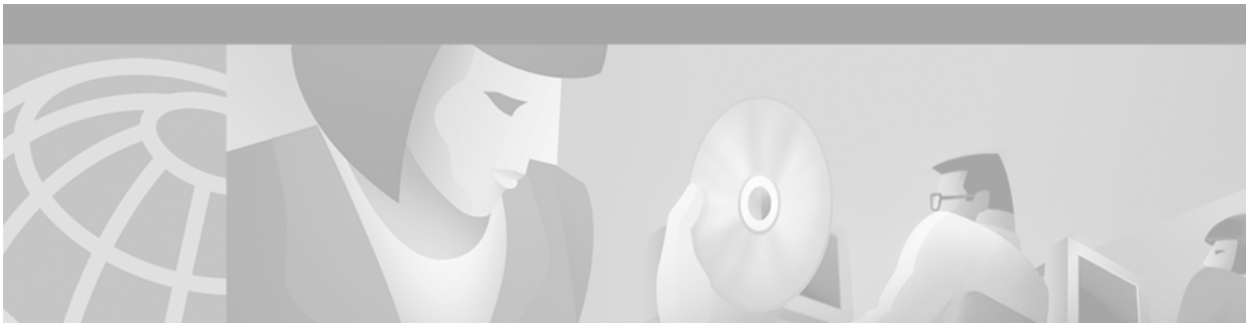


Frame Relay Switching Enhancements

This feature module describes the Frame Relay Switching Enhancements feature. It includes information on the benefits of this new feature, supported platforms, related documents, and so on.

This document includes the following sections:

Feature Overview

The Frame Relay Switching Enhancements feature enables a router in a Frame Relay network to be used as a Frame Relay switch.

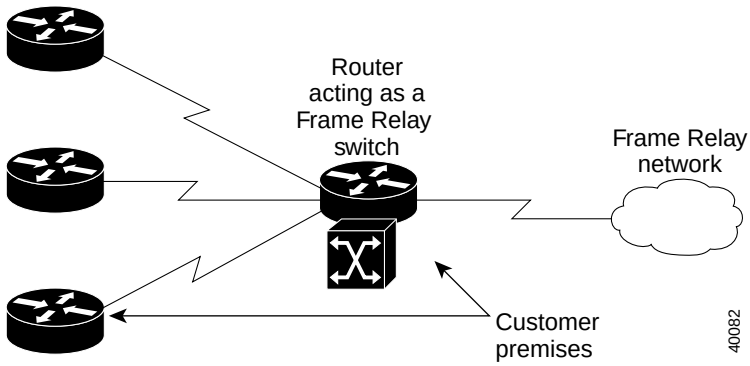
This feature includes the following Frame Relay switching enhancements:

- Traffic Shaping on Switched PVCs
- Frame Relay Switching over ISDN B Channels
- Traffic Policing on UNI DCE
- Congestion Management on Switched PVCs

Traffic Shaping on Switched PVCs

You can now configure Frame Relay traffic shaping on switched permanent virtual circuits (PVCs). By applying traffic shaping to switched PVCs you enable a router to be used as a Frame Relay port concentrator in front of a Frame Relay switch. The Frame Relay switch will shape the concentrated traffic before sending it into the network. Figure 1 shows the network configuration.

Figure 1 Router Used As a Frame Relay Port Concentrator



To create switched PVCs, use the **connec**t global configuration command. To configure traffic shaping, define the traffic-shaping parameters in a Frame Relay map class, identify the PVC as switched using the **frame-relay interface-dlci** interface command, and then attach the map class to the interface or a single switched PVC. All the traffic-shaping map-class parameters are applicable to switched PVCs: namely, Bc, Be, CIR, minimum CIR, average rate, peak rate, and adaptive shaping.

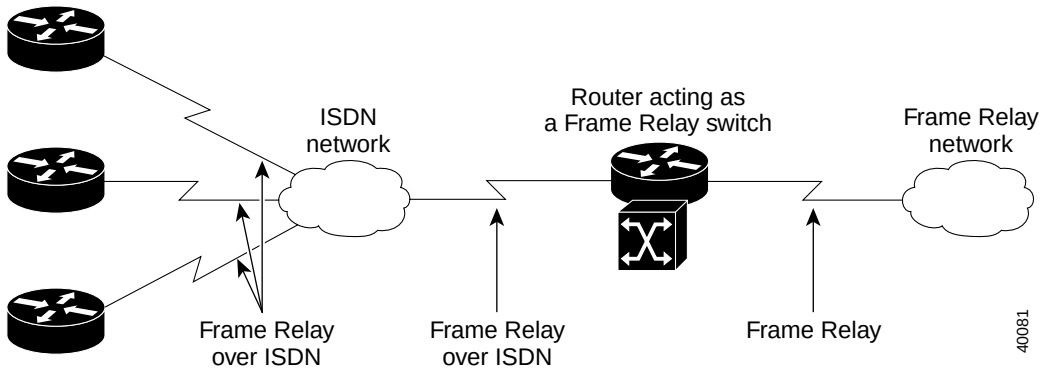
Frame Relay traffic shaping must be enabled on the interface before traffic-shaping map-class parameters will be effective. Note that when you enable Frame Relay traffic shaping, all PVCs, switched and terminated, will be shaped on that interface. Switched PVCs that are not associated with a map class will inherit shaping parameters from the interface or use default values.

The traffic-shaping enhancement to switched PVCs also allows you to set a maximum queue size for use with FIFO default queueing. To set the maximum FIFO queue size, use the **frame-relay holdq** map-class command. The default value is 40 packets, and the allowable range is from1 to 512.

Frame Relay Switching over ISDN B Channels

The Frame Relay Switching Enhancements feature enables you to transport Frame Relay data over ISDN to allow small offices to be hubbed out of larger offices rather than connecting them directly to the core network. The hub router acts as a Frame Relay switch, switching between ISDN and serial interfaces, as shown in Figure2.

Figure 2 Router Used As a Frame Relay Switch over ISDN



The Frame Relay switching over ISDN enhancement provides the following functionality:

- The Local Management Interface (LMI) mechanism that previously operated only on serial Frame Relay DCE interfaces now also operates on ISDN Frame Relay DCE interfaces.
- A single BRI/PRI interface can use a combination of switched PVCs and terminated Frame Relay PVCs.
- Frame Relay switching supports both leased-line ISDN, on which a B channel is permanently connected, and switched ISDN, on which B channels may be dynamically set up and torn down.

To configure Frame Relay switching over ISDN, use the **connect** global configuration command.

Traffic Policing on UNI DCE

The Frame Relay Switching Enhancements feature brings traffic policing functionality to User-Network Interface (UNI) DCEs in Frame Relay networks. Shaping affects outgoing traffic, and policing operates on incoming PVC traffic. When enabled on the interface, policing prevents traffic congestion by discarding or setting the DE bit on packets that exceed specified traffic parameters.

To enable Frame Relay policing on all switched PVCs on the interface, use the **frame-relay policing** interface command. To configure traffic policing, define policing parameters in a Frame Relay map class using the CIR, Bc, Be and Tc parameters. You can associate the map class with the interface or individual switched PVCs. Switched PVCs that are not associated with a map class will inherit policing parameters from the interface.

The CIR, Bc, Be, and Tc parameters are also used to configure traffic shaping. If you are going to use a map class to configure both policing and shaping, use the **in** and **out** keywords to distinguish between incoming and outgoing traffic. If you configure both shaping and policing on a switched PVC, the shaping parameters will be derived from the policing parameters unless you specifically define shaping parameters in the map class.

Congestion Management on Switched PVCs

The Frame Relay Switching Enhancements feature enables a router in a Frame Relay network to manage outgoing traffic congestion on switched PVCs. When Frame Relay congestion management is enabled, one way that the router manages congestion is by setting backward explicit congestion

notification (BECN) and forward explicit congestion notification (FECN) bits on packets. When a switched PVC or interface is congested, packets experiencing congestion are marked with the FECN bit, and packets traveling in the reverse direction are marked with the BECN bit. When these bits reach a user device at the end of the network, the user device can react to the ECN bits and adjust the flow of traffic.

A second way the router manages congestion is by discarding Frame Relay packets that are marked with the discard eligible (DE) bit and that exceed a specified level of congestion.

You can define two levels of congestion. The first level applies to individual PVCs transmitting traffic in excess of the committed information rate (CIR). The second level applies to all PVCs at an interface. This scheme allows you to adjust the congestion on PVCs transmitting above the CIR before applying congestion management measures to all PVCs.

Congestion management parameters can be configured on the output interface queue and on traffic-shaping queues. To configure congestion management on the output interface queue, first enable congestion management using the **frame-relay congestion-management** interface command. Then configure the explicit congestion notice (ECN) excess, ECN committed, and DE thresholds using the **threshold ecn** and **threshold de** frame relay congestion management commands.

When the output interface queue reaches or exceeds the ECN excess threshold, all Frame Relay DE bit packets on all PVCs crossing that interface will be marked with FECN or BECN, depending on their direction of travel. When the queue reaches or exceeds the ECN committed threshold, all Frame Relay packets will be marked with FECN or BECN.

When the queue reaches or exceeds the DE threshold, Frame Relay packets with the DE bit will be discarded rather than queued.

To configure per-PVC congestion management on traffic-shaping queues, use the **frame-relay congestion threshold ecn** and **frame-relay congestion threshold de** map-class commands. You can configure one ECN threshold for each traffic-shaping queue.

Benefits

Before the Frame Relay Switching Enhancements feature was introduced, routers had limited Frame Relay switching functionality. With this feature, a router acting as a virtual Frame Relay switch can be configured to do the following:

- Apply Frame Relay traffic shaping functionality to switched PVCs, enabling the router to act as a Frame Relay port concentrator.
- Support ISDN interfaces in addition to serial interfaces.
- Discard switched packets with the DE bit set when there is network congestion.
- Police incoming traffic to ensure adherence to service contracts.
- Set the Forward/Backward Explicit Congestion Notification (FECN/BECN) bits in switched packets when there is network congestion.
- Apply FRF.12 fragmentation to switched PVCs.

Restrictions

- The Frame Relay switching enhancements can be configured on the interface or individual PVCs; however, they cannot be configured on Frame Relay subinterfaces.
- The traffic-shaping enhancement does not support priority queueing or custom queueing.

- Frame Relay traffic shaping cannot be configured on ISDN interfaces.
- The router configured for Frame Relay switching over ISDN cannot initiate the ISDN call.

Related Documents

- *Cisco IOS Wide-Area Networking Configuration Guide*, Release 12.1
- *Cisco IOS Wide-Area Networking Command Reference*, Release 12.1
- *FRF.12 Support on Switched Frame Relay PVCs*, Cisco IOS Release 12.1(2)T

Supported Platforms

- Cisco 1600
- Cisco 2500 series
- Cisco 2600
- Cisco 3600 series
- Cisco 4000 series (Cisco 4000, 4000-M, 4500, 4500-M, 4700, 4700-M)
- Cisco 7200 series
- Cisco 7500 series (in nondistributed mode)

Supported Standards, MIBs, and RFCs

Standards

No new or modified standards are supported by this feature.

