



## Frame Relay PVC Interface Priority Queueing

The Frame Relay PVC Interface Priority Queueing feature provides an interface-level priority queueing scheme in which prioritization is based on destination permanent virtual circuit (PVC) rather than packet contents.

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## Prerequisites for Frame Relay PVC Interface Priority Queueing

- PVCs should be configured to carry a single type of traffic.
- The network should be configured with adequate call admission control to prevent starvation of any of the priority queues.

## Restrictions for Frame Relay PVC Interface Priority Queueing

- FR PIPQ is not supported on loopback or tunnel interfaces, or interfaces that explicitly disallow priority queueing.
- FR PIPQ is not supported with hardware compression.
- FR PIPQ cannot be enabled on an interface that is already configured with queueing other than FIFO queueing. FR PIPQ can be enabled if WFQ is configured, as long as WFQ is the default interface queueing method.

# Information About Frame Relay PVC Interface Priority Queueing

## Feature Overview

The Cisco Frame Relay MIB describes managed objects that enable users to remotely monitor Frame Relay operations using Simple Network Management Protocol (SNMP). The Frame Relay MIB Enhancements feature extends the Cisco Frame Relay MIB by adding MIB objects to monitor the following Frame Relay functionality:

- Frame Relay fragmentation
- Frame Relay-ATM Network Interworking (FRF.5)
- Frame Relay-ATM Service Interworking (FRF.8)
- Frame Relay switching
- Input and output rates of individual virtual circuits (VCs)

The table below describes the MIB tables and objects that are introduced by the Frame Relay MIB enhancements. For a complete description of the MIB, see the Cisco Frame Relay MIB file CISCO-FRAME-RELAY-MIB.mib, available through Cisco.com at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

**Table 1: MIB Tables and Objects Introduced by the Frame Relay MIB Enhancements**

Table or Object	Description
cfrFragTable	Table of Frame Relay fragmentation information.
cfrFRF5ConnectionTable	Table of Frame Relay-ATM Network Interworking connection information.
cfrFRF8ConnectionTable	Table of Frame Relay-ATM Service Interworking connection information.
cfrSwitchingTable	Table of Frame Relay switching entries.
cfrExtCircuitTxDataRate	Average rate, in bytes per second, at which data is transmitted on a circuit.
cfrExtCircuitTxPktRate	Average number of packets sent per second on a circuit.
cfrExtCircuitRcvDataRate	Average rate, in bytes per second, at which data is received on a circuit.
cfrExtCircuitRcvPktRate	Average number of packets received per second on a circuit.

The Frame Relay MIB Enhancements feature also modifies the **load-interval** command to enable you to configure the load interval per permanent virtual circuit (PVC). The load interval is the length of time for which data is used to compute load statistics, including input rate in bits and packets per second, output rate in bits and packets per second, load, and reliability. Before the introduction of this feature, the load interval could be configured only for the interface.

## Benefits

FR PIPQ provides four levels of PVC priority: high, medium, normal, and low. This method of queueing ensures that time/delay-sensitive traffic such as voice has absolute priority over signalling traffic, and that signalling traffic has absolute priority over data traffic, providing different PVCs are used for the different types of traffic.

# How to Configure Frame Relay PVC Interface Priority Queueing

## Configuring PVC Priority in a Map Class

To configure PVC priority within a map class, use the following commands beginning in global configuration mode:

### SUMMARY STEPS

1. Router(config)# **map-class frame-relay** *map-class-name*
2. Router(config-map-class)# **frame-relay interface-queue priority** {**high** | **medium** | **normal** | **low**}

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	Router(config)# <b>map-class frame-relay</b> <i>map-class-name</i>	Specifies a Frame Relay map class.
<b>Step 2</b>	Router(config-map-class)# <b>frame-relay interface-queue priority</b> { <b>high</b>   <b>medium</b>   <b>normal</b>   <b>low</b> }	Assigns a PVC priority level to a Frame Relay map class.

## Enabling FR PIPQ and Setting Queue Limits

To enable FR PIPQ and set the priority queue sizes, use the following commands beginning in global configuration mode:

### SUMMARY STEPS

1. Router(config)# **interface** *type number* [*name-tag*]
2. Router(config-if)# **encapsulation frame-relay**[**cisco** | **ietf**]
3. Router(config-if)# **frame-relay interface-queue priority** [*high-limit medium-limit normal-limit low-limit*]

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	Router(config)# <b>interface</b> <i>type number</i> [ <i>name-tag</i> ]	Configures an interface type and enters interface configuration mode.
<b>Step 2</b>	Router(config-if)# <b>encapsulation frame-relay</b> [ <b>cisco</b>   <b>ietf</b> ]	Enables Frame Relay encapsulation.

	Command or Action	Purpose
<b>Step 3</b>	Router(config-if)# <b>frame-relay interface-queue priority</b> [ <i>high-limit medium-limit normal-limit low-limit</i> ]	Enables FR PIPQ and sets the priority queue limits.

## Assigning a Map Class to a PVC

To assign a map class to a specific PVC, use the following commands beginning in interface configuration mode:

### SUMMARY STEPS

1. Router(config-if)# **frame-relay interface-dlci** *dlci*
2. Router(config-fr-dlci)# **class** *map-class-name*

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	Router(config-if)# <b>frame-relay interface-dlci</b> <i>dlci</i>	Specifies a single PVC on a Frame Relay interface.
<b>Step 2</b>	Router(config-fr-dlci)# <b>class</b> <i>map-class-name</i>	Associates a map class with a specified PVC.

