

# frame-relay lapf n201

To set the Link Access Procedure for Frame Relay (LAPF) N201 value (the maximum length of the Information field of the LAPF I frame), use the **frame-relay lapf n201** command in interface configuration mode. To reset the maximum length of the Information field to the default of 260 bytes (octets), use the **no** form of this command.

**frame-relay lapf n201** *bytes*

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

<b>Syntax Description</b>	<i>bytes</i> Maximum number of bytes in the Information field of the LAPF I frame. Range is from 1 to 16384. Default is 260.
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<b>Defaults</b>	260 bytes
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<b>Command Modes</b>	Interface configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	11.2	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

<b>Usage Guidelines</b>	<p>This command is used to tune Layer 2 system parameters to work well with the Frame Relay switch. Normally, you do not need to change the default setting.</p> <p>Manipulation of Layer 2 parameters is not recommended if you do not know well the resulting functional change. For more information, refer to the ITU-T Q.922 specification for LAPF.</p>
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<b>Examples</b>	<p>The following example resets the N201 maximum information field length to the default value:</p> <pre>no frame-relay lapf n201</pre>
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# frame-relay lapf t200

To set the Link Access Procedure for Frame Relay (LAPF) retransmission timer value T200, use the **frame-relay lapf t200** command in interface configuration mode. To reset the T200 timer to the default value of 15, use the **no** form of this command.

**frame-relay lapf t200** *tenths-of-a-second*

**no frame-relay lapf t200**

## Syntax Description

*tenths-of-a-second* Time, in tenths of a second. Range is from 1 to 100. Default is 15.

## Defaults

15 tenths of a second (1.5 seconds)

## Command Modes

Interface configuration

## Command History

Release	Modification
11.2	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

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

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

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

## Examples

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

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

## Related Commands

Command	Description
<b>frame-relay lapf t203</b>	Sets the LAPF link idle timer value T203 of DLCI 0.

# frame-relay lapf t203

To set the Link Access Procedure for Frame Relay (LAPF) link idle timer value T203 of data-link connection identifier (DLCI) 0, use the **frame-relay lapf t203** command in interface configuration mode. To reset the link idle timer to the default value, use the **no** form of this command.

**frame-relay lapf t203** *seconds*

**no frame-relay lapf t203**

<b>Syntax Description</b>	<i>seconds</i> Maximum time allowed with no frames exchanged. Range is from 1 to 65535 seconds. Default is 30.
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<b>Defaults</b>	30 seconds
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<b>Command Modes</b>	Interface configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	11.2	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

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

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

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

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

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

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

# frame-relay lmi-n391dte

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

**frame-relay lmi-n391dte** *keep-exchanges*

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

## Syntax Description

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

## Defaults

6 keep exchanges

## Command Modes

Interface configuration

## Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

Use this command when the interface is configured as data terminal equipment (DTE) or a Network-to-Network Interface (NNI) as a means of setting the full status message polling interval.

## Examples

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

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

# frame-relay lmi-n392dce

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

**frame-relay lmi-n392dce** *threshold*

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

Syntax Description	<i>threshold</i>	Error threshold value. Acceptable value is a positive integer in the range from 1 to 10.
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Defaults	2 errors
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Command Modes	Interface configuration
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Command History	Release	Modification
	10.0	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

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 <b>frame-relay lmi-n393dce</b> command.
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Examples	The following example sets the LMI failure threshold to 3. The router acts as a Frame Relay DCE or NNI switch.
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```
interface serial 0
 frame-relay intf-type DCE
 frame-relay lmi-n392dce 3
```

Related Commands	Command	Description
	<b>frame-relay lmi-n393dce</b>	Sets the DCE and NNI monitored events count.

## frame-relay lmi-n392dte

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

**frame-relay lmi-n392dte** *threshold*

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

<b>Syntax Description</b>	<i>threshold</i> Error threshold value. Acceptable value is a positive integer in the range from 1 to 10.
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<b>Defaults</b>	3 errors
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<b>Command Modes</b>	Interface configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.	
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.	

<b>Examples</b>	The following example sets the Local Management Interface (LMI) failure threshold to 3. The router acts as a Frame Relay DTE or NNI switch.
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```
interface serial 0
 frame-relay intf-type DTE
 frame-relay lmi-n392dte 3
```

# frame-relay lmi-n393dce

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

**frame-relay lmi-n393dce** *events*

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

## Syntax Description

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

## Defaults

2 events

## Command Modes

Interface configuration

## Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

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

## Examples

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

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

## Related Commands

Command	Description
<b>frame-relay lmi-n392dce</b>	Sets the DCE and the NNI error threshold.

## frame-relay lmi-n393dte

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

**frame-relay lmi-n393dte** *events*

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

<b>Syntax Description</b>	<i>events</i> Value of monitored events count. Acceptable value is a positive integer in the range from 1 to 10.
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<b>Defaults</b>	4 events
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<b>Command Modes</b>	Interface configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	10.0	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

<b>Examples</b>	The following example sets the Local Management Interface (LMI) monitored events count to 3. The router acts as a Frame Relay DTE or NNI switch.
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```
interface serial 0
 frame-relay intf-type DTE
 frame-relay lmi-n393dte 3
```

# frame-relay lmi-t392dce

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

**frame-relay lmi-t392dce** *seconds*

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

<b>Syntax Description</b>	<i>seconds</i> Polling verification timer value from 5 to 30 seconds.
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<b>Defaults</b>	15 seconds
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<b>Command Modes</b>	Interface configuration
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<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	10.0	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

<b>Usage Guidelines</b>	The value for the timer must be greater than the DTE or NNI keepalive timer.
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<b>Examples</b>	The following example indicates a polling verification timer on a DCE or NNI interface set to 20 seconds:
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```
interface serial 3
 frame-relay intf-type DCE
 frame-relay lmi-t392dce 20
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
		<b>keepalive (LMI)</b>

# frame-relay lmi-type

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

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

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

## Syntax Description

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

## Defaults

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

## Command Modes

Interface configuration

## Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

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

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

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

## Examples

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

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

# frame-relay local-dlci

To set the source data-link connection identifier (DLCI) for use when the Local Management Interface (LMI) is not supported, use the **frame-relay local-dlci** command in interface configuration mode. To remove the DLCI number, use the **no** form of this command.

**frame-relay local-dlci** *number*

**no frame-relay local-dlci**

## Syntax Description

<i>number</i>	Local (source) DLCI number to be used.
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## Defaults

No source DLCI is set.

## Command Modes

Interface configuration

## Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

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



### Note

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

## Examples

The following example specifies 100 as the local DLCI:

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

## frame-relay map

To define the mapping between a destination protocol address and the data-link connection identifier (DLCI) or Frame Relay permanent virtual circuit (PVC) bundle that connects to the destination address, use the **frame-relay map** command in interface configuration mode. To delete the map entry, use the **no** form of this command.

```
frame-relay map protocol protocol-address { dcli | vc-bundle vc-bundle-name } [broadcast] [ietf | cisco] [payload-compression { packet-by-packet | frf9 stac [one-way-negotiation] [ratio level] [skip-zero-sync] [software | hardware-options] | data-stream stac [one-way-negotiation] [ratio level] [software | hardware-options] }]
```