MIBs

No new or modified MIBs are supported by this feature.

For descriptions of supported MIBs and how to use MIBs, see the Cisco MIB web site on Cisco Connection Online (CCO) at http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

RFCs

No new or modified RFCs are supported by this feature.

Prerequisites

- Frame Relay switching must be enabled on the router before you can configure any of the Frame Relay switching enhancements. To enable Frame Relay switching, use the **frame-relay switching** global command.
- Frame Relay traffic shaping must be enabled on the outgoing interface before you can configure traffic shaping on switched PVCs. To enable Frame Relay traffic shaping, use the **frame-relay traffic-shaping** interface command.
- Frame Relay policing must be enabled on the incoming interface before you can configure traffic policing parameters. To enable Frame Relay policing, use the **frame-relay policing** interface command.
- Congestion management must be enabled on the outgoing interface before you can configure congestion management on switched PVCs. To enable congestion management, use the **frame-relay congestion-management** interface command.
- Switched PVCs must be created using the **connect** command.

Configuration Tasks

See the following sections for configuration tasks for the Frame Relay Switching Enhancements feature. Each task in the list is indicated as optional or required.

- Creating Switched PVCs
- Identifying a PVC As Switched
- Enabling Frame Relay Policing on the Interface
- Configuring Frame Relay Policing Parameters
- Configuring Congestion Management on the Interface
- Configuring Frame Relay Congestion Management on Traffic-Shaping Queues

Creating Switched PVCs

To create switched PVCs, use the following command in global configuration mode:

Command	Purpose
`Router(config)# connect connection-name interface dlci interface dlci`	Defines connections between Frame Relay PVCs.

Identifying a PVC As Switched

Before you can associate a map class with a switched PVC, you must identify the PVC as being switched. To identify a PVC as switched, use the following command in interface configuration mode:

Command	Purpose
`Router(config-if)# frame-relay interface-dlci dlci [ietf | cisco] [voice-encap size] [voice-cir cir] [ppp virtual-template-name] [switched]`	Identifies a PVC as switched.

Enabling Frame Relay Policing on the Interface

To enable Frame Relay policing on a interface, use the following command in interface configuration mode:

Command	Purpose
`Router(config-if)# frame-relay policing`	Enables Frame Relay policing on all switched PVC s on the interface.

Configuring Frame Relay Policing Parameters

To configure policing parameters in a Frame Relay map class, use one or more of the following commands in map-class configuration mode:

Command	Purpose
`Router(config-map-class)# frame-relay cir {in | out} bps`	Sets the CIR for a Frame Relay PVC.
`Router(config-map-class)# frame-relay bc {in | out} bits`	Sets the committed burst size for a Frame Relay PVC.
`Router(config-map-class)# frame-relay be {in | out} bits`	Sets the excess burst size for a Frame Relay PVC.
`Router(config-map-class)# frame-relay tc milliseconds`	Sets the measurement interval for policing incoming traffic on a PVC when the CIR is zero.

Configuring Congestion Management on the Interface

To configure Frame Relay congestion management on all switched PVCs on an interface, use the following commands beginning in interface configuration mode:

	Command	Purpose
Step 1	`Router(config-if)# frame-relay congestion management`	Enables Frame Relay congestion management on all switched PVCs on an interface and enters Frame Relay congestion management configuration mode.
Step 2	`Router(config-fr-congest)# threshold de percentage`	Configures the threshold at which DE-marked packets will be discarded from switched PVCs on the output interface.
Step 3	`Router(config-fr-congest)# threshold ecn {bc | be} percentage`	Configures the threshold at which ECN bits will be set on packets in switched PVCs on the output interface.

Configuring Frame Relay Congestion Management on Traffic-Shaping Queues

To configure Frame Relay congestion management on the traffic-shaping queues of switched PVCs, use one or more of the following commands in map-class configuration mode:

Command	Purpose
`Router(config-map-class)# frame-relay congestion threshold de` *percentage*	Configures the threshold at which DE-marked packets will be discarded from the traffic-shaping queue of a switched PVC.
`Router(config-map-class)# frame-relay congestion threshold ecn` *percentage*	Configures the threshold at which ECN bits will be set on packets in the traffic-shaping queue of a switched PVC.
`Router(config-map-class)# frame-relay holdq` *queue-size*	Configures the maximum size of a traffic-shaping queue on a switched PVC.

Verifying Frame Relay Policing

To verify Frame Relay policing on switched PVCs, use the following command in privileged EXEC mode:

Command	Purpose
`Router# show frame-relay pvc [interface` *interface*`] [`*dlci*`]`	Displays statistics about PVCs for Frame Relay interfaces.

Verifying Frame Relay Congestion Management

To verify Frame Relay congestion management on switched PVCs, use the following commands:

Command	Purpose
`Router# show frame-relay pvc [interface` *interface*`] [`*dlci*`]`	Displays statistics about PVCs for Frame Relay interfaces.
`Router# show interfaces serial` *number*	Displays information about the configuration and queue at the interface.

Monitoring and Maintaining Frame Relay Policing and Congestion Management

To monitor Frame Relay policing and congestion management, use the following commands:

Command	Purpose
`Router# show frame-relay pvc [interface` *interface*`] [`*dlci*`]`	Displays statistics about PVCs for Frame Relay interfaces.
`Router# show interfaces serial` *number*	Displays information about the configuration and queue at the interface.

Configuration Examples

This section provides the following configuration examples:

- Configuring Traffic Shaping on Switched PVCs Example
- Configuring Frame Relay Switching over ISDN B Channels Example
- Configuring Traffic Policing on a UNI DCE Example
- Configuring Congestion Management on Switched PVCs Example
- Configuring Congestion Management on the Traffic-Shaping Queue of a Switched PVC Example

Configuring Traffic Shaping on Switched PVCs Example

In the example that follows, traffic on serial interface 0 is being shaped prior to entry to the Frame Relay network. PVC 100/16 is shaped according to the “shape256K” class. PVC 200/17 is shaped using the “shape64K” class inherited from the interface.

```
frame-relay switching
  !
  interface serial0
    encapsulation frame-relay
    frame-relay intf-type dce
    frame-relay traffic-shaping
    frame-relay class shape64K
    frame-relay interface-dlci 16 switched
      class shape256K
  !
  interface serial1
    encapsulation frame-relay
    frame-relay intf-type dce
  !
  connect one serial0 16 serial1 100
  connect two serial0 17 serial1 200
  !
  map-class frame-relay shape256K
    frame-relay traffic-rate 256000 512000
  !
  map-class frame-relay shape64K
    frame-relay traffic-rate 64000 64000
```

Configuring Frame Relay Switching over ISDN B Channels Example

The following example illustrates Frame Relay switching over an ISDN dialer interface:

```
frame-relay switching
  !
  interface BRI0
    isdn switch-type basic-5ess
    dialer pool-member 1
    dialer pool-member 2
  !
  interface dialer1
    encapsulation frame-relay
    dialer pool 1
    dialer-group 1
    dialer caller 60038
    dialer string 60038
    frame-relay intf-type dce
  !
  interface dialer2
    encapsulation frame-relay
    dialer pool 2
    dialer-group 1
    dialer caller 60039
    dialer string 60039
    frame-relay intf-type dce
  !
  interface serial0
    encapsulation frame-relay
    frame-relay intf-type dce
  !
  connect one serial0 16 dialer1 100
  connect two serial0 17 dialer2 100
  dialer-list 1 protocol ip permit
```

Configuring Traffic Policing on a UNI DCE Example

In the following example, incoming traffic is being policed on serial interface 1. The interface uses policing parameters configured in map class “police256K.” PVC 100/16 inherits policing parameters from the interface. PVC 200/17 uses policing parameters configured in “police64K.”

```
frame-relay switching
!
interface serial0
  encapsulation frame-relay
  frame-relay intf-type dce
!
interface serial1
  encapsulation frame-relay
  frame-relay policing
  frame-relay class police256K
  frame-relay intf-type dce
  frame-relay interface-dlci 200 switched
    class police64K
!
connect one serial0 16 serial1 100
connect two serial0 17 serial1 200
!
map-class frame-relay police256K
  frame-relay cir 256000
  frame-relay bc 256000
  frame-relay be 0
!
map-class frame-relay police64K
  frame-relay cir 64000
  frame-relay bc 64000
  frame-relay be 64000
```

Configuring Congestion Management on Switched PVCs Example

The following example illustrates the configuration of congestion management and DE discard levels for all switched PVCs on serial interface 1. Policing is configured on PVC 16.

```
frame-relay switching
!
interface serial0
  encapsulation frame-relay
  frame-relay intf-type dce
  frame-relay policing
  frame-relay interface-dlci 16 switched
    class 256K
!
interface serial1
  encapsulation frame-relay
  frame-relay intf-type dce
  frame-relay congestion-management
    threshold ecn be 0
    threshold ecn bc 20
    threshold de 40
!
connect one serial1 100 serial0 16
!
map-class frame-relay 256K
  frame-relay cir 256000
  frame-relay bc 256000
  frame-relay be 256000
```

Configuring Congestion Management on the Traffic-Shaping Queue of a Switched PVC Example

The following example illustrates the configuration of congestion management in a class called perpvc_congestion. The class is associated with the traffic-shaping queue of DLCI 200 on serial interface 3.

```
map-class frame-relay perpvc_congestion
  frame-relay holdq 100
  frame-relay congestion threshold ecn 50

interface Serial3
  frame-relay traffic-shaping
  frame-relay interface-dlci 200 switched
    class perpvc_congestion
```

Command Reference

This section documents new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

connect (Frame Relay)

To define connections between Frame Relay PVCs, use the **connect** global configuration command. To remove connections, use the **no** form of this command.

connect *connection-name interface dlci interface dlci*

no connect *connection-name interface dlci interface dlci*

Syntax Description

connection-name	A name for this connection.
interface	Interface on which a PVC connection will be defined.
dlci	Data-link connection identifier (DLCI) number of PVC that will be connected.

Defaults

No default behavior or values.

Command Modes

Global configuration

Command History

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

Usage Guidelines

When Frame Relay switching is enabled, the **connect** command creates switched PVCs in Frame Relay networks.

Examples

The following example shows how to enable Frame Relay switching and define a connection called "one" between DLCI 16 on serial interface 0 and DLCI 100 on serial interface 1.

```
frame-relay switching
connect one serial0 16 serial1 100
```

Related Commands

Command	Description
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.

frame-relay congestion-management

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

frame-relay congestion-management

no frame-relay congestion-management

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

Interface configuration

Command History

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

Usage Guidelines

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

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

Examples

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

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

Related Commands

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

frame-relay congestion threshold de

To configure the threshold at which DE-marked packets will be discarded from the traffic-shaping queue of a switched PVC, use the **frame-relay congestion threshold de** map-class command. To reconfigure the threshold, use the **no** form of this command.

frame-relay congestion threshold de *percentage*

no frame-relay congestion threshold de *percentage*

Syntax Description

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

Defaults

100%.