## Verifying FR PIPQ

To verify the configuration of FR PIPQ, use one or more of the following commands in privileged EXEC mode:

Command	Purpose
Router# <b>show frame-relay pvc</b> [ <i>interface interface</i> ] [ <i>dlci</i> ]	Displays statistics about PVCs for Frame Relay interfaces.
Router# <b>show interfaces</b> [ <i>type number</i> ] [ <i>first</i> ] [ <i>last</i> ]	Displays the statistical information specific to a serial interface.
Router# <b>show queueing</b> [ <i>custom</i>   <i>fair</i>   <i>priority</i>   <i>random-detect</i> ] [ <i>interface atm_subinterface</i> [ <i>vc</i> [[ <i>vpi</i> /] <i>vci</i> ]]]	Lists all or selected configured queueing strategies.

## Monitoring and Maintaining FR PIPQ

To monitor and maintain FR PIPQ, use one or more of the following commands in privileged EXEC mode:

Command	Purpose
Router# <b>debug priority</b>	Debugs priority output queueing.
Router# <b>show frame-relay pvc</b> [ <i>interface</i> ] [ <i>dlci</i> ]	Displays statistics about PVCs for Frame Relay interfaces.
Router# <b>show interfaces</b> [ <i>type</i> <i>number</i> ] [ <i>first</i> ] [ <i>last</i> ]	Displays the statistical information specific to a serial interface.
Router# <b>show queue</b> <i>interface-name</i> <i>interface-number</i> [ <b>vc</b> [ <i>vpi</i> /] <i>vci</i> ] [ <i>queue-number</i> ]	Displays the contents of packets inside a queue for a particular interface or VC.
Router# <b>show queueing</b> [ <i>custom</i>   <i>fair</i>   <i>priority</i>   <i>random-detect</i> ] [ <i>interface</i> <i>atm_subinterface</i> [ <b>vc</b> [[ <i>vpi</i> /] <i>vci</i> ]]]	Lists all or selected configured queueing strategies.

## Configuration Examples for Frame Relay PVC Interface Priority Queueing

- [Monitoring and Maintaining FR PIPQ, on page 4](#)

### FR PIPQ Configuration Example

This example shows the configuration of four PVCs on serial interface 0. DLCI 100 is assigned high priority, DLCI 200 is assigned medium priority, DLCI 300 is assigned normal priority, and DLCI 400 is assigned low priority.

The following commands configure Frame Relay map classes with PVC priority levels:

```
Router(config)# map-class frame-relay HI
Router(config-map-class)# frame-relay interface-queue priority high
Router(config-map-class)# exit
Router(config)# map-class frame-relay MED
Router(config-map-class)# frame-relay interface-queue priority medium
Router(config-map-class)# exit
Router(config)# map-class frame-relay NORM
Router(config-map-class)# frame-relay interface-queue priority normal
Router(config-map-class)# exit
Router(config)# map-class frame-relay LOW
Router(config-map-class)# frame-relay interface-queue priority low
Router(config-map-class)# exit
```

The following commands enable Frame Relay encapsulation and FR PIPQ on serial interface 0. The sizes of the priority queues are set at a maximum of 20 packets for the high priority queue, 40 for the medium priority queue, 60 for the normal priority queue, and 80 for the low priority queue.

```
Router(config)# interface Serial0
Router(config-if)# encapsulation frame-relay
Router(config-if)# frame-relay interface-queue priority 20 40 60 80
```

The following commands assign priority to four PVCs by associating the DLCIs with the configured map classes:

```
Router(config-if)# frame-relay interface-dlci 100
Router(config-fr-dlci)# class HI
Router(config-fr-dlci)# exit
Router(config-if)# frame-relay interface-dlci 200
Router(config-fr-dlci)# class MED
Router(config-fr-dlci)# exit
Router(config-if)# frame-relay interface-dlci 300
Router(config-fr-dlci)# class NORM
Router(config-fr-dlci)# exit
Router(config-if)# frame-relay interface-dlci 400
Router(config-fr-dlci)# class LOW
Router(config-fr-dlci)# exit
```

## Additional References

### Related Documents

Related Topic	Document Title
WAN commands: complete command syntax, command modes, command history, defaults, usage guidelines, and examples	<i>Cisco IOS Wide-Area Networking Command Reference</i>

### Standards

Standard	Title
No new or modified standards are supported by this functionality.	--

### MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS XE software releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

### RFCs

RFC	Title
No new or modified RFCs are supported by this functionality.	--

**Technical Assistance**

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<a href="http://www.cisco.com/techsupport">http://www.cisco.com/techsupport</a>

## Feature Information for Frame Relay PVC Interface Priority Queueing

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 2: Feature Information for Frame Relay PVC Interface Priority Queueing**

Feature Name	Releases	Feature Information
Frame Relay PVC Interface Priority Queueing	Cisco IOS XE Release 2.1	The FR PIPQ feature provides an interface-level priority queueing scheme in which prioritization is based on destination permanent virtual circuit (PVC) rather than packet contents. For example, FR PIPQ allows you to configure a PVC transporting voice traffic to have absolute priority over a PVC transporting signalling traffic, and a PVC transporting signalling traffic to have absolute priority over a PVC transporting data.

## Glossary

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

**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.

**Frame Relay traffic shaping** --See FRTS.

**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 nonreal-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.

**PIPQ** --Permanent virtual circuit (PVC) interface priority queueing. An interface-level priority queueing scheme in which prioritization is based on destination PVC rather than packet contents.

**quality of service** --Measure of performance for a transmission system that reflects its transmission quality and service availability.

**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.

**WRED** --Weighted Random Early Detection. Combines IP Precedence and standard Random Early Detection (RED) to allow for preferential handling of voice traffic under congestion conditions without exacerbating the congestion. WRED uses and interprets IP Precedence to give priority to voice traffic over data traffic, dropping only data packets.