```
no frame-relay map protocol protocol-address
```

### Syntax Description

<i>protocol</i>	One of the following values: <b>appletalk</b> , <b>decnet</b> , <b>dls</b> , <b>ip</b> , <b>ipx</b> , <b>llc2</b> , and <b>rsrb</b> .
<i>protocol-address</i>	Destination protocol address.
<i>dcli</i>	DLCI number used to connect to the specified protocol address on the interface. Acceptable numbers are integers from 16 through 1007, inclusive.
<b>vc-bundle</b> <i>vc-bundle-name</i>	A specific Frame Relay PVC bundle configured on the interface.
<b>broadcast</b>	(Optional) Forwards broadcasts to this address when multicast is not enabled (see the <b>frame-relay multicast-dcli</b> command for more information about multicasts). This keyword also simplifies the configuration of Open Shortest Path First (OSPF) (see the “Usage Guidelines” section for more detail).
<b>ietf</b>	(Optional) Internet Engineering Task Force (IETF) form of Frame Relay encapsulation, based on RFC 1490 and RFC 2427. Used when the router or access server is connected to another vendor’s equipment across a Frame Relay network.
<b>cisco</b>	(Optional) Cisco-proprietary encapsulation method consisting of a four-byte header, with two bytes to identify the DLCI and two bytes to identify the packet type.
<b>payload-compression</b>	(Optional) Enables payload compression.
<b>packet-by-packet</b>	(Optional) Packet-by-packet payload compression using the Stacker method.
<b>frf9 stac</b>	(Optional) Enables FRF.9 compression using the Stacker method. <ul style="list-style-type: none"> <li>• If the router contains a CSA<sup>1</sup>, compression is performed in the CSA hardware (hardware compression).</li> <li>• If the CSA is not available, compression is performed in the software installed on the VIP2<sup>2</sup> (distributed compression).</li> <li>• If the VIP2 is not available, compression is performed in the main processor of the router (software compression).</li> </ul>

<b>one-way-negotiation</b>	(Optional) Enables one-way negotiation. Use this keyword if your router will be negotiating compression with another device that is running Cisco IOS Release 12.1(9) or earlier releases. Later Cisco IOS releases use a two-way handshake by default to negotiate compression.
<b>ratio</b> <i>level</i>	(Optional) Sets throughput versus compression ratio. This option is available only with hardware compression. Possible values for the <i>level</i> argument are as follows:  <b>high</b> —high compression versus low throughput <b>medium</b> —medium compression versus medium throughput <b>low</b> —low compression versus high throughput (default)
<b>software</b>	(Optional) Specifies that compression is implemented in the Cisco IOS software installed in the main processor of the router.
<i>hardware-options</i>	(Optional) Choose one of the following hardware options:  <b>caim</b> <i>element-number</i> —Enables the CAIM <sup>3</sup> to perform compression. <b>distributed</b> —Specifies that compression is implemented in the software that is installed in a VIP2. If the VIP2 is not available, compression is performed in the main processor of the router (software compression). This option applies only to the Cisco 7500 series routers. This option is not supported with data-stream compression. <b>csa</b> <i>csa_number</i> —Specifies the CSA to use for a particular interface. This option applies only to Cisco 7200 series routers.
<b>skip-zero-sync</b>	(Optional) Causes compression frames to be numbered starting from 1 rather than 0. Use this keyword if your router will be interoperating with a device conforming to IBM partner conventions.
<b>data-stream stac</b>	(Optional) Enables data-stream compression using the Stacker method.  <ul style="list-style-type: none"> <li>• If the router contains a CSA, compression is performed in the CSA hardware (hardware compression).</li> <li>• If the CSA is not available, compression is performed in the main processor of the router (software compression).</li> </ul>

1. CSA = compression service adapter
2. VIP2 = second-generation Versatile Interface Processor
3. CAIM = compression Advanced Interface Module

**Defaults**

No mapping is defined.

**Command Modes**

Interface configuration

## Command History

Release	Modification
10.0	This command was introduced.
11.3	The <b>payload-compress frf9 stac</b> keyword was added.
12.1(5)T	The <b>payload-compress data-stream stac</b> keyword was added.
12.2(4)T	The <b>skip-zero-sync</b> keyword was added.
12.2(13)T	The <b>vc-bundle</b> <i>vc-bundle-name</i> keyword and argument pair was added. The <b>apollo</b> , <b>vines</b> , and <b>xns</b> arguments were removed because Apollo Domain, Banyan VINES, and Xerox Network Systems are no longer available in the Cisco IOS software. The <b>one-way-negotiation</b> keyword was added.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

Many DLCIs can be known by a router or access server and can send data to many different places, but they are all multiplexed over one physical link. The Frame Relay map defines the logical connection between a specific protocol and address pair and the correct DLCI or PVC bundle.

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

Data-stream compression is supported on interfaces and virtual circuits (VCs) using Cisco proprietary encapsulation. When the **data-stream stac** keyword is specified, Cisco encapsulation is automatically enabled. FRF.9 compression is supported on IETF-encapsulated VCs and interfaces. When the **frf9 stac** keyword is specified, IETF encapsulation is automatically enabled.

Packet-by-packet compression is Cisco-proprietary and will not interoperate with routers of other manufacturers.

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

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

We recommend that you shut down the interface before changing encapsulation types. Although shutting down the interface is not required, it ensures that the interface is reset for the new encapsulation.

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

The **broadcast** keyword may 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. When the **frame-relay map** command (with the **broadcast** keyword) and the **ip ospf network** command (with the **broadcast** keyword) are configured, there is no need to configure any neighbors manually. OSPF will run automatically over the Frame Relay network as a broadcast network. (See the **ip ospf network** interface command for more detail.)

**Note**

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

**Examples****IP Address to DLCI Mapping: Example**

The following example maps the destination IP address 172.16.123.1 to DLCI 100:

```
interface serial 0
  frame-relay map ip 172.16.123.1 100 broadcast
```

OSPF will use DLCI 100 to broadcast updates.

**IP Address to Frame Relay PVC Bundle Mapping: Example**

The following example maps the destination IP address 172.16.123.1 to the Frame Relay PVC bundle named "MAIN-1":

```
interface serial 0
  frame-relay map ip 172.16.123.1 vc-bundle MAIN-1 broadcast
```

**FRF.9 Compression: Example**

The following example shows FRF.9 compression configuration using the **frame-relay map** command:

```
interface serial2/0/1
  ip address 172.16.1.4 255.255.255.0
  no ip route-cache
  encapsulation frame-relay ietf
  no keepalive
  shutdown
  frame-relay map ip 172.16.1.1 105 ietf payload-compression frf9 stac
```

**Data-Stream Compression: Example**

The following example shows data-stream compression configuration using the **frame-relay map** command:

```
interface serial0/0
  frame-relay map ip 10.0.0.1 100 payload-compression data-stream stac
```

**Related Commands**

Command	Description
<b>encapsulation frame-relay</b>	Enables Frame Relay encapsulation on an interface.
<b>frame-relay payload-compression</b>	Enables Stacker payload compression on a specified point-to-point interface or subinterface.
<b>frame-relay vc-bundle</b>	Creates a Frame Relay PVC bundle and enters Frame Relay VC-bundle configuration mode.
<b>ip ospf network</b>	Configures the OSPF network type to a type other than the default for a given medium.

# frame-relay map bridge

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

**frame-relay map bridge** *dcli* [**broadcast**] [**ietf**]

**no frame-relay map bridge** *dcli*

## Syntax Description

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

## Defaults

No broadcasts are forwarded.

## Command Modes

Interface configuration

## Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.4(13)	This command was modified to remove support for bridging for Frame Relay permanent virtual circuit (PVC) bundles.
12.0(32)SY3	This command was modified to remove support for bridging for Frame Relay PVC bundles.
12.4(15)T	This command was modified to remove support for bridging for Frame Relay PVC bundles.
12.2(14)S11b	This command was modified to remove support for bridging for Frame Relay PVC bundles.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.
12.0(33)S	This command was modified to remove support for bridging for Frame Relay PVC bundles.
12.2(33)SRC	This command was modified to remove support for bridging for Frame Relay PVC bundles.
12.2(44)SQ	This command was modified to remove support for bridging for Frame Relay PVC bundles.

**Examples**

The following example uses DLCI 144 for bridging:

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

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

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

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

# frame-relay map clns

To forward broadcasts when Connectionless Network Service (CLNS) is used for routing, use the **frame-relay map clns** command in interface configuration mode. To delete the map entry, use the **no** form of this command.

**frame-relay map clns** *dcli* [**broadcast**]

**no frame-relay map clns** *dcli*

## Syntax Description

<i>dcli</i>	DLCI number to which CLNS broadcasts are forwarded on the specified interface.
<b>broadcast</b>	(Optional) Broadcasts are forwarded when multicast is not enabled.

## Defaults

No broadcasts are forwarded.

## Command Modes

Interface configuration

## Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Examples

The following example uses DLCI 125 for CLNS routing:

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

# frame-relay map ip tcp header-compression

To assign to an IP map header compression characteristics that differ from the compression characteristics of the interface with which the IP map is associated, use the **frame-relay map ip tcp header-compression** command in interface configuration mode.