Command Modes

Map-class configuration

Command History

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

Usage Guidelines

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

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

Examples

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

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

Related Commands

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

frame-relay congestion threshold ecn

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

frame-relay congestion threshold ecn *percentage*

no frame-relay congestion threshold ecn *percentage*

Syntax Description

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

Defaults

100%.

Command Modes

Map-class configuration

Command History

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

Usage Guidelines

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

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

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

Examples

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

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

Related Commands

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

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

frame-relay holdq

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

frame-relay holdq *queue-size*

no frame-relay holdq *queue-size*

Syntax Description

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

Defaults

40 packets.

Command Modes

Map-class configuration

Command History

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

Usage Guidelines

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

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

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

Examples

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

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

Related Commands

Command	Description
frame-relay switching	Enables PVC switching on a Frame Relay DCE or Network-to-Network Interface (NNI).
frame-relay traffic-shaping	Enables both traffic shaping and per-PVC queueing for all PVCs and switched virtual circuits (SVCs) on a Frame Relay interface.

frame-relay interface-dlci

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

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

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

BOOTP Server Only

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

Syntax Description

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

Defaults

No DLCI is assigned.

The default PVC type is terminated.

Command Modes

Interface configuration

Command History

Release	Modification
10.0	This command was introduced.
11.3(1)MA	The **voice-encap** option was added for the Cisco MC3810.
12.0(1)T	The **ppp** keyword and *virtual-template-name* argument were introduced.
12.0(2)T	The **voice-cir** option was added for the Cisco MC3810.
12.0(3)T	The keyword **x25 profile** was introduced.
12.0(4)T	Usage guidelines for the Cisco MC3810 were added.
12.1(2)T	The **switched** keyword was added.

Usage Guidelines

Use the **frame-relay interface-dlci** command with the **switched** keyword to allow a map class to be associated with a switched PVC.

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

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

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

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

By issuing the **frame-relay interface-dlci** interface configuration command, you enter Frame Relay DLCI interface configuration mode (see the first example below). This gives you the following command options, which must be used with the relevant class or X.25-profile names you previously assigned:

- **class** *name*—Assigns a map class to a DLCI.
- **default**—Sets a command to its defaults.
- **no** {**class** *name* **| x25-profile** *name*}—Cancels the relevant class or X.25 profile.
- **x25-profile** *name*—Assigns an X.25 profile to a DLCI. (Annex G.)

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

When configuring the **voice-encap** option on the Cisco MC3810 to enable Voice over Frame Relay, set the data fragmentation size based on the port access rate. Table 1 lists recommended data fragmentation sizes for different port access rates. Note also that when the **voice-encap** option is configured on the Cisco MC3810, voice traffic is not shaped, and all priority queueing, custom queueing, and weighted fair queueing are disabled on the interface.

Table 1 Recommended Data Segmentation Sizes for Port Access Rates

Port Access Rate	Recommended Data Segmentation Size[1]
64 kbps	80 bytes
128 kbps	160 bytes
256 kbps	320 bytes
512 kbps	640 bytes
1536 kbps (full T1)	1600 bytes
2048 kbps (full E1)	1600 bytes

1. The data segmentation size is based for back-to-back Frame Relay. If sending traffic through an IGX with standard Frame Relay, add an extra 15 bytes to the recommended data segmentation size.

Note On the Cisco MC3810 only, the **voice-encap** option performs the same function as the **vofr cisco** interface configuration command introduced in Cisco IOS Release 12.0(3)XG. Either command is required in order to enable Voice over Frame Relay. The **voice-encap** option and the **vofr cisco** command are mutually exclusive on the same interface; you must choose which command to use. The **voice-encap** option does not support any priority queueing function, which provides greater throughput. The **vofr cisco** command uses weighted fair queueing, which reduces throughput but provides a means of prioritizing traffic flows.

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

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

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

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

Examples

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

```
interface serial0
    encapsulation frame-relay
    frame-relay interface-dlci 16 switched
      class shape256K
```

In the following example, DLCI 100 is assigned to serial subinterface 5.17:

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

In the following example, DLCI 26 over subinterface serial 1.1 is specified, and the characteristics under virtual-template 2 are assigned to this PPP connection:

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

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

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

The following example shows assigning DLCI 100 to serial subinterface 5.17:

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

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

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

The following example shows enabling Voice over Frame Relay on DLCI 100 on a Cisco MC3810 and setting the data fragmentation size to 80 bytes:

```
router(config)# interface serial0
router(config-if)# frame-relay interface-dlci 100 voice-encap 80
router(config-fr-dlci)#
```

The following example shows enabling Voice over Frame Relay on DLCI 100 on a Cisco MC3810, setting the data fragmentation size to 80 bytes, and setting the voice CIR to 24000 bps:

```
router(config)# interface serial0
router(config-if)# frame-relay interface-dlci 100 voice-encap 80 voice-cir 24000
router(config-fr-dlci)#
```

Related Commands

Command	Description
frag-pre-queuing	Sets the queueing on a Frame Relay or HDLC interface to occur after fragmentation.
frame-relay class	Associates a map class with an interface or subinterface.
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.
show interface	Displays P1024B/C information.
vofr	Configures subchannels and enables Voice over Frame Relay for a specific DLCI.

frame-relay policing

To enable Frame Relay policing on all switched PVCs on the interface, use the **frame-relay policing** interface configuration command. 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

Disabled.

Command Modes

Interface configuration

Command History

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

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
frame-relay bc	Specifies the incoming or outgoing committed burst size (Bc) for a Frame Relay virtual circuit.
frame-relay be	Specifies the incoming or outgoing excess burst size (Be) for a Frame Relay virtual circuit.
frame-relay cir	Specifies the incoming or outgoing committed information rate (CIR) for a Frame Relay virtual circuit.
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
frame-relay tc	Specifies the measurement interval for policing incoming traffic when the CIR is zero.

frame-relay tc

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

frame-relay tc *milliseconds*

no frame-relay tc *milliseconds*

Syntax Description

milliseconds	Time interval from 10 ms to 10,000 ms during which incoming traffic cannot exceed Bc plus Be.

Defaults

1000 ms.

Command Modes

Map-class configuration

Command History

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

Usage Guidelines

You must enable Frame Relay policing on the incoming interface, using the **frame-relay policing** interface command, before you can configure traffic policing parameters.

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

When the CIR is greater than 0, Tc is equal to Bc divided by the CIR.

Examples

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

Command	Description
frame-relay bc	Specifies the incoming or outgoing committed burst size (Bc) for a Frame Relay virtual circuit.
frame-relay be	Specifies the incoming or outgoing excess burst size (Be) for a Frame Relay virtual circuit.
frame-relay cir	Specifies the incoming or outgoing committed information rate (CIR) for a Frame Relay virtual circuit.

frame-relay policing	Enables Frame Relay policing on all switched PVCs on an interface.
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.

show frame-relay pvc

To display statistics about permanent virtual circuits (PVCs) for Frame Relay interfaces, use the **show frame-relay pvc** privileged EXEC command.

show frame-relay pvc [**interface** *interface*][*dlci*]

Syntax Description

interface	(Optional) Indicates a specific interface for which PVC information will be displayed.
interface	(Optional) Interface number containing the DLCI(s) for which you wish to display PVC information.
dlci	(Optional) A specific DLCI number used on the interface. Statistics for the specified PVC are displayed when a DLCI is also specified.

Defaults

No default behavior or values.

Command Modes

Privileged EXEC

Command History

Release	Modification
10.0	This command was introduced.
12.0(1)T	This command was modified to display statistics about virtual access interfaces used for PPP connections over Frame Relay.
12.0(3)XG	This command was modified to include the fragmentation type and size associated with a particular PVC when fragmentation is enabled on the PVC.
12.0(4)T	This command was modified to include the fragmentation type and size associated with a particular PVC when fragmentation is enabled on the PVC.
12.0(5)T	This command was modified to include information on the special voice queue that is created using the **queue** keyword of the **frame-relay voice bandwidth** command.
12.1(2)T	This command was modified to include information about Frame Relay traffic shaping and policing on switched PVCs.

Usage Guidelines

Use this command to monitor the PPP link control protocol (LCP) state as being open with an “up” state, or closed with a “down” state.

When “vofr” or “vofr cisco” have been configured on the PVC, and a voice bandwidth has been allocated to the class associated with this PVC, configured voice bandwidth and used voice bandwidth are also displayed.

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

Statistics Reporting

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

Per-VC counters are not incremented at all when either autonomous or silicon switching engine (SSE) switching is configured; therefore, PVC values will be inaccurate if either switching method is used.

Traffic Shaping

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

Traffic shaping is not supported on ISDN Frame Relay interfaces.

Examples

The various displays in this section show sample output for a variety of different PVCs. Some of the PVCs carry data only; some carry a combination of voice and data.

Frame Relay Congestion Management on a Switched PVC Example

The following is sample output from the **show frame-relay pvc** command that shows the statistics for a switched PVC on which Frame Relay congestion management is configured:

```
Router# show frame-relay pvc 200

PVC Statistics for interface Serial3/0 (Frame Relay DTE)

DLCI = 200, DLCI USAGE = SWITCHED, PVC STATUS = ACTIVE, INTERFACE = Serial3/0

  input pkts 341           output pkts 390          in bytes 341000
  out bytes 390000         dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 390
  out bcast pkts 0          out bcast bytes 0            Num Pkts Switched 341

  pvc create time 00:10:35, last time pvc status changed 00:10:06
  Congestion DE threshold 50
  shaping active
  cir 56000     bc 7000      be 0         byte limit 875    interval 125
  mincir 28000     byte increment 875   BECN response no
  pkts 346       bytes 346000    pkts delayed 339       bytes delayed 339000
  traffic shaping drops 0
  Queueing strategy:fifo
  Output queue 48/100, 0 drop, 339 dequeued
```

Frame Relay Policing on a Switched PVC Example

The following is sample output from the **show frame-relay pvc** command that shows the statistics for a switched PVC on which Frame Relay policing is configured:

```
Router# show frame-relay pvc 100

PVC Statistics for interface Serial1/0 (Frame Relay DCE)

DLCI = 100, DLCI USAGE = SWITCHED, PVC STATUS = ACTIVE, INTERFACE = Serial1/0

  input pkts 1260          output pkts 0            in bytes 1260000
  out bytes 0              dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  out bcast pkts 0          out bcast bytes 0            Num Pkts Switched 1260

  pvc create time 00:03:57, last time pvc status changed 00:03:19
  policing enabled, 180 pkts marked DE
  policing Bc  6000        policing Be  6000        policing Tc  125 (msec)
  in Bc pkts   1080        in Be pkts   180         in xs pkts   0
  in Bc bytes  1080000     in Be bytes  180000      in xs bytes  0
```

The following is sample output from the **show frame-relay pvc** command that shows the PVC statistics for serial interface 5 (slot 1 and DLCI 55 is up) during a PPP session over Frame Relay:

```
 Router# show frame-relay pvc 55

PVC Statistics for interface Serial5/1 (Frame Relay DTE)
DLCI = 55, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial5/1.1
     input pkts 9             output pkts 16           in bytes 154
     out bytes 338            dropped pkts 6           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 0         out bcast bytes 0
     pvc create time 00:35:11, last time pvc status changed 00:00:22
     Bound to Virtual-Access1 (up, cloned from Virtual-Template5)
```

The following is sample output from the **show frame-relay pvc** command for a PVC carrying Voice over Frame Relay configured via the **vofr cisco** command. The **frame-relay voice bandwidth** command has been configured on the class associated with this PVC, as has fragmentation. The fragmentation employed is Cisco proprietary.

