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 *Router Products Configuration Guide*.

clear frame-relay-inarp

To clear dynamically created Frame Relay maps, which are created by the use of 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 encapsulation frame-relay** command disables Frame Relay.

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

Syntax Description

no keyword	Uses Cisco's own encapsulation, which is a four-byte header, with two bytes for the DLCI and two bytes to identify the packet type.
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

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 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 trasnmitted 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 bytes
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 it does not include 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 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. Consider starting with 20 packets per DLCI.

In general, 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 interface-dlci

Use the **frame-relay interface-dlci** interface configuration command to allow use of subinterfaces in the Frame Relay network. To remove this feature, use the **no frame-relay interface-dlci** command.

frame-relay interface-dlci *dlci* [*option*]
no frame-relay interface-dlci *dlci* [*option*]

Syntax Description

dlci	DLCI number for the interface
option	(Optional) Broadcast or encapsulation keyword, as defined in Table 9-1

Table 9-1 Frame Relay Subinterface Configuration Options

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

Default

None

Command Mode

Interface configuration

Usage Guidelines

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

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 the DLCI
frame-relay interface-dlci 100
```

Use a question mark at the command parser to obtain a list of acceptable arguments, as needed.

frame-relay intf-type

Use the **frame-relay intf-type** interface configuration command to configure a Frame Relay switch type. Use the **no frame-relay intf-type** 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 functions as a switch connected to a router.
dte	(Optional) Router is connected to a Frame Relay network.
nni	(Optional) Router 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 (InvARP) on the router configured for Frame Relay. Use the **no frame-relay inverse-arp** 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	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 router 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 VC, 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 VCs 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 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 frame-relay keepalive** command to disable this capability.

frame-relay keepalive *number*
no frame-relay keepalive

Syntax Description

number	An integer that defines the keepalive interval. 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 Local Management Interface (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 netbooting 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 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
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 frame-relay lmi-n391dte** 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 router 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 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

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 three. 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

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

Command Mode

Interface configuration

Example

In the following example, the LMI failure threshold is set to three. 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

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

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 three. 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

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

Command Mode

Interface configuration

Example

In the following example, the LMI monitored events count is set to three. 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

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

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:

```
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 frame-relay lmi-type** 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 Serial1
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 frame-relay local-dlci** 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

Use the **frame-relay map** interface configuration command to define the mapping between an address and the DLCI used to connect to the address. Use the **no frame-relay map** command to delete the map entry.

frame-relay map *protocol protocol-address dlci* [**broadcast**] [**ietf** | **cisco**]
no frame-relay map *protocol protocol-address*

Syntax Description

protocol	Supported protocols: **appletalk**, **decnet**, **ip**, **xns**, **ipx**, and **vines**.
protocol-address	Address for the protocol.
dlci	DLCI number for the interface.
broadcast	(Optional) Broadcasts should be forwarded 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 "Usage Guidelines" for more detail).
ietf	(Optional) IETF form of Frame Relay encapsulation. Use when the router is connected to another vendor's equipment across a Frame Relay network.
cisco	(Optional) Cisco encapsulation method.

Default

No mapping is defined.

Command Mode

Interface configuration

Usage Guidelines

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

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.

OSPF treats a nonbroadcast, multiaccess network such as Frame Relay much the same way it treats a broadcast network in that it requires selection of a designated router. 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 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.

frame-relay map bridge

Use the **frame-relay map bridge** interface configuration command to specify that broadcasts should be forwarded when bridging. Use the **no frame-relay map bridge** command to delete the map entry.

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

Syntax Description

dlci	The DLCI number for the interface.
broadcast	(Optional) Broadcasts should be forwarded to this address when multicast is not enabled.

Default

No broadcasts are forwarded.

Command Mode

Interface configuration

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 *Router Products Configuration Guide* for more examples of subinterfaces.

frame-relay map clns

Use the **frame-relay map clns** interface configuration command to specify that broadcasts should be forwarded when routing using ISO CLNS. Use the **no frame-relay map clns** 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 for the interface.
broadcast	(Optional) Broadcasts should be forwarded to this address when multicast is not enabled.

Default

No broadcasts are forwarded.