```
frame-relay map ip ip-address dlc [broadcast] tcp header-compression [active | passive]
[connections number]
```

Syntax Description		
<i>ip-address</i>		IP address of the destination or next hop.
<i>dlci</i>		Data-link connection identifier (DLCI) number.
<b>broadcast</b>		(Optional) Forwards broadcasts to the specified IP address.
<b>active</b>		(Optional) Compresses the header of every outgoing TCP/IP packet.
<b>passive</b>		(Optional) Compresses the header of an outgoing TCP/IP packet only if an incoming TCP/IP packet had a compressed header.
<b>connections</b> <i>number</i>		(Optional) Specifies the maximum number of TCP header compression connections. The range is from 3 to 256. Default is 256.

**Defaults** Maximum number of TCP header compression connections: 256

**Command Modes** Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.
	12.1(2)T	This command was modified to enable the configuration of the maximum number of header compression connections.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines** If you do not specify the number of TCP header compression connections, the map will inherit the current value from the interface.

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

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

If you change the encapsulation characteristics of the interface to Internet Engineering Task Force (IETF) encapsulation, you lose the TCP header compression configuration of the associated IP map.

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

We recommend that you shut down the interface before changing encapsulation types. Although shutting down the interface is not required, it ensures that the interface is reset for the new encapsulation.

---

### Examples

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

```
interface serial 1
 encapsulation frame-relay
 ip address 10.108.177.170 255.255.255.0
 frame-relay map ip 10.108.177.180 190 tcp header-compression active
```

---

### Related Commands

Command	Description
<b>frame-relay ip tcp compression-connections</b>	Specifies the maximum number of TCP header compression connections that can exist on a Frame Relay interface.
<b>frame-relay ip tcp header-compression</b>	Enables TCP header compression for all Frame Relay maps on a physical interface.
<b>frame-relay map ip compress</b>	Enables both RTP and TCP header compression on a link.
<b>show frame-relay ip tcp header-compression</b>	Displays statistics and TCP/IP header compression information for the interface.

# frame-relay mincir

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

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

```
no frame-relay mincir
```

Syntax Description	in	Specifies an incoming CIR.
	out	Specifies an outgoing CIR.
	bps	Rate, in bits per second.

**Defaults** 56000 bps

**Command Modes** Map-class configuration

Command History	Release	Modification
	11.2	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines** Rate values greater than 2048 must be entered with trailing zeros. For example, 2048000 and 5120000. The network uses the **mincir** value when allocating resources for the SVC. If the **mincir** value cannot be supported, the call is cleared.

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

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

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

■ frame-relay mincir

---

**Related Commands**

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

---

# frame-relay multicast-dlci

To define the data-link connection identifier (DLCI) to be used for multicasts, use the **frame-relay multicast-dlci** command in interface configuration mode. To remove the multicast group, use the **no** form of this command.

**frame-relay multicast-dlci** *number*

**no frame-relay multicast-dlci**

Syntax Description	<i>number</i>	Multicast DLCI.
--------------------	---------------	-----------------

**Defaults** No DLCI is defined.

**Command Modes** Interface configuration

Command History	Release	Modification
	10.0	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

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



**Note**

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

**Examples** The following example specifies 1022 as the multicast DLCI:

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

# frame-relay multilink ack

To configure the number of seconds for which a bundle link will wait for a hello message acknowledgment before resending the hello message, use the **frame-relay multilink ack** command in interface configuration mode. To reset this parameter to the default setting, use the **no** form of this command.

**frame-relay multilink ack** *seconds*

**no frame-relay multilink ack**

<b>Syntax Description</b>	<i>seconds</i>	Number of seconds for which a bundle link will wait for a hello message acknowledgment before resending the hello message. Range: 1 to 10. Default: 4.
---------------------------	----------------	--

**Command Default** The default acknowledgement interval is 4 seconds.

**Command Modes** Interface configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(17)S	This command was introduced.
	12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
	12.0(24)S	This command was implemented on VIP-enabled Cisco 7500 series routers.
	12.3(4)T	Support for this command on VIP-enabled Cisco 7500 series routers was integrated into Cisco IOS Release 12.3(4)T.
	12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
	12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines** The **frame-relay multilink ack** command can be configured only on bundle link interfaces that have been associated with a bundle using the **encapsulation frame-relay mfr** command.

Both ends of a bundle link send out hello messages at regular intervals. When a peer device receives a hello message, it responds by sending an acknowledgment. This exchange of hello messages and acknowledgments serves as a keepalive mechanism for the link. If the bundle link sends a hello message but does not receive an acknowledgment, it will resend the hello message up to a configured maximum number of times. If the bundle link exhausts the maximum number of retries, the bundle link line protocol is considered down (nonoperational).

The **frame-relay multilink ack** command setting on the local router is independent of the setting on the peer device.

**Examples**

The following example shows how to configure the bundle link to wait 6 seconds before resending hello messages:

```
interface serial0
 encapsulation frame-relay mfr0
 frame-relay multilink ack 6
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>encapsulation frame-relay mfr</b>	Creates a multilink Frame Relay bundle link and associates the link with a bundle.
<b>frame-relay multilink bandwidth-class</b>	Specifies the bandwidth class used to trigger activation or deactivation of the Frame Relay bundle.
<b>frame-relay multilink hello</b>	Configures the interval at which a bundle link will send out hello messages.
<b>frame-relay multilink retry</b>	Configures the maximum number of times that a bundle link will resend a hello message while waiting for an acknowledgment.

## frame-relay multilink bandwidth-class

To specify the criterion used to activate or deactivate a Frame Relay bundle, use the **frame-relay multilink bandwidth-class** command in interface configuration mode. To reset the bandwidth class to the default, use the **no** form of this command.

**frame-relay multilink bandwidth-class** [a | b | c [*threshold*]]

**no frame-relay multilink bandwidth-class**

Syntax Description	
<b>a</b>	<p>(Optional) Bandwidth class A (single link) criterion will be used to activate or deactivate the Frame Relay bundle. This is the default.</p> <ul style="list-style-type: none"> <li>• Criterion for activation—One or more bundle links indicate (by issuing a BL_ACTIVATE message) that operational bandwidth is available. When this occurs, the bundle emulates a physical link by issuing a PH_ACTIVATE message to the data-link layer.</li> <li>• Criterion for deactivation—All bundle links are down and issue a BL_DEACTIVATE message, which triggers a PH_DEACTIVATE message to be sent to the data-link layer, indicating that the Frame Relay bundle cannot accept frames.</li> </ul>
<b>b</b>	<p>(Optional) Bandwidth class B (all links) criterion will be used to activate or deactivate the Frame Relay bundle.</p> <ul style="list-style-type: none"> <li>• Criterion for activation—All bundle links indicate (by issuing a BL_ACTIVATE message) that operational bandwidth is available. When this occurs, the bundle emulates a physical link by issuing a PH_ACTIVATE message to the data-link layer.</li> <li>• Criterion for deactivation—Any bundle link is down and issues a BL_DEACTIVATE message, which triggers a PH_DEACTIVATE message to be sent to the data-link layer, indicating that the Frame Relay bundle cannot accept frames.</li> </ul>
<b>c</b>	<p>(Optional) Bandwidth class C (threshold) criterion will be used to activate or deactivate the Frame Relay bundle.</p> <ul style="list-style-type: none"> <li>• Criterion for activation—The minimum number of links in the configured bundle issue a BL_ACTIVATE message. When this occurs, the bundle emulates a physical link by issuing a PH_ACTIVATE message to the data-link layer.</li> <li>• Criterion for deactivation—The number of bundle links issuing a BL_ACTIVATE message falls below the configured <i>threshold</i> value. When this occurs, a PH_DEACTIVATE message is sent to the data-link layer, which indicates that the Frame Relay bundle cannot accept frames.</li> </ul>
<i>threshold</i>	<p>(Optional) Number of bundle links. The range is from 1 to 65535. If the <i>threshold</i> argument is not specified, the default value is 1.</p>

**Command Default** Frame Relay bundles use bandwidth class A (single link).

**Command Modes** Interface configuration

Command History	Release	Modification
	12.0(30)S	This command was introduced.
	12.4(2)T	This command was integrated into Cisco IOS Release 12.4(2)T.
	12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines** The **frame-relay multilink bandwidth-class** command can be configured only on a bundle's main interface. If no bandwidth class is specified by using the **frame-relay multilink bandwidth-class** command, the Frame Relay bundle uses the class A (single link) criterion.

**Examples** The following example shows how to specify the class B (all links) bandwidth class to trigger activation or deactivation of the Frame Relay bundle on MFR interface 0:

```
interface mfr0
  frame-relay multilink bandwidth-class b
```

The following example shows how to specify the class C (threshold) bandwidth class to trigger activation or deactivation of the Frame Relay bundle on MFR interface 0, where the minimum threshold of links indicating BL\_ACTIVATE is 3:

```
interface mfr0
  frame-relay multilink bandwidth-class c 3
```

Related Commands	Command	Description
	<b>interface mfr</b>	Configures a multilink Frame Relay bundle interface.
	<b>show frame-relay multilink</b>	Displays configuration information and statistics about multilink Frame Relay bundles and bundle links.

# frame-relay multilink bid

To assign a bundle identification (BID) name to a multilink Frame Relay bundle, use the **frame-relay multilink bid** command in interface configuration mode. To reset the name to the default, use the **no** form of this command.

**frame-relay multilink bid** *name*

**no frame-relay multilink bid**

## Syntax Description

<i>name</i>	Bundle identification (BID) name. The name can be up to 49 characters long. The default is “mfr” followed by the number assigned to the bundle using the <b>interface mfr</b> command; for example, “mfr0.”
-------------	---

## Command Default

The BID name is assigned automatically as “mfr” followed by the number assigned to the bundle.

## Command Modes

Interface configuration

## Command History

Release	Modification
12.0(17)S	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
12.0(24)S	This command was implemented on VIP-enabled Cisco 7500 series routers.
12.3(4)T	Support for this command on VIP-enabled Cisco 7500 series routers was integrated into Cisco IOS Release 12.3(4)T.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

This command can be entered only on the multilink Frame Relay bundle interface.