A sample configuration for this scenario is shown first, and then the output for the **show frame-relay pvc** command:

```
interface serial 0
     encapsulation frame-relay
     frame-relay traffic-shaping
     frame-relay interface-dlci 108
       vofr cisco
       class vofr-class
   map-class frame-relay vofr-class
     frame-relay fragment 100
     frame-relay fair-queue
     frame-relay cir 64000
     frame-relay voice bandwidth 25000
Router# show frame-relay pvc 108
PVC Statistics for interface Serial0 (Frame Relay DTE)
DLCI = 108, DLCI USAGE = LOCAL, PVC STATUS = STATIC, INTERFACE = Serial0
  input pkts 1260          output pkts 1271         in bytes 95671
  out bytes 98604          dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  out bcast pkts 1271       out bcast bytes 98604
  pvc create time 09:43:17, last time pvc status changed 09:43:17
  Service type VoFR-cisco
  configured voice bandwidth 25000, used voice bandwidth 0
  voice reserved queues 24, 25
  fragment type VoFR-cisco         fragment size 100
  cir 64000     bc 64000     be 0         limit 1000   interval 125
  mincir 32000     byte increment 1000  BECN response no
  pkts 2592      bytes 205140    pkts delayed 1296      bytes delayed 102570
  shaping inactive
  shaping drops 0
  Current fair queue configuration:
   Discard     Dynamic      Reserved
   threshold   queue count  queue count
64          16           2
  Output queue size 0/max total 600/drops 0
```

Note that the “fragment type” field in the **show frame-relay pvc** display can have the following entries:

- VoFR-cisco—Indicates that fragmented packets will contain the Cisco proprietary header.
- VoFR—Indicates that fragmented packets will contain the FRF.11 Annex C header.
- end-to-end—Indicates that pure FRF.12 fragmentation is carried on this virtual circuit.

The following is sample output from the **show frame-relay pvc** command for an application employing pure FRF.12 fragmentation. A sample configuration for this scenario is shown first, and then the output for the **show frame-relay pvc** command:

```
interface serial 0
     encapsulation frame-relay
     frame-relay traffic-shaping
     frame-relay interface-dlci 110
       class frag
   map-class frame-relay frag
     frame-relay fragment 100
     frame-relay fair-queue
     frame-relay cir 64000

Router# show frame-relay pvc 110
PVC Statistics for interface Serial0 (Frame Relay DTE)
DLCI = 110, DLCI USAGE = LOCAL, PVC STATUS = STATIC, INTERFACE = Serial0
  input pkts 0             output pkts 243          in bytes 0
  out bytes 7290           dropped pkts 0           in FECN pkts 0
  in BECN pkts 0           out FECN pkts 0          out BECN pkts 0
  in DE pkts 0             out DE pkts 0
  out bcast pkts 243        out bcast bytes 7290
  pvc create time 04:03:17, last time pvc status changed 04:03:18
  fragment type end-to-end         fragment size 100
  cir 64000     bc 64000     be 0         limit 1000   interval 125
  mincir 32000     byte increment 1000  BECN response no
  pkts 486       bytes 14580     pkts delayed 243       bytes delayed 7290
  shaping inactive
  shaping drops 0
  Current fair queue configuration:
   Discard     Dynamic      Reserved
   threshold   queue count  queue count
   64          16           2
  Output queue size 0/max total 600/drops 0
```

Note that when voice is not configured, voice bandwidth output is not displayed.

The following is sample output from the **show frame-relay pvc** command for multipoint subinterfaces carrying data only. The output displays both the subinterface number and the DLCI. This display is the same whether the PVC is configured for static or dynamic addressing. Note that neither fragmentation nor voice is configured on this PVC.

```
Router# show frame-relay pvc
DLCI = 300, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.103
input pkts 10  output pkts 7  in bytes 6222
out bytes 6034  dropped pkts 0  in FECN pkts 0
in BECN pkts 0  out FECN pkts 0  out BECN pkts 0
in DE pkts 0  out DE pkts 0
outbcast pkts 0  outbcast bytes 0
pvc create time 0:13:11  last time pvc status changed 0:11:46
DLCI = 400, DLCI USAGE = LOCAL, PVC STATUS = ACTIVE, INTERFACE = Serial0.104
input pkts 20  output pkts 8  in bytes 5624
out bytes 5222  dropped pkts 0  in FECN pkts 0
in BECN pkts 0  out FECN pkts 0  out BECN pkts 0
in DE pkts 0  out DE pkts 0
outbcast pkts 0  outbcast bytes 0
pvc create time 0:03:57  last time pvc status changed 0:03:48
```

The following is sample output from the **show frame-relay pvc** command for a PVC carrying voice and data traffic with a special queue specifically for voice traffic created using the **frame-relay voice bandwidth** command **queue** keyword:

```
Router# show frame-relay pvc interface serial 1 45

 PVC Statistics for interface Serial1 (Frame Relay DTE)

 DLCI = 45, DLCI USAGE = LOCAL, PVC STATUS = STATIC, INTERFACE = Serial1

   input pkts 85            output pkts 289          in bytes 1730
   out bytes 6580           dropped pkts 11          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 0          out bcast bytes 0
   pvc create time 00:02:09, last time pvc status changed 00:02:09
   Service type VoFR
   configured voice bandwidth 25000, used voice bandwidth 22000
   fragment type VoFR         fragment size 100
   cir 20000     bc   1000      be 0         limit 125    interval 50
   mincir 20000     byte increment 125   BECN response no
   fragments 290       bytes 6613      fragments delayed 1         bytes delayed 33
   shaping inactive
   traffic shaping drops 0
    Voice Queueing Stats: 0/100/0 (size/max/dropped)
   ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
   Current fair queue configuration:
    Discard     Dynamic      Reserved
    threshold   queue count  queue count
    64          16           2
   Output queue size 0/max total 600/drops 0
```

Table 2 provides a listing of the fields in these displays and a description of each field.

Table 2 show frame-relay pvc Field Descriptions

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

Table 2 show frame-relay pvc Field Descriptions (continued)

Field	Description
out DE pkts	Number of DE packets sent.
out bcast pkts	Number of output broadcast packets.
out bcast bytes	Number of output broadcast bytes.
Num Pkts Switched	Number of packets switched from input dlci to output dlci.
pvc create time	Time at which the PVC was created.
last time pvc status changed	Time at which the PVC changed status (from active to inactive).
pkts marked DE	Number of packets marked DE because they exceeded the Bc.
policing Bc	Committed burst size.
policing Be	Excess burst size.
policing Tc	Measurement interval for counting Bc and Be.
in Bc pkts	Number of packets received within the committed burst.
in Be pkts	Number of packets received within the excess burst.
in xs pkts	Number of packets dropped because they exceeded the combined burst.
in Bc bytes	Number of bytes received within the committed burst.
in Be bytes	Number of bytes received within the excess burst.
in xs bytes	Number of bytes dropped because they exceeded the combined burst.
Congestion DE threshold	PVC percentage at which packets with the DE bit are dropped.
Congestion ECN threshold	PVC percentage at which packets are set with the BECN and FECN bits.
Service-type	Type of service performed by this PVC; can be VoFR or VoFR-cisco.
configured voice bandwidth	Amount of bandwidth in bits per second reserved for voice traffic on this PVC.
used voice bandwidth	Amount of bandwidth in bits per second currently being used for voice traffic.
voice reserved queues	Queue numbers reserved for voice traffic on this PVC. This field was removed in Cisco IOS Release 12.0(5)T.
fragment type	Type of fragmentation configured for this PVC. Possible types are: • VoFR-cisco—Fragmented packets containing the Cisco proprietary header. • VoFR—Fragmented packets containing the FRF.11 Annex C header. • end-to-end—Fragmented packets containing the standard FRF.12 header.
fragment size	Size of the fragment payload in bytes.
cir	Current committed information rate (CIR), in bits per second.
bc	Current committed burst size, in bits.
be	Current excess burst size, in bits.
limit	Maximum number of bytes transmitted per internal interval (excess plus sustained).
interval	Interval being used internally (may be smaller than the interval derived from Bc/CIR; this happens when the router determines that traffic flow will be more stable with a smaller configured interval).

Table 2 show frame-relay pvc Field Descriptions (continued)

Field	Description
mincir	Minimum committed information rate (CIR) for the PVC.
byte increment	Number of bytes that will be sustained per internal interval.
BECN response	Indicates that Frame Relay has BECN Adaptation configured.
pkts	Number of packets associated with this PVC that have gone through the traffic shaping system.
bytes	Number of bytes associated with this PVC that have gone through the traffic shaping system.
pkts delayed	Number of packets associated with this PVC that have been delayed by the traffic shaping system.
bytes delayed	Number of bytes associated with this PVC that have been delayed by the traffic shaping system.
shaping	Indicates that shaping will be active for all PVCs that are fragmenting data; otherwise, shaping will be active if the traffic being sent exceeds the CIR for this circuit.
shaping drops	Number of packets dropped by the traffic shaping process.
Voice Queueing Stats	Statistics showing the size of packets, the maximum number of packets, and the number of packets dropped in the special voice queue created using the **frame-relay voice bandwidth** command **queue** keyword.
Discard threshold	Maximum number of packets that can be stored in each packet queue. If additional packets are received after a queue is full, they will be discarded.
Dynamic queue count	Number of packet queues reserved for best-effort traffic.
Reserved queue count	Number of packet queues reserved for voice traffic.
Output queue size	Size in bytes of each output queue.
max total	Maximum number of packets of all types that can be queued in all queues.
drops	Number of frames dropped by all output queues.

