access server 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

Use the **frame-relay lmi-n392dce** interface configuration command to set the data communications equipment (DCE) and NNI error threshold. Use the **no frame-relay lmi-n392dce** command to remove the current setting.

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

2 errors

Command Mode

Interface configuration

Usage Guidelines

In Cisco's implementation, N392 errors must occur within the number defined by the N393 event count in order for the link to be declared down. Therefore, the threshold value for this command must be less than the count value defined in the **frame-relay lmi-n393dce** command.

Example

In the following example, the LMI failure threshold is set to 3. The access server 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

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

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

2 errors

Command Mode

Interface configuration

Example

In the following example, the LMI failure threshold is set to 3. The access server 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

Use the **frame-relay lmi-n393dce** interface configuration command to set the DCE and NNI monitored events count. Use the **no** form of the command to remove the current setting.

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

2 events

Command Mode

Interface configuration

Usage Guidelines

This command and the **frame-relay lmi-n392dce** command define the condition that causes the link to be declared down. In Cisco's implementation, N392 errors must occur within the *events* 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 access server 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

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

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

Syntax Description

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

Default

2 events

Command Mode

Interface configuration

Example

In the following example, the LMI monitored events count is set to 3. The access server 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

Use the **frame-relay lmi-t392dce** interface configuration command to set the polling verification timer on a DCE or NNI interface. Use the **no** form of the command to remove the current setting.

frame-relay lmi-t392dce *timer*
no frame-relay lmi-t392dce *timer*

Syntax Description

timer	Polling verification timer value (in seconds). Acceptable value is a positive integer in the range 5 through 30.

Default

15 seconds

Command Mode

Interface configuration

Usage Guidelines

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

frame-relay keepalive

frame-relay lmi-type

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

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

Syntax Description

ansi	Annex D defined by ANSI standard T1.617
cisco	Group of 4 LMI
q933a	ITU-T[1] Q.933 Annex A

1. 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

Cisco LMI

Command Mode

Interface configuration

Usage Guidelines

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

The **no** form of the command is included to maintain backwards compatibility. If the LMI type is changed from ANSI or ITU-T, the LMI type reverts to the Cisco type.

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

Example

The following is an example of the commands you enter to select the ANSI Annex D LMI type:

```
interface serial 1
encapsulation frame-relay
frame-relay lmi-type ansi
```

frame-relay local-dlci

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

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

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.

Syntax Description

number	Local (source) DLCI number for the interface

Default

No source DLCI is set.

Command Mode

Interface configuration

Usage Guidelines

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

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 stack method.

Default

No mapping is defined.

Command Mode

Interface configuration

Usage Guidelines

There can be many DLCIs known by a router or access server that can send data to many different places, but they are all multiplexed over one physical link. The Frame Relay map 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 using 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 commands

frame-relay payload-compress packet-by-packet

frame-relay map ip tcp header-compression

To assign header-compression characteristic to an IP map that differs 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 the command. To disable TCP/IP header compression on the IP map, use the **nocompress** form of the command.

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

Syntax Description

ip-address	IP address.
dlci	DLCI number.
broadcast	(Optional) Forward broadcasts to the specified IP address.
cisco	(Optional) Use Cisco's proprietary encapsulation. This is the default.
ietf	(Optional) Use RFC 1294 encapsulation. No TCP header compression is done if IETF encapsulation is chosen for the IP map or the associated interface.
nocompress	(Optional) Disable TCP/IP header compression for this map.
active	Compress the header of every outgoing TCP/IP packet.
passive	Compress the header of an outgoing TCP/IP packet only if the incoming TCP/IP packet had a compressed header.

Default

The default encapsulation keyword is **cisco**.

Command Mode

Interface configuration

Usage Guidelines

IP maps inherit the compression characteristics of the associated interface unless this command is used to provide different characteristics. This command can also be used to configure 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 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 interface serial 1 to enable active TCP header compression.

```
interface serial 1
encapsulation frame-relay
ip address 172.30.177.170 255.255/255/0
frame-relay map ip 172.30.177.170 190 cisco tcp header-compression active
```

Related Command

frame-relay ip tcp header-compression

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 the command to remove the multicast group.

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

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.

Syntax Description

number	Multicast DLCI. (Note that this is *not* the multicast group number, which is an entirely different value.)

Default

No DLCI is defined.

Command Mode

Interface configuration

Usage Guidelines

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

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 the stack 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 and arguments.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

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 Commands

frame-relay map

frame-relay priority-dlci-group

To enable DLCI-based Frame Relay priority levels and define the priority level of specified DLCIs, 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 high priority.
medium-DLCI	DLCI that is to have medium priority.
normal-DLCI	DLCI that is to have normal priority.
low-DLCI	DLCI that is to have lowest priority.

Default

Disabled

Command Mode

Interface configuration

Usage Guidelines

This command applies at the subinterface level.

Priority levels in descending order are high, medium, normal, and low.