**Note** You can enter the **frame-relay multilink bid** command at any time without affecting the current state of the interface; however, the BID will not go into effect until the interface has gone from the down state to the up state. One way to bring the interface down and back up again is by using the **shutdown** and **no shutdown** commands in interface configuration mode.

Only one BID is allowed per bundle. A later entry of the **frame-relay multilink bid** command supersedes prior entries.

The local and peer BIDs do not have to be unique.

**Examples**

The following example shows how to assign a BID of “bundle1” to the multilink Frame Relay bundle. The previous BID for the bundle was “mfr0.”

```
interface mfr0
 frame-relay multilink bid bundle1
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>frame-relay multilink lid</b>	Assigns a LID name to a multilink Frame Relay bundle link.
<b>interface mfr</b>	Configures a multilink Frame Relay bundle interface.
<b>show frame-relay multilink</b>	Displays configuration information and statistics about multilink Frame Relay bundles and bundle links.
<b>shutdown (interface)</b>	Disables an interface.

# frame-relay multilink hello

To configure the interval at which a bundle link will send out hello messages, use the **frame-relay multilink hello** command in interface configuration mode. To reset this value to the default setting, use the **no** form of this command.

**frame-relay multilink hello** *seconds*

**no frame-relay multilink hello**

## Syntax Description

<i>seconds</i>	Interval, in seconds, at which a bundle link will send out hello messages. Range: 1 to 180. Default: 10.
----------------	---

## Command Default

The interval is set at 10 seconds.

## Command Modes

Interface configuration

## Command History

Release	Modification
12.0(17)S	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
12.0(24)S	This command was implemented on VIP-enabled Cisco 7500 series routers.
12.3(4)T	Support for this command on VIP-enabled Cisco 7500 series routers was integrated into Cisco IOS Release 12.3(4)T.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

The **frame-relay multilink hello** command can be configured only on bundle link interfaces that have been associated with a bundle using the **encapsulation frame-relay mfr** command.

Both ends of a bundle link send out hello messages at regular intervals. When a peer device receives a hello message, it responds by sending an acknowledgment. This exchange of hello messages and acknowledgments serves as a keepalive mechanism for the link. If the bundle link sends a hello message but does not receive an acknowledgment, it will resend the hello message up to a configured maximum number of times. If the bundle link exhausts the maximum number of retries, the bundle link line protocol is considered down (nonoperational).

The setting of the hello message interval on the local router is independent of the setting on the peer device.

**Examples**

The following example shows how to configure a bundle link to send hello messages every 15 seconds:

```
interface serial0
 encapsulation frame-relay mfr0
 frame-relay multilink hello 15
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>encapsulation frame-relay mfr</b>	Creates a multilink Frame Relay bundle link and associates the link with a bundle.
<b>frame-relay multilink ack</b>	Configures the number of seconds that a bundle link will wait for a hello message acknowledgment before resending the hello message.
<b>frame-relay multilink retry</b>	Configures the maximum number of times that a bundle link will resend a hello message while waiting for an acknowledgment.

# frame-relay multilink lid

To assign a bundle link identification (LID) name to a multilink Frame Relay bundle link, use the **frame-relay multilink lid** command in interface configuration mode. To reset the name to the default, use the **no** form of this command.

**frame-relay multilink lid** *name*

**no frame-relay multilink lid**

## Syntax Description

<i>name</i>	Bundle link identification (LID) name. The name can be up to 49 characters long. The default is the name of the physical interface.
-------------	---

## Command Default

The name of the physical interface is used as the LID.

## Command Modes

Interface configuration

## Command History

Release	Modification
12.0(17)S	This command was introduced.
12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
12.0(24)S	This command was implemented on VIP-enabled Cisco 7500 series routers.
12.3(4)T	Support for this command on VIP-enabled Cisco 7500 series routers was integrated into Cisco IOS Release 12.3(4)T.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

The **frame-relay multilink lid** command can be configured only on bundle link interfaces that have been associated with a bundle using the **encapsulation frame-relay mfr** command.



### Note

You can enter the **frame-relay multilink lid** command at any time without affecting the current state of the interface; however, the LID will not go into effect until the interface has gone from the down state to the up state. One way to bring the interface down and back up again is by using the **shutdown** and **no shutdown** commands in interface configuration mode.

The LID will be used to identify the bundle link to peer devices and to enable the devices to identify which bundle links are associated with which bundles. The LID can also be assigned when the bundle link is created by using the **encapsulation frame-relay mfr** command with the *name* argument. If the LID is not assigned, the default LID is the name of the physical interface. The local and peer LIDs do not have to be unique.

---

**Examples**

The following example shows the LID named BL1 assigned to serial interface 0:

```
interface serial 0
 encapsulation frame-relay mfr0
 frame-relay multilink lid BL1
```

---

**Related Commands**

Command	Description
<b>encapsulation frame-relay mfr</b>	Creates a multilink Frame Relay bundle link and associates the link with a bundle.
<b>frame-relay multilink bid</b>	Assigns a BID name to a multilink Frame Relay bundle.
<b>show frame-relay multilink</b>	Displays configuration information and statistics about multilink Frame Relay bundles and bundle links.
<b>shutdown (interface)</b>	Disables an interface.

# frame-relay multilink output-threshold

To configure the number of bytes that a bundle link will transmit before the load-balancing mechanism causes transmission to roll over to the next available link, use the **frame-relay multilink output-threshold** command in interface configuration mode. To reset this value to the default setting, use the **no** form of this command.

**frame-relay multilink output-threshold** *bytes*

**no frame-relay multilink output-threshold**

<b>Syntax Description</b>	<i>bytes</i>	Number of bytes that a bundle link will transmit before the load-balancing mechanism causes transmission to roll over to the next link. Range: 20 to 2147483647. Default: 300.
---------------------------	--------------	--

**Command Default** The number of bytes transmitted is set at 300.

**Command Modes** Interface configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.2(8)T	This command was introduced.
	12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
	12.0(30)S	This command was integrated into Cisco IOS Release 12.0(30)S.
	12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines** Multilink Frame Relay enables load balancing across bundle links that are in the same bundle. When a bundle link has reached its output threshold, transmission rolls over to the next available bundle link in the bundle.

The output threshold mechanism applies only when the bundle interface is using FIFO output queuing. When the bundle interface is not using FIFO output queuing, the algorithm for choosing a bundle link interface for output selects the bundle link that has the empty or shortest output queue.

The default output threshold is 300 bytes. This default value will work effectively if all the bundle links in the bundle have the same speed. To efficiently use bundle links with different speeds, use the **frame-relay multilink output-threshold** command to adjust the output threshold of the links as appropriate.

The **frame-relay multilink output-threshold** command can be used on the bundle interface and the bundle links. If the command is used on the bundle interface, the configured output threshold will apply to all bundle links in the bundle. If the command is used on a specific bundle link, the output threshold will overwrite the current setting for that bundle link.

---

**Examples**

The following example shows how to configure the bundle link output threshold at 600 bytes. When the bundle link reaches the threshold, transmission will roll over to the next link.

```
interface serial0
 encapsulation frame-relay mfr0
 frame-relay multilink output-threshold 600
```

---

**Related Commands**

Command	Description
<b>encapsulation frame-relay mfr</b>	Creates a multilink Frame Relay bundle link and associates the link with a bundle.
<b>frame-relay multilink bandwidth-class</b>	Specifies the bandwidth class used to trigger activation or deactivation of the Frame Relay bundle.

# frame-relay multilink retry

To configure the maximum number of times that a bundle link will resend a hello message while waiting for an acknowledgment, use the **frame-relay multilink retry** command in interface configuration mode. To reset this value to the default setting, use the **no** form of this command.

**frame-relay multilink retry** *number*

**no frame-relay multilink retry**

<b>Syntax Description</b>	<i>number</i>	Maximum number of times that a bundle link will resend a hello message while waiting for an acknowledgment. Range: 1 through 5. Default: 2.
---------------------------	---------------	---

**Command Default** The number of retries is set at 2.

**Command Modes** Interface configuration

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.0(17)S	This command was introduced.
	12.2(8)T	This command was integrated into Cisco IOS Release 12.2(8)T.
	12.0(24)S	This command was implemented on VIP-enabled Cisco 7500 series routers.
	12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
	12.3(4)T	Support for this command on VIP-enabled Cisco 7500 series routers was integrated into Cisco IOS Release 12.3(4)T.
	12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines** The **frame-relay multilink retry** command can be configured only on bundle link interfaces that have been associated with a bundle using the **encapsulation frame-relay mfr** command.

If the bundle link sends the maximum number of hello messages without receiving an acknowledgment, the bundle link line protocol is considered down (nonoperational).

The maximum number of retries configured on the local router is independent of the maximum number configured on the peer device.