Related Commands

Command	Description
frame-relay pvc	Configures Frame Relay PVCs for FRF.8 Frame Relay-ATM Service Interworking.
show dial-peer voice	Displays configuration information and call statistics for dial peers.
show frame-relay fragment	Displays Frame Relay fragmentation details.
show frame-relay vofr	Displays details about FRF.11 subchannels being used on Voice over Frame Relay DLCIs.
show interfaces serial	Displays information about a serial interface.
show traffic-shape queue	Displays information about the elements queued at a particular time at the VC (DLCI) level.

show interfaces serial

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

Cisco 4000 Series

show interfaces serial [*number* [**:***channel-group*] [**accounting**]

Cisco 7200 Series

show interfaces serial [*slot*/*port*] [**accounting**]

Cisco 7000 and Cisco 7500 Series with the RSP7000, RSP7000CI, or Ports on VIPs

show interfaces serial [*slot*/*port-adapter*/*port*]

Cisco 7500 Series

show interfaces serial [*slot*/*port* [**:***channel-group*]] [**accounting**]

Cisco 7500 Series with a CT3IP

show interfaces serial [*slot*/*port-adapter*/*port*] [**:***t1-channel*] [**accounting** | **crb**]

Cisco AS5800 Access Servers

show interfaces serial *dial-shelf/slot/t3-port***:***t1-num***:***chan-group*

Syntax Description

number	(Optional) Number of the port being configured.
:*channel-group*	(Optional) On the Cisco 4000 series with an NPM or Cisco 7500 series routers with a MultiChannel Interface Processor (MIP), specifies the T1 channel-group number in the range of 0 to 23 defined with the **channel-group** controller configuration command.
accounting	(Optional) Displays the number of packets of each protocol type that have been sent through the interface.
slot	(Optional) Number of the slot being configured. Refer to the appropriate hardware manual for slot and port information.
port	(Optional) Number of the port being configured. Refer to the appropriate hardware manual for slot and port information.
port-adapter	(Optional) Number of the port adapter being configured. Refer to the appropriate hardware manual for information about port adapter compatibility.
:*t1-channel*	(Optional) For the CT3IP, the T1 channel is a number between 1 and 28. T1 channels on the CT3IP are numbered from 1 to 28 rather than the more traditional zero-based scheme (0 to 27) used with other Cisco products. This is to ensure consistency with telco numbering schemes for T1 channels within channelized T3 equipment.

crb	(Optional) Shows interface routing and bridging information.
dial-shelf	Dial shelf chassis in the Cisco AS5800 access server containing the CT3 interface card.
slot	Location of the CT3 interface card in the dial shelf chassis.
t3-port	T3 port number. The only valid value is 0.
:t1-num	T1 time slot in the T3 line. The value can be from 1 to 28.
chan-group	Channel group identifier.

Defaults

No default behavior or values.

Command Modes

Privileged EXEC

EXEC when using Frame Relay encapsulation

Command History

Release	Modification
10.0	This command was introduced for the Cisco 4000 series routers.
11.0	This command was introduced for the Cisco 7000 series routers.
11.1 CA	This command was modified to include sample output for the PA-2JT2 serial port adapter, PA-E3 serial port adapter, and PA-T3 serial port adapter.
11.3	This command was modified to include the CT3IP.
12.0(3)T	This command was modified to include support for the Cisco AS5800 access servers.
12.1(2)T	This command was modified to include information about Frame Relay congestion management.

Usage Guidelines

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

Examples

The following is sample output from the **show interfaces serial** command when congestion management is configured on the FIFO interface queue.

```
Router# show interface Serial3/0
Serial3/0 is up, line protocol is up
  Hardware is M4T
  Description:Connects to Router Serial3/0
  MTU 1500 bytes, BW 2048 Kbit, DLY 20000 usec,
     reliability 255/255, txload 2/255, rxload 2/255
  Encapsulation FRAME-RELAY, crc 16, loopback not set
  Keepalive set (10 sec)
  LMI enq sent  9, LMI stat recvd 9, LMI upd recvd 0, DTE LMI up
  LMI enq recvd 0, LMI stat sent  0, LMI upd sent  0
  LMI DLCI 0  LMI type is ANSI Annex D  frame relay DTE
  FR SVC disabled, LAPF state down
  Congestion ECN thresholds 0/50
  Broadcast queue 0/64, broadcasts sent/dropped 0/0, interface broadcasts 0
  Last input 00:00:02, output 00:00:00, output hang never
  Last clearing of "show interface" counters 00:01:28
  Queueing strategy:fifo
  Output queue 56/100, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 20000 bits/sec, 7 packets/sec
  5 minute output rate 24000 bits/sec, 7 packets/sec
     622 packets input, 613131 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     658 packets output, 649126 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions     DCD=up  DSR=up  DTR=up  RTS=up  CTS=up
```

Table 3 describes the output fields unique to Frame Relay congestion management.

Table 3 show interfaces serial Field Descriptions Relevant to Frame Relay Congestion Management

Field	Description
Congestion ECN thresholds	Be ECN threshold (in packets) at which packets are marked with BECN and FECN bits/Bc ECN threshold at which packets are marked with BECN and FECN bits.
Congestion ECN Be threshold	Be ECN threshold (in packets) at which packets are marked with BECN and FECN bits
Congestion DE threshold	PVC queue percentage at which packets marked with the DE bit are dropped.
DE drops	Number of DE bit-marked packets dropped.

The following is sample output from the **show interfaces serial** command for a synchronous serial interface:

```
Router# show interfaces serial

Serial 0 is up, line protocol is up
   Hardware is MCI Serial
   Internet address is 150.136.190.203, subnet mask is 255.255.255.0
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
   Encapsulation HDLC, loopback not set, keepalive set (10 sec)
   Last input 0:00:07, output 0:00:00, output hang never
   Output queue 0/40, 0 drops; input queue 0/75, 0 drops
   Five minute input rate 0 bits/sec, 0 packets/sec
   Five minute output rate 0 bits/sec, 0 packets/sec
       16263 packets input, 1347238 bytes, 0 no buffer
       Received 13983 broadcasts, 0 runts, 0 giants
       2 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 2 abort
1 carrier transitions

     22146 packets output, 2383680 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets, 0 restarts
```

Table 4 describes significant fields shown in the display.

Table 4 show interfaces serial Field Descriptions

Field	Description
Serial ... is {up | down} ... is administratively down	Indicates whether the interface hardware is currently active (whether carrier detect is present), inactive, or has been taken down by an administrator.
line protocol is {up | down}	Indicates whether the software processes that handle the line protocol consider the line usable (that is, whether keepalives are successful) or it has been taken down by an administrator.
Hardware is	Specifies the hardware type.
Internet address is	Specifies the Internet address and subnet mask.
MTU	Maximum transmission unit of the interface.
BW	Indicates the value of the bandwidth parameter that has been configured for the interface (in kilobits per second). The bandwidth parameter is used to compute Interior Gateway Routing Protocol (IGRP) metrics only. If the interface is attached to a serial line with a line speed that does not match the default (1536 or 1544 for T1 and 56 for a standard synchronous serial line), use the **bandwidth** command to specify the correct line speed for this serial line.
DLY	Delay of the interface in microseconds.
rely	Reliability of the interface as a fraction of 255 (255/255 is 100 percent reliability), calculated as an exponential average over 5 minutes.
load	Load on the interface as a fraction of 255 (255/255 is completely saturated), calculated as an exponential average over 5 minutes.
Encapsulation	Encapsulation method assigned to interface.
loopback	Indicates whether loopback is set or not.
keepalive	Indicates whether keepalives are set or not.

Table 4 show interfaces serial Field Descriptions (continued)

Field	Description
Last input	Number of hours, minutes, and seconds since the last packet was successfully received by an interface. Useful for knowing when a dead interface has failed.
Last output	Number of hours, minutes, and seconds since the last packet was successfully transmitted by an interface.
output hang	Number of hours, minutes, and seconds since the interface was last reset because of a transmission that took too long. When the number of hours in any of the "last" fields exceeds 24 hours, the number of days and hours is printed. If that field overflows, asterisks are printed.
Output queue, drops input queue, drops	Number of packets in output and input queues. Each number is followed by a slash, the maximum size of the queue, and the number of packets dropped because of a full queue.
5 minute input rate 5 minute output rate	Average number of bits and packets transmitted per second in the last 5 minutes. The 5-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period.
packets input	Total number of error-free packets received by the system.
bytes	Total number of bytes, including data and MAC encapsulation, in the error-free packets received by the system.
no buffer	Number of received packets discarded because there was no buffer space in the main system. Compare with ignored count. Broadcast storms on Ethernet networks and bursts of noise on serial lines are often responsible for no-input-buffer events.
Received... broadcasts	Total number of broadcast or multicast packets received by the interface.
runts	Number of packets that are discarded because they are smaller than the minimum packet size for the medium.
giants	Number of packets that are discarded because they exceed the maximum packet size for the medium.
input errors	Total number of no-buffer, runts, giants, CRCs, frame, overrun, ignored, and abort counts. Other input-related errors can also increment the count, so this sum might not balance with the other counts.
CRC	Cyclic redundancy checksum generated by the originating station or far-end device does not match the checksum calculated from the data received. On a serial link, CRCs usually indicate noise, gain hits, or other transmission problems on the data link.
frame	Number of packets received incorrectly having a CRC error and a noninteger number of octets. On a serial line, this is usually the result of noise or other transmission problems.

Table 4 show interfaces serial Field Descriptions (continued)

Field	Description
overrun	Number of times the serial receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data.
ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. Broadcast storms and bursts of noise can cause the ignored count to be increased.
abort	Illegal sequence of one bits on a serial interface. This usually indicates a clocking problem between the serial interface and the data link equipment.
carrier transitions	Number of times the carrier detect signal of a serial interface has changed state. For example, if data carrier detect (DCD) goes down and comes up, the carrier transition counter will increment two times. Modem or line problems may be present if the carrier detect line is changing state often.
packets output	Total number of messages transmitted by the system.
bytes output	Total number of bytes, including data and MAC encapsulation, transmitted by the system.
underruns	Number of times that the transmitter has been running faster than the router can handle. This might never be reported on some interfaces.
output errors	Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this might not balance with the sum of the enumerated output errors because some datagrams can have more than one error, and others can have errors that do not fall into any of the specifically tabulated categories.
collisions	Number of messages retransmitted due to an Ethernet collision. This usually is the result of an overextended LAN (Ethernet or transceiver cable too long, more than two repeaters between stations, or too many cascaded multiport transceivers). Some collisions are normal. However, if your collision rate climbs to about 4 or 5 percent, you should consider verifying that there is no faulty equipment on the segment or moving some existing stations to a new segment. A packet that collides is counted only once in output packets.
interface resets	Number of times an interface has been completely reset. This can happen if packets queued for transmission were not sent within several seconds' time. On a serial line, this can be caused by a malfunctioning modem that is not supplying the transmit clock signal, or by a cable problem. If the system notices that the carrier detect line of a serial interface is up, but the line protocol is down, it periodically resets the interface in an effort to restart it. Interface resets can also occur when an interface is looped back or shut down.
restarts	Number of times the controller was restarted because of errors.
alarm indications, remote alarms, rx LOF, rx LOS	Number of channel service unit (CSU)/data service unit (DSU) alarms, and number of occurrences of receive loss of frame and receive loss of signal.
BER inactive, NELR inactive, FELR inactive	Status of G.703-E1 counters for bit-error rate (BER) alarm, near-end loop remote (NELR), and far-end loop remote (FELR). Note that you cannot set the NELR or FELR.