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 priority levels, the last DLCI specified in the command line is used as the value of the remaining arguments. For example, the following two commands are equivalent:

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

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

Related Command

frame-relay map
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 the 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 the access server uses to transmit the packet
out-dlci	DLCI the access server uses to transmit the packet over the specified *out-interface*

Default

No static route is specified.

Command Mode

Interface configuration

Examples

The following example configures a static route that allows packets in DLCI 100 and transmits packets out over DLCI 200 on serial interface 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 serial interface 1 and serial interface 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
```

form of the**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 the command to disable switching.

frame-relay switching
no frame-relay switching

Syntax Description

This command has no arguments or keywords.

Command Mode

Global configuration

Default

Disabled

Usage Guidelines

This command must be added 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
```

show frame-relay lmi

Use the **show frame-relay lmi** EXEC command to display statistics about the Local Management Interface (LMI).

show frame-relay lmi [*interface*]

Syntax Description

interface	(Optional) LMI statistics for only the specified interface

Command Mode

EXEC

Usage Guidelines

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 9-1 describes significant fields shown in the displays.

Table 9-1 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 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 ip tcp header-compression

To display statistics and tcp 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

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 9-2 describes the fields shown in the display.

Table 9-2 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.
bytes sent	Actual number of bytes transmitted.

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 map

Use the **show frame-relay map** EXEC command to display the current Frame Relay map entries and information about these connections.

show frame-relay map

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

Sample Display

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

```
router# show frame-relay map

Serial 1 (administratively down): ip 172.30.177.177
dlci 177 (oxB1,0x2C10), static,
broadcast,
CISCO
TCP/IP Header Compression (inherited), passive (inherited)
```

Table 9-3 describes significant fields shown in the display.

Table 9-3 Show Frame-Relay Map Field Descriptions

Field	Description
Serial 1 (administratively down):	Identifies a Frame Relay interface and its status (up or down).
IP 172.30.177.177:	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 or not 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 header compression characteristics were inherited from the interface or were explicitly configured for the IP map.

Related Command

frame-relay inverse-arp

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) DLCI number for the interface. Statistics for the specified PVC display when a DLCI is also specified.

Command Mode

EXEC

Usage Guidelines

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

When the interface is configured as a pure DCE, the PVC status is determined by the status of incoming and outgoing interfaces and line status. If the outgoing interface is a tunnel, the final PVC status is determined by what is learned from the tunnel.

If the remote Frame Relay interface goes down, the status is reflected in the LMI over the tunnel. If the tunnel goes down, it is reflected by its line protocol when it does not have a route to the other end of the tunnel.

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

Congestion control mechanisms are currently not supported, but the switch will pass FECN, BECN, and DE bits unchanged from ingress to egress points in the network.

Sample Display

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
```

Table 9-4 describes the fields shown in the display.

Table 9-4 Show Frame-Relay PVC Field Descriptions

Field	Description
DLCI	DLCI number for the interface.
DLCI USAGE	Lists SWITCHED when the access server is used as a switch, or LOCAL when the access server is used as a DTE.
PVC STATUS	Status of the PVC: ACTIVE, INACTIVE, or DELETED.
input pkts	Number of input packets.
output pkts	Number of output packets.
in bytes	Number of incoming bytes.
out bytes	Number of outgoing bytes.
dropped pkts	Number of dropped packets.
in FECN pkts	Number of incoming FECN packets.
out FECN pkts	Number of outgoing FECN packets.
in BECN pkts	Number of incoming BECN packets.
out BECN pkts	Number of outgoing BECN packets.
in DE pkts	Number of incoming DE packets.
out DE pkts	Number of outgoing DE packets.
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 switched packets seen.

show frame-relay route

Enter the **show frame-relay route** EXEC command at the system prompt 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

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 9-5 describes significant fields shown in the display.

Table 9-5 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 traffic

Use the **show frame-relay traffic** EXEC command to display the access server's global Frame Relay statistics since the last reload.

show frame-relay traffic

Syntax Description

This command has no arguments or keywords.

Command Mode

EXEC

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 on the multicast DLCI, the DLCI of the interface, and the LMI DLCI used for the Local Management Interface.

The multicast DLCI and the local DLCI can be set using the **frame-relay multicast-dlci** and the **frame-relay local-dlci** commands, or provided through the Local Management Interface. The status information is taken from the LMI, when active.

show interfaces serial *number*

Syntax Description

number	Interface number.

Command Mode

EXEC

Sample Displays

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

```
router# show interfaces serial 1

Serial1 is up, line protocol is down
  Hardware is MCI Serial
  Internet address is 172.30.174.48, 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 sent), the number of status messages received (LMI recvd), and the number of status updates received (upd recvd). See the *Frame Relay Interface* specification for additional explanations of this output.

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

```
router# show interfaces serial 1
Serial1 is up, line protocol is down
  Hardware is MCI Serial
  Internet address is 172.30.174.48, 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 description for 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 in another chapter.

show interfaces †