**Examples**

The following example shows how to configure a bundle link to send a hello message a maximum of 3 times while waiting for an acknowledgment:

```
interface serial0
 encapsulation frame-relay mfr0
 frame-relay multilink retry 3
```

**Related Commands**

Command	Description
<b>encapsulation frame-relay mfr</b>	Creates a multilink Frame Relay bundle link and associates the link with a bundle.
<b>frame-relay multilink ack</b>	Configures the number of seconds that a bundle link will wait for a hello message acknowledgment before resending the hello message.
<b>frame-relay multilink hello</b>	Configures the interval at which a bundle link will send out hello messages.

# frame-relay payload-compression

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

```
frame-relay payload-compression { packet-by-packet | frf9 stac [one-way-negotiation]
  [ratio level] [skip-zero-sync] [software | hardware-options] | data-stream stac
  [one-way-negotiation] [ratio level] [software | hardware-options] }
```

```
no frame-relay payload-compression { packet-by-packet | frf9 stac | data-stream stac }
```

Syntax Description	
<b>packet-by-packet</b>	Packet-by-packet payload compression using the Stacker method.
<b>frf9 stac</b>	Enables FRF.9 compression using the Stacker method. <ul style="list-style-type: none"> <li>• If the router contains a CSA<sup>1</sup>, compression is performed in the CSA hardware (hardware compression).</li> <li>• If the CSA is not available, compression is performed in the software installed on the VIP2<sup>2</sup> (distributed compression).</li> <li>• If the VIP2 is not available, compression is performed in the main processor of the router (software compression).</li> </ul>
<b>one-way-negotiation</b>	(Optional) Enables one-way negotiation. Use this keyword if your router will be negotiating compression with another device that is running Cisco IOS Release 12.1(9) or earlier releases. Later Cisco IOS releases use a two-way handshake by default to negotiate compression.
<b>ratio level</b>	(Optional) Sets throughput versus compression ratio. This option is available only with hardware compression. Possible values for the <i>level</i> argument are as follows: <p><b>high</b>—high compression versus low throughput</p> <p><b>medium</b>—medium compression versus medium throughput</p> <p><b>low</b>—low compression versus high throughput (default)</p>
<b>skip-zero-sync</b>	(Optional) Causes compression frames to be numbered starting from 1 rather than 0. Use this keyword if your router will be interoperating with a device that conforms to IBM partner conventions.
<b>software</b>	(Optional) Specifies that compression is implemented in the Cisco IOS software installed in the main processor of the router.

<i>hardware-options</i>	<p>(Optional) Choose one of the following hardware options:</p> <p><b>caim</b> <i>element-number</i>—Enables the CAIM<sup>3</sup> to perform compression.</p> <p><b>distributed</b>—Specifies that compression is implemented in the software that is installed in a VIP2. If the VIP2 is not available, compression is performed in the main processor of the router (software compression). This option applies only to the Cisco 7500 series routers. This option is not supported with data-stream compression.</p> <p><b>csa</b> <i>csa_number</i>—Specifies the CSA to use for a particular interface. This option applies only to Cisco 7200 series routers.</p>
<b>data-stream stac</b>	<p>Enables data-stream compression using the Stacker method.</p> <ul style="list-style-type: none"> <li>• If the router contains a CSA, compression is performed in the CSA hardware (hardware compression).</li> <li>• If the CSA is not available, compression is performed in the main processor of the router (software compression).</li> </ul>

1. CSA = compression service adapter
2. VIP2 = second-generation Versatile Interface Processor
3. CAIM = Compression Advanced Interface Module

**Defaults**

Payload compression is not enabled.

**Command Modes**

Interface configuration

**Command History**

Release	Modification
11.0	This command was introduced.
11.2	The <b>packet-by-packet</b> keyword was added.
11.3	The <b>frf9 stac</b> keyword was added.
12.1(5)T	The <b>data-stream stac</b> keyword was added.
12.2(4)T	The <b>skip-zero-sync</b> keyword was added.
12.2(13)T	The <b>one-way-negotiation</b> keyword was added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines**

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

We recommend that you shut down the interface before changing encapsulation types. Although shutting down the interface is not required, it ensures that the interface is reset for the new encapsulation.

Data-stream hardware compression is supported on interfaces and virtual circuits (VCs) using Cisco proprietary encapsulation. When the **data-stream stac** keyword is specified, Cisco encapsulation is automatically enabled. FRF.9 compression is supported on VCs and interfaces that using Internet Engineering Task Force (IETF) encapsulation type. When the **frf9 stac** keyword is specified, IETF encapsulation is automatically enabled.

---

## Examples

### FRF.9 Compression: Example

The following example configures FRF.9 compression for subinterfaces:

```
interface serial2/0/0
  no ip address
  no ip route-cache
  encapsulation frame-relay
  ip route-cache distributed
  no keepalive
  shutdown
!
interface serial2/0/0.500 point-to-point
  ip address 172.16.1.4 255.255.255.0
  no cdp enable
  frame-relay interface-dlci 500 ietf
  frame-relay payload-compression frf9 stac
```

### Data-Stream Compression: Example

The following example shows the configuration of data-stream compression using the **frame-relay payload-compression** command:

```
interface serial1/0
  encapsulation frame-relay
  frame-relay traffic-shaping
!
interface serial1/0.1 point-to-point
  ip address 10.0.0.1 255.0.0.0
  frame-relay interface-dlci 100
  frame-relay payload-compression data-stream stac
```

---

## Related Commands

Command	Description
<b>frame-relay map</b>	Defines mapping between a destination protocol address and the DLCI used to connect to the destination address.

# frame-relay policing

To enable Frame Relay policing on all switched PVCs on the interface, use the **frame-relay policing** command in interface configuration mode. To disable Frame Relay policing, use the **no** form of this command.

**frame-relay policing**

**no frame-relay policing**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Frame Relay policing is not enabled on switched PVCs.

## Command Modes

Interface configuration

## Command History

Release	Modification
12.1(2)T	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

You must enable Frame Relay policing on the incoming interface before you can configure traffic-policing parameters.

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

## Examples

The following example shows the configuration of Frame Relay policing on serial interface 0:

```
interface serial0
 frame-relay policing
```

## Related Commands

Command	Description
<b>frame-relay bc</b>	Specifies the incoming or outgoing Bc for a Frame Relay virtual circuit.
<b>frame-relay be</b>	Specifies the incoming or outgoing Be for a Frame Relay virtual circuit.
<b>frame-relay cir</b>	Specifies the incoming or outgoing CIR for a Frame Relay virtual circuit.
<b>frame-relay switching</b>	Enables PVC switching on a Frame Relay DCE or NNI.
<b>frame-relay tc</b>	Specifies the measurement interval for policing incoming traffic when the CIR is zero.

# frame-relay priority-dlci-group

To prioritize multiple data-link connection identifiers (DLCIs) according to the type of Frame Relay traffic, use the **frame-relay priority-dlci-group** interface configuration command.

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

Syntax Description		
	<i>group-number</i>	Specific group number.
	<i>high-dlci</i>	DLCI that is to have highest priority level.
	<i>medium-dlci</i>	DLCI that is to have medium priority level.
	<i>normal-dlci</i>	DLCI that is to have normal priority level.
	<i>low-dlci</i>	DLCI that is to have lowest priority level.

**Defaults** Disabled

**Command Modes** Interface configuration

Command History	Release	Modification
	11.0	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

This command is applied at the interface or subinterface level. Levels in descending order are high, medium, normal, and low.

This command allows you to define different DLCIs for different categories of traffic based on traffic priorities. This command does not itself define priority queuing, but it can be used in conjunction with priority queuing.

A global priority list must be defined, and the associated DLCIs must already be applied to the configuration before you enable this command.

Associate the DLCIs to their prospective groups and define their priority levels. This command is used for multiple DLCIs, where the source and destination endpoints are the same (parallel paths). This command should not be used on a main interface, or point-to-point subinterface, where only a single DLCI is configured.

A DLCI can only be affiliated with a single priority-group; however, there can be multiple groups per interface or subinterface.

You must configure the *high-priority* and *medium-priority* DLCI values. If you do not explicitly associate a DLCI for the *normal-dlci* and *low-dlci* priority levels, the last DLCI specified in the command line is used as the value of the remaining arguments. For example, the following two commands are equivalent:

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

When you configure static map entries using **frame-relay map** commands or use Inverse Address Resolution Protocol (ARP), the high-level DLCI is the only DLCI that is mapped. In the example, DLCI 40 is defined as having the highest priority. Therefore, DLCI 40 is the only DLCI that should be included in the **frame-relay map** command. DLCI 50 should not be included in a **frame-relay map** command.