The following is sample output from the **show interfaces serial** command for a PA-2JT2 serial interface:

```
Router# show interfaces serial 3/0/0

Serial3/0/0 is up, line protocol is up
  Hardware is cyBus Serial
  Internet address is 1.0.0.1/8
  MTU 1500 bytes, BW 6312 Kbit, DLY 20000 usec, rely 255/255, load 26/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 00:04:31, output 00:04:31, output hang never
  Last clearing of “show interface” counters 00:06:07
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 162000 bits/sec, 8 packets/sec
  5 minute output rate 162000 bits/sec, 8 packets/sec
     20005 packets input, 20080520 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     20005 packets output, 20080520 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
     0 cv errors, 0 crc5 errors, 0 frame errors
     rxLOS inactive, rxLOF inactive, rxPAIS inactive
     rxAIS inactive, rxRAI inactive, rxHBER inactive
```

The following counters appear in the output of the **show interfaces serial** command for a PA-2JT2 serial interface:

- cv errors—B8ZS/B6ZS coding violation counter
- crc5 errors—CRC-5 error counter
- frame errors—framing error counter

The following alarm indicators also appear in the output of the **show interfaces serial** command for a PA-2JT2 serial interface:

- rxLOS—receive loss of signal alarm
- rxLOF—receive loss of frame alarm
- rxPAIS—receive payload alarm indication signal (AIS)
- rxAIS—receive physical AIS
- rxRAI—receive remote alarm indication signal
- rxHBER—receive high bit-error rate alarm

Table 5 describes significant fields shown in the display that are different from the fields described in Table 4.

Table 5 show interfaces serial Field Descriptions—PA-2JT2

Field	Description
Last clearing of “show interface” counters	Time the counters were last cleared.
Queueing strategy	First-in, first-out queueing strategy (other queueing strategies you might see are priority-list, custom-list, and weighted fair).
output buffer failures	Number of no-resource errors received on the output.

Table 5 show interfaces serial Field Descriptions—PA-2JT2 (continued)

Field	Description
output buffers swapped out	Number of packets swapped to dynamic random-access memory (DRAM).
carrier transitions	Number of times the carrier detect signal of a serial interface has changed state. For example, if data carrier detect (DCD) goes down and comes up, the carrier transition counter will increment two times. Modem or line problems may be present if the carrier detect line is changing state often.
cv errors	B8ZS/B6ZS (zero suppression) coding violation counter.
crc5 errors	CRC-5 error counter.
frame errors	Framing error counter.
rx LOS	Receive loss of signal alarm. Value is active or inactive.
rxLOF	Receive loss of frame alarm. Value is active or inactive.
rxPAIS	Receive loss of payload alarm indication signal (AIS). Value is active or inactive.
rxAIS	Receive loss of physical AIS. Value is active or inactive.
rxRAI	Receive remote AIS. Value is active or inactive.
rxHBER	Receive high bit-error rate alarm. Value is active or inactive.

The following is sample output from the **show interfaces serial** command for a PA-E3 serial port adapter installed in chassis slot 2:

```
Router# show interfaces serial 2/0

Serial2/0 is up, line protocol is up
  Hardware is M1T-E3 pa
  Internet address is 131.1.1.1/24
  MTU 4470 bytes, BW 34010 Kbit, DLY 200 usec, rely 128/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 1w0d, output 00:00:48, output hang never
  Last clearing of “show interface” counters 1w0d
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     20 packets input, 2080 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 parity
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     11472 packets output, 3824748 bytes, 0 underruns
     0 output errors, 0 applique, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions
    rxLOS inactive, rxLOF inactive, rxAIS inactive
    txAIS inactive, rxRAI inactive, txRAI inactive
```

Table 6 describes significant fields shown in the display that are different from the fields described in Table 4.

Table 6 show interfaces serial Field Descriptions—PA-E3

Field	Description
Last clearing of “show interface” counters	Time the counters were last cleared.
Queueing strategy	First-in, first-out queueing strategy (other queueing strategies you might see are priority-list, custom-list, and weighted fair).
parity	Number of the parity errors on the interface.
applique	Indicates that an unrecoverable error has occurred on the E3 applique. The router then invokes an interface reset.
output buffer failures	Number of no-resource errors received on the output.
output buffers swapped out	Number of packets swapped to DRAM.
rxLOS, rxLOF, rxAIS	Receive loss of signal, loss of frame, and alarm indication signal status. Value is inactive or active.
txAIS, rxRAI, txRAI	Transmit alarm indication signal, receive remote alarm indicator, and transmit remote alarm indicator status. Value is inactive or active. When the router receives an LOS, LOF, or AIS, the txRAI is active. When the remote router receives an LOS, LOF, or AIS, the rxRAI is active.

The following is sample output from the **show interfaces serial** command for a 1-port PA-T3 serial port adapter-configured VIP2 in chassis slot 1, in port adapter slot 0:

```
Router# show interfaces serial 1/0/0

Serial1/0/0 is up, line protocol is up
  Hardware is cyBus PODS3 Serial
  Internet address is 133.1.1.1/24
  MTU 4470 bytes, BW 44736 Kbit, DLY 200 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input 00:00:05, output 00:00:02, output hang never
  Last clearing of “show interface” counters 5d02h
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 27269 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     79039 packets input, 14195344 bytes, 0 no buffer
     Received 84506 broadcasts, 0 runts, 0 giants
              0 parity
     9574 input errors, 6714 CRC, 0 frame, 1 overrun, 0 ignored, 2859 abort
     62472 packets output, 13751644 bytes, 0 underruns
     0 output errors, 0 applique, 10 interface resets
     0 output buffer failures, 0 output buffers swapped out
     16 carrier transitions
   rxLOS inactive, rxLOF inactive, rxAIS inactive
   txAIS inactive, rxRAI inactive, txRAI inactive
```

Table 7 describes significant fields shown in the display that are different from the fields described in Table 4.

Table 7 show interfaces serial Field Descriptions—PA-T3

Field	Description
Last clearing of “show interface” counters	Time the counters were last cleared.
Queueing strategy	First-in, first-out queueing strategy (other queueing strategies you might see are priority-list, custom-list, and weighted fair).
parity	Number of the parity errors on the interface.
applique	Indicates an unrecoverable error has occurred on the T3 applique. The router then invokes an interface reset.
output buffer failures	Number of no resource errors received on the output.
output buffers swapped out	Number of packets swapped to DRAM.
rxLOS, rxLOF, rxAIS	Receive loss of signal, loss of frame, and alarm indication signal status. Values are inactive or active.
txAIS, rxRAI, txRAI	Transmit alarm indication signal, receive remote alarm indicator, and transmit remote alarm indicator status. Values are inactive or active. When the router receives an LOS, LOF, or AIS, the txRAI is active. When the remote router receives an LOS, LOF, or AIS, the rxRAI is active.

The following is sample output of the **show interfaces serial** command for the CT3IP serial interface:

```
Router# show interfaces serial 3/0/0:25

Serial3/0/0:25 is up, line protocol is up
  Hardware is cyBus T3
  Internet address is 25.25.25.2/24
  MTU 1500 bytes, BW 1536 Kbit, DLY 20000 usec, rely 255/255, load 12/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 00:19:01, output 00:11:49, output hang never
  Last clearing of “show interface” counters 00:19:39
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/64/0 (size/threshold/drops)
     Conversations 0/1 (active/max active)
     Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 69000 bits/sec, 90 packets/sec
  5 minute output rate 71000 bits/sec, 90 packets/sec
     762350 packets input, 79284400 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     150 input errors, 0 CRC, 0 frame, 150 overrun, 0 ignored, 0 abort
     763213 packets output, 80900472 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     0 carrier transitions no alarm present
  Timeslot(s) Used:1-24, Transmitter delay is 0 flags, transmit queue length 5
  non-inverted data
```

Most fields are described in Table 4. Fields relevant to the CT3IP are described in Table 8.

Table 8 show interfaces serial Field Descriptions—CT3IP

Field	Description
Timeslot(s) Used	Number of time slots assigned to the T1 channel.
Transmitter delay	Number of idle flags inserted between HDLC frames.
transmit queue length	Number of packets allowed in the transmit queue.
non-inverted data	Indicates whether or not the interface is configured for inverted data.

The following is sample output of the **show interfaces serial** command for the HDLC synchronous serial interface on a Cisco 7500 series routers:

```
Router# show interfaces serial 1/0

Serial1/0 is up, line protocol is up
  Hardware is cxBus Serial
  Internet address is 150.136.190.203, subnet mask is 255.255.255.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive set (10 sec)
  Last input 0:00:07, output 0:00:00, output hang never
  Last clearing of “show interface” counters 2w4d
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  Five minute input rate 0 bits/sec, 0 packets/sec
  Five minute output rate 0 bits/sec, 0 packets/sec
     16263 packets input, 1347238 bytes, 0 no buffer
     Received 13983 broadcasts, 0 runts, 0 giants
     2 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 2 abort
     22146 packets output, 2383680 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets, 0 restarts
     1 carrier transitions
```

The following is sample output of the **show interfaces serial** command for a G.703 interface on which framing is enabled:

```
Router# show interfaces serial 2/3
Serial2/3 is up, line protocol is up
  Hardware is cxBus Serial
  Internet address is 5.4.4.1, subnet mask is 255.255.255.0
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
  Encapsulation HDLC, loopback not set, keepalive not set
  Last input 0:00:21, output 0:00:21, output hang never
  Last clearing of “show interface” counters never
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  Five minute input rate 0 bits/sec, 0 packets/sec
  Five minute output rate 0 bits/sec, 0 packets/sec
     53 packets input, 7810 bytes, 0 no buffer
     Received 53 broadcasts, 0 runts, 0 giants
     2 input errors, 2 CRC, 0 frame, 0 overrun, 0 ignored, 2 abort
     56 packets output, 8218 bytes, 0 underruns
     0 output errors, 0 collisions, 2 interface resets, 0 restarts
     1 carrier transitions
     2 alarm indications, 333 remote alarms, 332 rx LOF, 0 rx LOS
     RTS up, CTS up, DTR up, DCD up, DSR up
     BER inactive, NELR inactive, FELR inactive
```

Table 4 describes fields shown in the display.

Example with Frame Relay Encapsulation

When using the Frame Relay encapsulation, use the **show interfaces** command to display information on the multicast DLCI, the DLCI of the interface, and the LMI DLCI used for the local management interface.

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

The following is sample output from the **show interfaces serial** command when Frame Relay encapsulation and LMI is enabled:

```
Router# show interfaces serial

Serial 2 is up, line protocol is up
   Hardware type is MCI Serial
   Internet address is 131.108.122.1, subnet mask is 255.255.255.0
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
   Encapsulation FRAME-RELAY, loopback not set, keepalive set (10 sec)
   multicast DLCI 1022, status defined, active
   source DLCI    20, status defined, active
   LMI DLCI 1023, LMI sent 10, LMI stat recvd 10, LMI upd recvd 2
   Last input 7:21:29, output 0:00:37, output hang never
   Output queue 0/100, 0 drops; input queue 0/75, 0 drops
   Five minute input rate 0 bits/sec, 0 packets/sec
   Five minute output rate 0 bits/sec, 0 packets/sec
       47 packets input, 2656 bytes, 0 no buffer
       Received 5 broadcasts, 0 runts, 0 giants
       5 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 57 abort
       518 packets output, 391205 bytes
       0 output errors, 0 collisions, 0 interface resets, 0 restarts
       1 carrier transitions
```

In this display, the multicast DLCI has been changed to 1022 with the **frame-relay multicast-dlci** interface configuration command.