Command Mode

Interface configuration

Example

The following example uses DLCI 125 for ISO CLNS routing:

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

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 frame-relay multicast-dlci** 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 route

Use the **frame-relay route** interface configuration command to specify the static route for PVC switching. Use the **no frame-relay route** 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 router uses to transmit the packet.
out-dlci	DLCI the router 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 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 switching

Use the **frame-relay switching** global configuration command to enable PVC switching on a Frame Relay DCE or an NNI. Use the **no frame-relay switching** 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 9-2 describes significant fields shown in the output.

Table 9-2 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 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

Serial2 (up): IP 131.108.122.2 dlci 20(0x14,0x0440), dynamic
         CISCO, BW= 56000, status defined, active
```

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

Table 9-3 Show Frame-Relay Map Field Descriptions

Field	Description
Serial2 (up):	Identifies a Frame Relay interface and its status (up or down).
IP 131.108.122.2:	Destination IP address.
dlci 20 (0x14,0x0440)	DLCI that identifies the logical connection being used to reach this interface. This value is displayed in three ways; its decimal value (20), its hexadecimal value (0x14), and its value as it would appear on the wire (0x0440).
dynamic	Indicates whether or not this is a static, dynamic, or broadcast entry.
CISCO	Specifies the encapsulation type: CISCO or IETF.
BW= 56000	The bandwidth information that was in the LMI packet the router received from the switch, as described in the PVC information element in the LMI specification.
status defined, active	Indicates whether the DLCI is active or inactive. This information is displayed if the LMI defines it.

If the optional **broadcast** keyword is entered for a static map entry, this also will be shown.

Sample Display Using CLNS

The following is sample output for the **show frame-relay map** command when CLNS is enabled:

```
Router# show frame-relay map

Serial0 (up): CLNS  dlci 100(0x64,0x1840), static, broadcast,
   CISCO, BW = 64000, status defined, active
Serial0: CLNS  dlci 102(0x66,0x1860), static, broadcast,
   CISCO, BW = 64000, status defined, active
```

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

Table 9-4 Show Frame-Relay Map with CLNS Field Descriptions

Field	Description
Serial0 (up):	Indicates the interface associated on the DLCI in this entry and its status (up or down).
CLNS	Indicates the higher-level protocol used on the DLCI in this entry.
dlci 100	Number of the DLCI in this entry.
(0x64,0x1840)	0x64 indicates the hexadecimal equivalent of the DLCI number (100 in this case). 0x1840 is the value used by the Frame Relay code for the first two bytes of a packet when sending to this particular DLCI. This translation is shown in the LMI specification.
static	Indicates whether this is a static or dynamic entry.
broadcast	Indicates that any broadcast from the CLNS code which is sent to the interface in this entry (Serial 0, in this case), should be sent on this DLCI (100, in this case).
CISCO	Specifies the LMI type: CISCO, ANSI, ITU-T
BW = 64000	Bandwidth information that was in the LMI packet the router received from the switch, as described in the PVC information element in the LMI specification.
status defined, active	Indicates whether the DLCI is active or inactive. This information is displayed if the LMI defines it.

Related Commands

clear frame-relay-inarp
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 unit number.
dlci	(Optional) A specific DLCI number used on the interface. Statistics for the specified PVC display when a DLCI is 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 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 status of the outgoing PVC (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 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 1 describes the fields shown in the display.

Table 1 Show Frame-Relay PVC Field Descriptions

Field	Description
DLCI	Data Link Connection Identifier for the PVC.
DLCI USAGE	Lists SWITCHED when the router is used as a switch, or LOCAL when the router is used as a DTE.
PVC STATUS	Status of the PVC: ACTIVE, INACTIVE, or DELETED.
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.
in FECN pkts	Number of packets received with the FECN bit set.
in BECN pkts	Number of packets received with the BECN bit set.
out FECN pkts	Number of packets sent with the FECN bit set.
out BECN pkts	Number of packets sent with the BECN bit set.
in DE pkts	Number of DE packets received.
out DE pkts	Number of DE packets sent.
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; this PVC is the source PVC.

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 9-1 describes significant fields shown in the output.

Table 9-1 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 router'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 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 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 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 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†