## Examples

The following example shows the **frame-relay priority-dlci-group** command configured on a main interface with a static Frame Relay map entry. Note that DLCI 40 is the high-priority DLCI as defined in the **frame-relay priority-dlci-group** command and the only DLCI included in the **frame-relay map** command.

```
interface serial 1
 ip address 172.21.177.1 255.255.255.0
 encapsulation frame-relay
 frame-relay priority-dlci-group 1 40
 frame-relay map ip 172.21.177.2 40 broadcast
```

The following example shows the **frame-relay priority-dlci-group** command configured on subinterfaces where multiple priority groups are defined. DLCI 40 is the high-priority DLCI in group 1, and DLCI 80 is the high-priority DLCI in group 2.

```
interface Serial3
 no ip address
 encapsulation frame-relay
 !
interface Serial3.2 multipoint
 ip address 172.21.177.1 255.255.255.0
 frame-relay interface-dlci 40
 frame-relay priority-dlci-group 1 40
 !
interface Serial3.3 multipoint
 ip address 131.108.177.180 255.255.255.0
 frame-relay priority-dlci-group 2 80 90 100 100
 frame-relay interface-dlci 80
 !
interface Serial 4
 no ip address
 encapsulation frame-relay
 !
interface serial4.1 multipoint
 ip address 172.16.1.1 255.255.255.0
 frame-relay priority-dlci-group 3 200 210 300 300
 frame-relay priority-dlci-group 4 400 410 410 410
 frame-relay interface-dlci 200
 frame-relay interface-dlci 400
```

## Related Commands

Command	Description
<b>frame-relay map</b>	Defines mapping between a destination protocol address and the DLCI used to connect to the destination address.

# frame-relay priority-group

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

**frame-relay priority-group** *list-number*

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

Syntax Description	<i>list-number</i>	Priority-list number to be associated with the specified map class.
--------------------	--------------------	---

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

Command Modes	Map-class configuration
---------------	-------------------------

Command History	Release	Modification
	11.2	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

Usage Guidelines	Use the <b>priority-list</b> commands to define the priority queue. Because only one form of queueing can be associated with a particular map class, subsequent definitions overwrite previous ones.
------------------	--

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

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

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

priority-list 1 protocol ip high
```

**Related Commands**

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

## frame-relay pvc

To configure Frame Relay permanent virtual circuits (PVCs) for FRF.8 Frame Relay-ATM Service Interworking, use the **frame-relay pvc** command in interface configuration mode. To remove the PVC, use the **no** form of the command.

```
frame-relay pvc dcli service {transparent | translation} [clp-bit {0 | 1 | map-de}] [de-bit
{0 | 1 | map-clp}] [efci-bit {0 | 1 | map-fecn}] interface atm0 {vpi/vci | vcd}
```

```
no frame-relay pvc dcli service {transparent | translation} [clp-bit {0 | 1 | map-de}] [de-bit
{0 | 1 | map-clp}] [efci-bit {0 | 1 | map-fecn}] interface atm0 {vpi/vci | vcd}
```

### Syntax Description

<i>dcli</i>	A value ranging from 16 to 1007 for the PVC's data-link connection identifier (DLCI). Use this label when you associate a Frame Relay PVC with an ATM PVC.
<b>service</b> { <b>transparent</b>   <b>translation</b> }	In the <b>transparent</b> mode of Service Interworking, encapsulations are sent unaltered. In <b>translation</b> mode, mapping and translation take place. There is no default.
<b>clp-bit</b> { <b>0</b>   <b>1</b>   <b>map-de</b> }	(Optional) Sets the mode of DE/CLP mapping in Frame Relay to the ATM direction. The default is <b>map-de</b> . <ul style="list-style-type: none"> <li>• <b>map-de</b>—Specifies Mode 1 (see section 4.2.1 of FRF.8)</li> <li>• <b>0</b> or <b>1</b>—Specifies Mode 2 (see section 4.2.1 of FRF.8)</li> </ul>
<b>de-bit</b> { <b>0</b>   <b>1</b>   <b>map-clp</b> }	(Optional) Sets the mode of DE/CLP mapping in the ATM-to-Frame Relay direction. The default is <b>map-clp</b> . <ul style="list-style-type: none"> <li>• <b>map-clp</b>—Specifies Mode 1 (see section 4.2.1 of FRF.8)</li> <li>• <b>0</b> or <b>1</b>—Specifies Mode 2 (see section 4.2.1 of FRF.8)</li> </ul>
<b>efci-bit</b> { <b>0</b>   <b>1</b>   <b>map-fecn</b> }	(Optional) Sets FECN and the ATM EFCI in the Frame Relay-to-ATM direction. <b>map-fecn</b> is the default. <ul style="list-style-type: none"> <li>• <b>0</b>—Sets a constant value rather than mapping.</li> <li>• <b>1</b>—Sets a constant value rather than mapping.</li> <li>• <b>map-fecn</b>—Adheres to Mode 1 and maps the FECN indicators to EFCI indicators.</li> </ul>
<b>interface atm0</b> { <i>vpi/vci</i>   <i>vcd</i> }	Maps the Frame Relay PVC to an ATM PVC specified by slot number (0 is the only option for ATM on the Cisco MC3810) and either one of the following labels: <ul style="list-style-type: none"> <li>• <i>vpi/vci</i>—The virtual path identifier-virtual channel identifier (VPI-VCI) pair for the ATM PVC</li> <li>• <i>vcd</i>—The ATM virtual circuit descriptor (VCD) for the ATM PVC</li> </ul>

### Command Default

No Frame Relay PVCs are configured.

**Command Modes** Interface configuration

Command History	Release	Modification
	12.0(7)T	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines** This command applies only to Frame Relay-ATM Service Interworking (FRF.8) on the Cisco MC3810. Use this command to create Frame Relay PVCs for association with ATM PVCs when you are configuring FRF.8 Frame Relay-ATM Service Interworking on the Cisco MC3810 multiservice access concentrator.

**Examples** The following example shows two Frame Relay PVCs configured on a serial interface of a Cisco MC3810:

```
frame-relay pvc 222 service translation clp-bit map-de de-bit map-clp efci-bit map-fecn
interface ATM0 222/222
frame-relay pvc 925 service transparent clp-bit map-de de-bit map-clp efci-bit map-fecn
interface ATM0 92/92
```

Related Commands	Command	Description
	<b>pvc</b>	Creates an ATM PVC on a main interface or subinterface; assigns a name to an ATM PVC; specifies ILMI, QSAAL, or SMDS as the encapsulation type on an ATM PVC; or enters interface-ATM-VC configuration mode.

# frame-relay qos-autosense

To enable Enhanced Local Management Interface (ELMI) on the Cisco router, use the **frame-relay qos-autosense** command in interface configuration mode. To disable Enhanced Local Management Interface on the Cisco router, use the **no** form of this command.

**frame-relay qos-autosense**

**no frame-relay qos-autosense**

**Syntax Description** This command has no arguments or keywords.

**Defaults** ELMI is not enabled.

**Command Modes** Interface configuration

Command History	Release	Modification
	11.2	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines** Enhanced Local Management Interface must be configured on both the Cisco router and the Cisco switch.

Traffic shaping is optional with Enhanced Local Management Interface. Configure traffic shaping on the interface if you want QoS information to be used by the router for traffic rate enforcement.

**Examples** This configuration example shows a Frame Relay interface enabled to receive Enhanced Local Management Interface messages from the Cisco switch that is also configured with Enhanced Local Management Interface enabled. Traffic shaping is also configured on the interface for traffic rate enforcement and dynamic rate throttling. This allows the router to adjust its output rate based on congestion information it receives from the switch.

```
interface serial0
  no ip address
  encapsulation frame-relay
  frame-relay lmi-type ansi
  frame-relay traffic-shaping
  frame-relay qos-autosense

interface serial0.1 point-to-point
  no ip address
  frame-relay interface-dlci 101
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>encapsulation frame-relay</b>	Enables Frame Relay encapsulation.
<b>frame-relay adaptive-shaping</b>	Selects the type of backward notification you want to use.
<b>frame-relay traffic-shaping</b>	Enables both traffic shaping and per-VC queueing for all PVCs and SVCs on a Frame Relay interface.
<b>show frame-relay qos-autosense</b>	Displays the QoS values sensed from the switch.

## frame-relay route

To specify the static route for permanent virtual circuit (PVC) switching, use the **frame-relay route** command in interface configuration mode. To remove a static route, use the **no** form of this command.

**frame-relay route** *in-dlci* **interface** *out-interface-type* *out-interface-number* *out-dlci*  
[**voice-encap** *size*]

**no frame-relay route** *in-dlci* **interface** *out-interface-type* *out-interface-number* *out-dlci*  
[**voice-encap** *size*]

### Syntax Description

<i>in-dlci</i>	DLCI on which the packet is received on the interface.
<b>interface</b> <i>out-interface-type</i> <i>out-interface-number</i>	Interface that the router or access server uses to transmit the packet.
<i>out-dlci</i>	DLCI that the router or access server uses to transmit the packet over the interface specified by the <i>out-interface</i> argument.
<b>voice encap</b> <i>size</i>	(Optional) (Supported on the Cisco MC3810 only.) Specifies that data segmentation will be used to support Voice over Frame Relay. Note that the voice encapsulation applies only to the input DLCI side. The valid range is from 8 to 1600.