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

Example with ANSI LMI

For a serial interface with the ANSI LMI enabled, use the **show interfaces serial** command to determine the LMI type implemented.

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

```
Router# show interfaces serial

Serial 1 is up, line protocol is up
   Hardware is MCI Serial
   Internet address is 131.108.121.1, subnet mask is 255.255.255.0
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
   Encapsulation FRAME-RELAY, loopback not set, keepalive set
   LMI DLCI    0, LMI sent 10, LMI stat recvd 10
   LMI type is ANSI Annex D
   Last input 0:00:00, output 0:00:00, output hang never
   Output queue 0/40, 0 drops; input queue 0/75, 0 drops
```

```
Five minute input rate 0 bits/sec, 1 packets/sec
Five minute output rate 1000 bits/sec, 1 packets/sec
    261 packets input, 13212 bytes, 0 no buffer
    Received 33 broadcasts, 0 runts, 0 giants
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    238 packets output, 14751 bytes, 0 underruns
    0 output errors, 0 collisions, 0 interface resets, 0 restarts
```

Notice that the **show interfaces serial** output for a serial interface with ANSI LMI shown in this display is very similar to that for encapsulation set to Frame Relay, as shown in the previous display. Table 9 describes the few differences that exist.

Table 9 show interfaces serial Field Description—with ANSI LMI

Field	Description
LMI DLCI 0	Identifies the DLCI used by the LMI for this interface. The default is 1023.
LMI sent 10	Number of LMI packets sent by the router.
LMI type is ANSI Annex D	Indicates that the interface is configured for the ANSI-adopted Frame Relay specification T1.617 Annex D.

Example with LAPB Encapsulation

Use the **show interfaces** command to display operation statistics for an interface using LAPB encapsulation.

The following is a partial sample output from the **show interfaces serial** command for a serial interface using LAPB encapsulation:

```
Router# show interfaces serial 1

LAPB state is SABMSENT, T1 3000, N1 12056, N2 20, k7,Protocol ip
VS 0, VR 0, RCNT 0, Remote VR 0, Retransmissions 2
IFRAMEs 0/0 RNRs 0/0 REJs 0/0 SABMs 3/0 FRMRs 0/0 DISCs 0/0
```

Table 10 shows the fields relevant to all LAPB connections.

Table 10 show interfaces serial Field Descriptions—LAPB

Field	Description
LAPB state is	State of the LAPB protocol.
T1 3000, N1 12056,...	Current parameter settings.
Protocol	Protocol encapsulated on a LAPB link; this field is not present on interfaces configured for multiprotocol LAPB or X.25 encapsulations.
VS	Modulo 8 frame number of the next outgoing information frame.
VR	Modulo 8 frame number of the next information frame expected to be received.
RCNT	Number of received information frames that have not yet been acknowledged.
Remote VR	Number of the next information frame the remote device expects to receive.
Retransmissions	Count of current retransmissions due to expiration of T1.

Table 10 show interfaces serial Field Descriptions—LAPB (continued)

Field	Description
Window is closed	No more frames can be transmitted until some outstanding frames have been acknowledged. This message should be displayed only temporarily.
IFRAMEs	Count of information frames in the form of sent/received.
RNRs	Count of Receiver Not Ready frames in the form of sent/received.
REJs	Count of Reject frames in the form of sent/received.
SABMs	Count of Set Asynchronous Balanced Mode commands in the form of sent/received.
FRMRs	Count of Frame Reject frames in the form of sent/received.
DISCs	Count of Disconnect commands in the form of sent/received.

Show Interfaces Serial with PPP

An interface configured for synchronous PPP encapsulation differs from the standard **show interfaces serial** output. An interface configured for PPP might include the following information:

```
lcp state = OPEN
ncp ipcp state = OPEN   ncp osicp state = NOT NEGOTIATED
ncp ipxcp state = NOT NEGOTIATED   ncp xnscp state = NOT NEGOTIATED
ncp vinescp state = NOT NEGOTIATED   ncp deccp state = NOT NEGOTIATED
ncp bridgecp state = NOT NEGOTIATED   ncp atalkcp state = NOT NEGOTIATED
```

Table 11 show the fields relevant to PPP connections.

Table 11 show interfaces serial Field Descriptions—with PPP Encapsulation

Field	Description
lcp state	Link Control Protocol.
ncp ipcp state	Network Control Protocol Internet Protocol Control Protocol.
ncp osicp state	Network Control Protocol OSI (CLNS) Control Protocol.
ncp ipxcp state	Network Control Protocol IPX (Novell) Control Protocol.
ncp xnscp state	Network Control Protocol XNS Control Protocol.
ncp vinescp state	Network Control Protocol VINES Control Protocol.
ncp deccp state	Network Control Protocol DECnet Control Protocol.
ncp bridgecp state	Network Control Protocol Bridging Control Protocol.
ncp atalkcp state	Network Control Protocol AppleTalk Control Protocol.

Example with SDLC Connections

Use the **show interfaces** command to display the Synchronous Data Link Control (SDLC) information for a given SDLC interface. The following is sample output from the **show interfaces** command for an SDLC primary interface supporting the SDLLC function:

```
Router# show interfaces

Serial 0 is up, line protocol is up
Hardware is MCI Serial
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
Encapsulation SDLC-PRIMARY, loopback not set
    Timers (msec): poll pause 100 fair poll 500. Poll limit 1
    [T1 3000, N1 12016, N2 20, K 7] timer: 56608 Last polled device: none
    SDLLC [ma: 0000.0C01.14--, ring: 7 bridge: 1, target ring: 10
              largest token ring frame 2052]
SDLC addr C1 state is CONNECT
     VS 6, VR 3, RCNT 0, Remote VR 6, Current retransmit count 0
     Hold queue: 0/12 IFRAMEs 77/22 RNRs 0/0 SNRMs 1/0 DISCs 0/0
     Poll: clear, Poll count: 0, chain: p: C1 n: C1
     SDLLC [largest SDLC frame: 265, XID: disabled]
 Last input 00:00:02, output 00:00:01, output hang never
 Output queue 0/40, 0 drops; input queue 0/75, 0 drops
 Five minute input rate 517 bits/sec, 30 packets/sec
 Five minute output rate 672 bits/sec, 20 packets/sec
     357 packets input, 28382 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     926 packets output, 77274 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets, 0 restarts
     2 carrier transitions
```

Table 12 shows the fields relevant to all SDLC connections.

Table 12 show interfaces serial Field Descriptions—with SDLC Enabled

Field	Description
Timers (msec): poll pause, fair poll, Poll limit	Current values of these timers, as described in the configuration section, for this interface.
T1, N1, N2, K	Values for these parameters, as described in the configuration section, for this interface.

Table 13 shows other data given for each SDLC secondary interface configured to be attached to this interface.

Table 13 SDLC Secondary Interface Descriptions

SDLC Secondary	Description
addr	Address of this secondary.
state is	Current state of this connection, which is one of the following: • DISCONNECT—No communication is being attempted to this secondary. • CONNECT—A normal connect state exists between this router and this secondary. • DISCSENT—This router has sent a disconnect request to this secondary and is awaiting its response. • SNRMSENT—This router has sent a connect request (SNRM) to this secondary and is awaiting its response. • THEMBUSY—This secondary has told this router that it is temporarily unable to receive any more information frames. • USBUSY—This router has told this secondary that it is temporarily unable to receive any more information frames. • BOTHBUSY—Both sides have told each other that they are temporarily unable to receive any more information frames. • ERROR—This router has detected an error and is waiting for a response from the secondary acknowledging this.
VS	Sequence number of the next information frame sent by this station.
VR	Sequence number of the next information frame from this secondary that this station expects to receive.
Remote VR	Last frame transmitted by this station that has been acknowledged by the other station.
Current retransmit count:	Number of times the current I-frame or sequence of I-frames has been retransmitted.
Hold Queue	Number of frames in hold queue/maximum size of hold queue.
IFRAMEs, RNRs, SNRMs, DISCs	Sent/received count for these frames.
Poll	"Set" if this router has a poll outstanding to the secondary; "clear" if it does not.
Poll Count	Number of polls in a row that have been given to this secondary at this time.
Chain	Shows the previous (p) and next (n) secondary address on this interface in the *round robin loop* of polled devices.

Example with SDLLC

Use the **show interfaces serial** command to display the SDLLC statistics for SDLLC configured interfaces.

The following is sample output from the **show interfaces serial** command for an a serial interface configured for SDLC Logical Link Control (SDLLC):

```
Router# show interfaces serial

Serial 0 is up, line protocol is up
   Hardware is MCI Serial
   MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec, rely 255/255, load 1/255
   Encapsulation SDLC-PRIMARY, loopback not set
       Timers (msec): poll pause 100 fair poll 500. Poll limit 1
       [T1 3000, N1 12016, N2 20, K 7] timer: 56608 Last polled device: none
       SDLLC [ma: 0000.0C01.14--, ring: 7 bridge: 1, target ring: 10
              largest token ring frame 2052]
   SDLC addr C1 state is CONNECT
       VS 6, VR 3, RCNT 0, Remote VR 6, Current retransmit count 0
       Hold queue: 0/12 IFRAMEs 77/22 RNRs 0/0 SNRMs 1/0 DISCs 0/0
       Poll: clear, Poll count: 0, chain: p: C1 n: C1
       SDLLC [largest SDLC frame: 265, XID: disabled]
   Last input 00:00:02, output 00:00:01, output hang never
   Output queue 0/40, 0 drops; input queue 0/75, 0 drops
   Five minute input rate 517 bits/sec, 30 packets/sec
   Five minute output rate 672 bits/sec, 20 packets/sec
       357 packets input, 28382 bytes, 0 no buffer
       Received 0 broadcasts, 0 runts, 0 giants
       0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
       926 packets output, 77274 bytes, 0 underruns
       0 output errors, 0 collisions, 0 interface resets, 0 restarts
       6608 Last polled device: none
       SDLLC [ma: 0000.0C01.14--, ring: 7 brid2 carrier transitions
```

Most of the output shown in the display is generic to all SDLC encapsulated interfaces and is described in the "LLC2 and SDLC Commands" chapter in the *Cisco IOS Bridging and IBM Networking Command Reference*. Table 14 shows the parameters specific to SDLLC.

Table 14 SDLLC Parameter Descriptions

Field	Description
SDLLC ma	Lists the MAC address configured for this interface. The last byte is shown as "--" to indicate that it is filled in with the SDLC address of the connection.
ring, bridge, target ring	Lists the parameters as configured by the **sdllc traddr** command.
largest token ring frame	Shows the largest Token Ring frame that is accepted on the LLC2 side of the connection.
largest SDLC frame	Shows the largest SDLC frame that is accepted and will be generated on the SDLC side of the connection.
XID	Enabled or disabled: Shows whether XID processing is enabled on the SDLC side of the connection. If enabled, it will show the XID value for this address.

Example with X.25

The following is a partial sample output from the **show interfaces serial** command for a serial X.25 interface:

```
Router# show interfaces serial 1

X25 address 000000010100, state R1, modulo 8, idle 0, timer 0, nvc 1
  Window size: input 2, output 2, Packet size: input 128, output 128
  Timers: T20 180, T21 200, T22 180, T23 180, TH 0
  Channels: Incoming-only none, Two-way 1-1024, Outgoing-only none
(configuration on RESTART: modulo 8,
  Window size: input 2 output 2, Packet size: input 128, output 128
  Channels: Incoming-only none, Two-way 5-1024, Outgoing-only none)
  RESTARTs 3/2 CALLs 1000+2/1294+190/0+0/ DIAGs 0/0
```

The stability of the X.25 protocol requires that some parameters not be changed without a restart of the protocol. Any change to these parameters is held until a restart is sent or received. If any of these parameters changes, the configuration on restart information will be output as well as the values that are currently in effect.

Table 15 describes significant fields shown in the display.

Table 15 show interfaces serial Field Descriptions—with X.25 Enabled

Field	Description
X25 address 000000010100	Address used to originate and accept calls.
state R1	State of the interface. Possible values are • R1—the normal ready state • R2—the DTE restarting state • R3—the DCE restarting state If the state is R2 or R3, the interface is awaiting acknowledgment of a Restart packet.
modulo 8	Modulo value; determines the packet sequence numbering scheme used.
idle 0	Number of minutes for which the Cisco IOS software waits before closing idle virtual circuits that it originated or accepted.
timer 0	Value of the interface timer, which is zero unless the interface state is R2 or R3.
nvc 1	Default maximum number of simultaneous virtual circuits permitted to and from a single host for a particular protocol.
Window size: input 2, output 2	Default window sizes (in packets) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.
Packet size: input 128, output 128	Default maximum packet sizes (in bytes) for the interface. The **x25 facility** interface configuration command can be used to override these default values for the switched virtual circuits originated by the router.

Table 15 show interfaces serial Field Descriptions—with X.25 Enabled (continued)

Field	Description
Timers: T20 180, T21 200, T22 180, T23 180	Values of the X.25 timers: • T10 through T13 for a DCE device • T20 through T23 for a DTE device
TH0	Packet acknowledgment threshold (in packets). This value determines how many packets are received before an explicit acknowledgment is sent. The default value (0) sends an explicit acknowledgment only when the incoming window is full.
Channels: Incoming-only none Two-way 5-1024 Outgoing-only none	Displays the virtual circuit ranges for this interface.
RESTARTs 3/2	Shows Restart packet statistics for the interface using the format Sent/Received.
CALLs 1000+2/1294+190/0+0	Successful calls sent + failed calls/calls received + calls failed/calls forwarded + calls failed. Calls forwarded are counted as calls sent.
DIAGs 0/0	Diagnostic messages sent and received.

Example with Accounting Option

The following example illustrates the **show interfaces serial** command with the **accounting** option on a Cisco 7500 series routers:

```
Router# show interfaces serial 1/0 accounting

Serial1/0
       Protocol    Pkts In   Chars In   Pkts Out  Chars Out
             IP       7344    4787842       1803    1535774
      Appletalk      33345    4797459      12781    1089695
        DEC MOP          0          0        127       9779
            ARP          7        420         39       2340
```

Example with Cisco AS5800 Access Server

The following example shows the activity that occurred on the serial interface in shelf 1, slot 4, port 0 for time slot 2 in group 23:

```
Router# show interfaces serial 1/4/0:2:23
Serial1/4/0:2:23 is up, line protocol is up (spoofing)
 Hardware is DS-T1
 MTU 1500 bytes, BW 64 Kbit, DLY 20000 usec, rely 255/255, load 1/255
 Encapsulation HDLC, loopback not set
 Last input 00:00:01, output 00:00:01, output hang never
 Last clearing of "show interface" counters 22:24:30
 Queueing strategy: fifo
 Output queue 0/40, 0 drops; input queue 0/75, 0 drops
 5 minute input rate 0 bits/sec, 0 packets/sec
```

```
 5 minute output rate 0 bits/sec, 0 packets/sec
     5274 packets input, 20122 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     5274 packets output, 30836 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
     2 carrier transitions no alarm present
 Timeslot(s) Used:24, subrate: 64Kb/s, transmit delay is 0 flags
Router#
```

Table 16 describes the fields shown in the **show interfaces serial** display that are different from the fields described in Table 4.

Table 16 show interfaces serial Field Descriptions

Field	Description
Last clearing of “show interface” counters	Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) were last reset to zero.
Queueing strategy	Displays the type of queueing configured for this interface. In the example output, the type of queueing configured is first-in, first-out (FIFO).
throttles	Number of times the receiver on the port was disabled, possibly because of buffer or processor overload.
output buffer failures	Number of times the output buffer has failed.
output buffer swapped out	Number of times the output buffer has been swapped out.
Timeslot(s) Used	Number of time slots assigned to the T1 channel.
subrate	Bandwidth of each time slot.
transmit delay is ...	Number of idle flags inserted between frames.

threshold de

To configure the threshold at which DE-marked packets will be discarded from switched PVCs on the output interface, use the **threshold de** Frame Relay congestion management command. To reconfigure the threshold, use the **no** form of this command.

threshold de *percentage*

no threshold de *percentage*

Syntax Description

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

Defaults

100%.

Command Modes

Frame Relay congestion management configuration

Command History

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

Usage Guidelines

You must enable Frame Relay congestion management on the interface before congestion management parameters will be effective. To enable Frame Relay congestion management and to enter Frame Relay congestion management configuration mode, use the **frame-relay congestion-management** interface command.

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

Examples

The following example shows how to configure a DE threshold of 40% on serial interface 1.

```
interface serial1
    encapsulation frame-relay
    frame-relay congestion-management
      threshold de 40
```

Related Commands

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

Command	Description
frame-relay congestion threshold ecn	Configures the threshold at which ECN bits will be set on packets in the traffic-shaping queue of a switched PVC.
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
threshold ecn	Configures the threshold at which ECN bits will be set on packets in switched PVCs on the output interface.

threshold ecn

To configure the threshold at which ECN bits will be set on packets in switched PVCs on the output interface, use the **threshold ecn** Frame Relay congestion management command. To reconfigure the threshold, use the **no** form of this command.

threshold ecn {**bc** | **be**} *percentage*

no threshold ecn {**bc** | **be**} *percentage*

Syntax Description

bc	Specifies threshold for committed traffic.
be	Specifies threshold for excess traffic.
percentage	Threshold at which ECN bits will be set on packets, specified as a percentage of maximum queue size.

Defaults

100%

Command Modes

Frame Relay congestion management

Command History

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

Usage Guidelines

You must enable Frame Relay congestion management on the interface before congestion management parameters will be effective. To enable Frame Relay congestion management and to enter Frame Relay congestion management configuration mode, use the **frame-relay congestion-management** interface command.

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

You can configure separate queue thresholds for committed and excess traffic.

Configure the Be ECN threshold so that it is greater than or equal to zero and less than or equal to the Bc ECN threshold. Configure the Bc ECN threshold so that it is less than or equal to 100.

Examples

The following example shows how to configure a Be threshold of 0 and a Bc threshold of 20% on serial interface 1.

```
interface serial1
    encapsulation frame-relay
    frame-relay congestion-management
      threshold ecn be 0
      threshold ecn bc 20
```

Related Commands

Command	Description
frame-relay congestion management	Enables Frame Relay congestion management functions on all switched PVCs on an interface, and enters congestion management configuration mode.
frame-relay congestion threshold de	Configures the threshold at which DE-marked packets will be discarded from the traffic-shaping queue of a switched PVC.
frame-relay congestion threshold ecn	Configures the threshold at which ECN bits will be set on packets in the traffic-shaping queue of a switched PVC.
frame-relay switching	Enables PVC switching on a Frame Relay DCE or NNI.
threshold de	Configures the threshold at which DE-marked packets will be discarded from switched PVCs on the output interface.

Glossary

BECN—backward explicit congestion notification. Bit set by a Frame Relay network in frames traveling in the opposite direction of frames encountering a congested path. Data terminal equipment (DTE) receiving frames with the BECN bit can request that higher-level protocols take flow-control action as appropriate.

CIR—committed information rate. Rate at which a Frame Relay network agrees to transfer information under normal conditions, averaged over a minimum increment of time.

DCE—data circuit-terminating equipment. Devices and connections of a communications network that make up the network end of the user-to-network interface. The DCE provides a physical connection to the network, forwards traffic, and provides a clocking signal used to synchronize data transmission between DCE and DTE devices.

DE—discard eligible. If the network is congested, DE traffic may be dropped to ensure delivery of higher priority traffic.

DLCI—data-link connection identifier. Value that specifies a permanent virtual circuit (PVC) or switched virtual circuit (SVC) in a Frame Relay network.

FECN—forward explicit congestion notification. Bit set by a Frame Relay network to inform DTE receiving the frame that congestion was experienced in the path from source to the destination. DTE receiving frames with the FECN bit can request that higher-level protocols take flow-control action as appropriate.

FIFO queueing—First-in, first-out queueing. FIFO involves buffering and forwarding of packets in the order of arrival. FIFO embodies no concept of priority or classes of traffic. There is only one queue, and all packets are treated equally. Packets are sent out an interface in the order in which they arrive.

FRF.12—The FRF.12 Implementation Agreement was developed to allow long data frames to be fragmented into smaller pieces and interleaved with real-time frames. In this way, real-time voice and non-real-time data frames can be carried together on lower-speed links without causing excessive delay to the real-time traffic.

FRTS—Frame Relay Traffic Shaping. FRTS uses queues on a Frame Relay network to limit surges that can cause congestion. Data is buffered and then sent into the network in regulated amounts to ensure that the traffic will fit within the promised traffic envelope for the particular connection.

LMI—Local Management Interface. Set of enhancements to the basic Frame Relay specification. LMI includes support for a keepalive mechanism, a multicast mechanism, global addressing, and a status mechanism.

UNI—User-Network Interface. ATM Forum specification that defines an interoperability standard for the interface between ATM-based products located in a private network and the switches located within the public carrier networks. Also used to describe similar connections in Frame Relay networks.

VoFR—Voice over Frame Relay. Enables a router to carry voice traffic over a Frame Relay network. When sending voice traffic over Frame Relay, the voice traffic is segmented and encapsulated for transit across the Frame Relay network using FRF.12 encapsulation.

Voice over Frame Relay—See VoFR.

WFQ—weighted fair queueing. Congestion management algorithm that identifies conversations (in the form of traffic streams), separates packets that belong to each conversation, and ensures that capacity is shared fairly among these individual conversations. WFQ is an automatic way of stabilizing network behavior during congestion and results in increased performance and reduced retransmission.