### Defaults

No static route is specified.

### Command Modes

Interface configuration

### Command History

Release	Modification
10.0	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

### Usage Guidelines

When used with voice, the **frame-relay route** command is applied on both interfaces. If the **voice-encap** keyword is specified on one interface, the incoming frames on that interface are defragmented before being routed to the other interface. The outgoing frames on that interface are then fragmented after being routed from the other interface, and before transmission out the interface.



#### Note

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

**Examples**

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

```
frame-relay route 100 interface Serial 2 200
```

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 Serial 2 200
  frame-relay route 101 interface Serial 2 201
  clockrate 2000000
```

# frame-relay svc

To enable Frame Relay switched virtual circuit (SVC) operation on the specified interface, use the **frame-relay svc** command in interface configuration mode. To disable SVC operation on the specified interface, use the **no** form of this command.

**frame-relay svc**

**no frame-relay svc**

**Syntax Description** This command has no arguments or keywords.

**Defaults** SVC operation is not enabled.

**Command Modes** Interface configuration

Command History	Release	Modification
	11.2	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

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

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

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

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

Related Commands	Command	Description
	<b>encapsulation frame-relay</b>	Enables Frame Relay encapsulation.
	<b>frame-relay lmi-type</b>	Selects the LMI type.
	<b>interface serial</b>	Specifies a serial interface created on a channelized E1 or channelized T1 controller (for ISDN PRI, CAS, or robbed bit signalling).
	<b>ip address</b>	Sets a primary or secondary IP address for an interface.

# frame-relay switching

To enable permanent virtual switching (PVC) switching on a Frame Relay DCE device or a Network-to-Network Interface (NNI), use the **frame-relay switching** command in global configuration mode. To disable switching, use the **no** form of this command.

**frame-relay switching**

**no frame-relay switching**

---

**Syntax Description** This command has no arguments or keywords.

---

**Defaults** Switching is not enabled.

---

**Command Modes** Global configuration

---

Command History	Release	Modification
	10.0	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

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

---

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

```
frame-relay switching
```

# frame-relay tc

To set the measurement interval for policing incoming traffic when the committed information rate (CIR) is zero, use the **frame-relay tc** command in map-class configuration mode. To reset the measurement interval for policing, use the **no** form of this command.

**frame-relay tc** *milliseconds*

**no frame-relay tc** *milliseconds*

<b>Syntax Description</b>	<i>milliseconds</i>	Time interval from 10 ms to 10,000 ms, during which incoming traffic cannot exceed committed burst size (Bc) plus excess burst size (Be).
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<b>Defaults</b>	1000 ms
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<b>Command Modes</b>	Map-class configuration
----------------------	-------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.1(2)T	This command was introduced.
	12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
	12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

<b>Usage Guidelines</b>	<p>You must enable Frame Relay policing on the incoming interface, using the <b>frame-relay policing</b> interface command, before you can configure traffic-policing parameters.</p> <p>You must enable Frame Relay switching using the <b>frame-relay switching</b> global command before the <b>frame-relay tc</b> command will be effective on switched PVCs.</p> <p>When the CIR is greater than 0, Tc is equal to Bc divided by the CIR.</p>
-------------------------	--

<b>Examples</b>	The following example shows how to configure a policing measurement interval of 800 milliseconds within a map class called "police":
-----------------	--

```
map-class frame-relay police
  frame-relay tc 800
```

**Related Commands**

<b>Command</b>	<b>Description</b>
<b>frame-relay bc</b>	Specifies the incoming or outgoing Bc for a Frame Relay virtual circuit.
<b>frame-relay be</b>	Specifies the incoming or outgoing Be for a Frame Relay virtual circuit.
<b>frame-relay cir</b>	Specifies the incoming or outgoing CIR for a Frame Relay virtual circuit.
<b>frame-relay policing</b>	Enables Frame Relay policing on all switched PVCs on an interface.
<b>frame-relay switching</b>	Enables PVC switching on a Frame Relay DCE or NNI.

# frame-relay traffic-rate

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

**frame-relay traffic-rate** *average* [*peak*]

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

## Syntax Description

<i>average</i>	Average rate, in bits per second; equivalent to specifying the contracted committed information rate (CIR).
<i>peak</i>	(Optional) Peak rate, in bits per second; equivalent to $CIR + Be/Tc = CIR (1 + Be/Bc) = CIR + EIR$ . If the <i>peak</i> value is not configured, the peak rate will default to the configured <i>average</i> value.

## Defaults

If the peak rate is omitted, the default value used is the average rate configured.

## Command Modes

Map-class configuration

## Command History

Release	Modification
11.2	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

The configured *peak* and *average* rates are converted to the equivalent CIR, excess burst size (Be), and committed burst size (Bc) values for use by the VC. When the values are translated, the *average* rate is used as the CIR. This value is assumed to be for one second. The generated Bc value is 1/8 the CIR value with an interval of 125 milliseconds.

The Be value is derived from the *peak* rate by subtracting by the *average* rate. The value of the *peak* rate minus *average* rate is assumed to be for one second. The generated Be value is 1/8 the *peak* rate minus the *average* rate with an interval of 125 milliseconds. If the *peak* value is not configured, the peak rate will default to the configured *average* value, and the Be value will equal 0.

For example, entering the **frame-relay traffic-rate 64000 96000** command will result in a CIR of 64000 bps. Assuming 8 intervals of 125 milliseconds, the Bc is 64000/8 or 8000 bits. The Be value is calculated by subtracting 64000 from 96000, so the one-second value is 32000 bits. For each 125-millisecond interval, the Be value is 4000 bits.

Note that the **show frame-relay pvc** command displays Be and Bc values based on an interval of one second. Internally the values being used are based on an interval of 125 milliseconds. The configuration examples below include the **frame-relay traffic-rate** command and corresponding **show frame-relay pvc** command output.

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

## Examples

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

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

map-class frame-relay fast_vc
  frame-relay traffic-rate 64000 96000
```

The following sample output for the **show frame-relay pvc** command is for the PVC configured in the preceding example. Note that the display shows values for Be and Bc that are based on an interval of one second. Internally the values being used are based on an interval of 125 milliseconds, which means that the actual Be value being used is 4000 bits and the actual Bc value being used is 8000 bits.

```
Router# show frame-relay pvc 100

PVC Statistics for interface Serial0 (Frame Relay DTE)

DLCI = 100, DLCI USAGE = LOCAL, PVC STATUS = STATIC, INTERFACE = Serial0.100

input pkts 0          output pkts 2314      in bytes 0
out bytes 748080      dropped pkts 0        in pkts dropped 0
out pkts dropped 0    out bytes dropped 0
in FECN pkts 0       in BECN pkts 0       out FECN pkts 0
out BECN pkts 0      in DE pkts 0         out DE pkts 0
out bcast pkts 2308  out bcast bytes 747792
pvc create time 1d16h, last time pvc status changed 1d16h
cir 64000    bc 64000    be 32000    byte limit 5000    interval 125
mincir 32000    byte increment 1000 Adaptive Shaping none
pkts 12      bytes 3888    pkts delayed 0      bytes delayed 0
shaping inactive
traffic shaping drops 0
Queueing strategy:fifo
Output queue 0/40, 0 drop, 0 dequeued
```

## Related Commands

Command	Description
<b>frame-relay bc</b>	Specifies the incoming or outgoing Bc for a Frame Relay VC.
<b>frame-relay be</b>	Sets the incoming or outgoing Be for a Frame Relay VC.
<b>frame-relay cir</b>	Specifies the incoming or outgoing CIR for a Frame Relay VC.

# frame-relay traffic-shaping

To enable both traffic shaping and per-virtual-circuit queueing for all permanent virtual circuits (PVCs) and switched virtual circuits (SVCs) on a Frame Relay interface, use the **frame-relay traffic-shaping** command in interface configuration mode. To disable traffic shaping and per-virtual-circuit queueing, use the **no** form of this command.

**frame-relay traffic-shaping**

**no frame-relay traffic-shaping**

## Syntax Description

This command has no arguments or keywords.

## Defaults

Frame Relay traffic shaping is not enabled.

## Command Modes

Interface configuration

## Command History

Release	Modification
11.2	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

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

The default committed information rate (CIR) of 56K will apply in the following situations:

- When traffic shaping is enabled (by using the **frame-relay traffic-shaping** command), but a map-class is not assigned to the VC
- When traffic shaping is enabled (by using the **frame-relay traffic-shaping** command) and a map class is assigned to the VC, but traffic-shaping parameters have not been defined in the map-class

Frame Relay traffic shaping is not effective for Layer 2 PVC switching using the **frame-relay route** command.

## Examples

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

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

Related Commands	Command	Description
	<b>frame-relay class</b>	Associates a map class with an interface or subinterface.
	<b>frame-relay custom-queue-list</b>	Specifies a custom queue to be used for the VC queueing associated with a specified map class.
	<b>frame-relay priority-group</b>	Assigns a priority queue to VCs associated with a map class.
	<b>frame-relay traffic-rate</b>	Configures all the traffic-shaping characteristics of a VC in a single command.
	<b>map-class frame-relay</b>	Specifies a map class to define QoS values for an SVC.

# frame-relay traps-maximum dlc-status-change

To change the maximum number of frDLCIStatusChange traps that Frame Relay generates at linkup or when receiving LMI Full Status messages, use the **frame-relay traps-maximum dlc-status-change** command in interface configuration mode. To disable any limit on the number of traps, use the **no** form of this command.

**frame-relay traps-maximum dlc-status-change** *traps*

**no frame-relay traps-maximum dlc-status-change**

<b>Syntax Description</b>	<i>traps</i>	Number of traps.
---------------------------	--------------	------------------

<b>Command Default</b>	Enabled (and the maximum number of traps is equal to the maximum number of trap events specified for the SNMP server message queue).
------------------------	--

<b>Command Modes</b>	Interface configuration (config-if)
----------------------	-------------------------------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	11.1(33)CC	This command was introduced.
11.1(33)CV	This command was integrated into Cisco IOS Release 11.1(33)CV.	
12.1(8)	This command was integrated into Cisco IOS Release 12.1(8).	

<b>Usage Guidelines</b>	<p>You should set the maximum number of traps based on the number of PVCs on the interface as well as on the SNMP server message queue length. A low number on an interface with many PVCs can be reached quickly, which can cause a large number of traps to be dropped. Also, you should set this number smaller than the SNMP server message queue length (which is specified by the <b>snmp-server queue-length</b> command, which has a default of 10 traps).</p>
-------------------------	--

The traps counter for this command is reset when a keepalive message is exchanged on the Frame Relay interface.



<b>Note</b>	Frame Relay frDLCIStatusChange traps are not generated when the line status or line protocol status of an interface changes to down.
-------------	--

This command does not restrict traps caused by individual circuit status changes.

**Examples**

The following example sets a maximum of 256 traps on serial interface 3/3:

```
Router> enable
Password:
Router# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)# interface serial 3/3
Router(config-if)# encapsulation frame-relay
Router(config-if)# frame-relay traps-maximum 256
Router(config-if)# end
```

**Related Commands**

Command	Description
<b>snmp-server enable traps frame-relay</b>	Enables Frame Relay SNMP notifications.
<b>snmp-server host</b>	Specifies the recipient of an SNMP notification operation.
<b>snmp-server queue-length</b>	Establishes the message queue length for each trap host.
<b>snmp-server trap link</b>	Enables linkUp/linkDown SNMP traps, which are compliant with RFC 2233.
<b>snmp-server trap-source</b>	Specifies the interface (and hence the corresponding IP address) from which an SNMP trap should originate.
<b>snmp-server trap-timeout</b>	Defines how often to try resending trap messages on the retransmission queue.

# frame-relay vc-bundle

To create a Frame Relay permanent virtual circuit (PVC) bundle (if the bundle does not already exist) and to enter Frame Relay VC-bundle configuration mode, use the **frame-relay vc-bundle** command in interface configuration mode. To remove a Frame Relay PVC bundle, use the **no** form of this command.

```
frame-relay vc-bundle vc-bundle-name
```

```
no frame-relay vc-bundle vc-bundle-name
```

## Syntax Description

<i>vc-bundle-name</i>	Name of the Frame Relay PVC bundle.
-----------------------	-------------------------------------

## Command Default

A Frame Relay PVC bundle is not created.

## Command Modes

Interface configuration

## Command History

Release	Modification
12.2(13)T	This command was introduced.
12.2(16)BX	This command was integrated into Cisco IOS Release 12.2(16)BX.
12.0(26)S	This command was integrated into Cisco IOS Release 12.0(26)S.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

## Usage Guidelines

Use this command to create a unique Frame Relay PVC bundle (if one has not already been created using the **frame-relay map** command). You can also use this command to enter Frame Relay VC-bundle configuration mode, so that you can configure PVC bundle attributes and PVC bundle members.

## Examples

The following example creates a Frame Relay PVC bundle named MAIN-1:

```
interface serial 0
  frame-relay vc-bundle MAIN-1
```

## Related Commands

Command	Description
<b>frame-relay map</b>	Defines mapping between a destination protocol address and the DLCI or Frame Relay PVC bundle that connects to the destination address.

## fr-atm connect dlc

To connect a Frame Relay data-link connection identifier (DLCI) to an ATM virtual circuit descriptor for FRF.5 Frame Relay-ATM Interworking (currently available only for the Cisco MC3810), use the **fr-atm connect dlc** interface configuration command. The encapsulation type of the current interface must be Frame Relay or Frame Relay 1490 Internet Engineering Task Force (IETF). To remove the DLCI-to-VCD connection, use the **no** form of this command.

```
fr-atm connect dlc dlci atm-interface [pvc name | [vpi/vci]] [clp-bit {map-de | 0 | 1}] [de-bit
{no-map-clp | map-clp}]
```

```
no fr-atm connect dlc dlci atm-interface [pvc name | [vpi/vci]] [clp-bit {map-de | 0 | 1}] [de-bit
{no-map-clp | map-clp}]
```

### Syntax Description

<i>dlci</i>	Frame Relay DLCI number.
<i>atm-interface</i>	ATM interface connected to the DLCI.
<b>pvc name</b>	(Optional) ATM PVC name.
<i>vpi/vci</i>	(Optional) ATM PVC virtual path identifier (VPI)/virtual channel identifier (VCI). The default value for <i>vpi</i> is 0 if no value is entered.  When specifying the ATM PVC, enter one of the following PVC designations: <ul style="list-style-type: none"> <li>• The <i>name</i> value</li> <li>• The <i>vpi</i> value alone</li> <li>• The <i>vpi/vci</i> combination</li> </ul>
<b>clp-bit</b> { <b>map-de</b>   <b>0</b>   <b>1</b> }	(Optional) Sets the mode of Discard Eligibility/Cell Loss Priority (DE/CLP) mapping in the Frame Relay to ATM direction. The default is <b>map-de</b> .  <b>map-de</b> —Specifies Mode 1 (as described in section 4.4.2 of FRF.5). <b>0</b> or <b>1</b> —Specifies Mode 2 (as described in section 4.4.2 of FRF.5).
<b>de-bit</b> { <b>no-map-clp</b>   <b>map-clp</b> }	(Optional) Sets the mode of DE/CLP mapping in the ATM to Frame Relay direction. The default is <b>map-clp</b> .  <b>map-clp</b> —Specifies Mode 1 (as described in section 4.4.2 of FRF.5). <b>no-map-clp</b> —Specifies Mode 2 (as described in section 4.4.2 of FRF.5).

### Defaults

No Frame Relay-ATM connection is configured.

### Command Modes

Interface configuration

**Command History**

Release	Modification
11.3 MA	This command was introduced.
12.0	Management CLI support was added.
12.0(7)T	The <b>clp-bit</b> and <b>de-bit</b> keywords were added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2SX	This command is supported in the Cisco IOS Release 12.2SX train. Support in a specific 12.2SX release of this train depends on your feature set, platform, and platform hardware.

**Usage Guidelines**

This command only applies to Frame Relay-ATM Network Interworking (FRF.5) on the Cisco MC3810.

**Note**

The Cisco MC3810 provides only *network interworking* (FRF.5). The Cisco MC3810 can be used with *service interworking* (FRF.8), which is provided by the carrier's ATM network equipment.

**Examples**

The following example configures a Frame Relay-ATM Interworking connection on FR-ATM interface 20, in which Frame Relay DLCI 100 is connected to ATM VPI/VCI 100/200 for ATM interface 0:

```
interface fr-atm 20
 fr-atm connect dlci 100 atm0 100/200 clp-bit map-de de-bit map-clp
```

The following example configures a Frame Relay-ATM Interworking connection on FR-ATM interface 10, in which Frame Relay DLCI 150 is connected to ATM VPI/VCI 0/150 for ATM interface 0:

```
interface fr-atm 10
 fr-atm connect dlci 150 atm0 0/150 clp-bit map-de de-bit map-clp
```

**Related Commands**

Command	Description
<b>interface fr-atm</b>	Creates a Frame Relay-ATM Interworking interface on the Cisco MC3810 multiservice concentrator.