



Adaptive Frame Relay Traffic Shaping for Interface Congestion

Feature History

Release	Modification
12.2(4)T	This feature was introduced.

This document describes the Adaptive Frame Relay Traffic Shaping for Interface Congestion feature in Cisco IOS Release 12.2(4)T. It includes the following sections:

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Feature Overview

The Adaptive Frame Relay Traffic Shaping for Interface Congestion feature enhances Frame Relay traffic shaping functionality by adjusting permanent virtual circuit (PVC) sending rates based on interface congestion. When this new feature is enabled, the traffic-shaping mechanism monitors interface congestion. When the congestion level exceeds a configured value called *queue depth*, the sending rate of all PVCs is reduced to the minimum committed information rate (minCIR). As soon as interface congestion drops below the queue depth, the traffic-shaping mechanism changes the sending rate of the PVCs back to the committed information rate (CIR). This process guarantees the minCIR for PVCs when there is interface congestion.



Note

The sum of the minCIR values for all PVCs on the interface must be less than the usable interface bandwidth.

This new feature works in conjunction with backward explicit congestion notification (BECN) and Foresight functionality. If interface congestion exceeds the queue depth when adaptive shaping for interface congestion is enabled along with BECN or ForeSight, then the PVC sending rate is reduced to the minCIR. When interface congestion drops below the queue depth, then the sending rate is adjusted in response to BECN or ForeSight.

Before the introduction of this feature, interface congestion caused packets to be delayed or dropped at the interface. The Adaptive Frame Relay Traffic Shaping for Interface Congestion feature helps ensure that packet drop occurs at the virtual circuit (VC) queues. When used with FRF.12 fragmentation, this feature also ensures that packets are dropped before fragmentation occurs.

Benefits

The Adaptive Frame Relay Traffic Shaping for Interface Congestion feature

- Guarantees minCIR for PVCs when there is interface congestion, as long as the sum of the minCIR values for the PVCs is less than the usable interface bandwidth.
- Increases the useful data rate by ensuring that packets are dropped before FRF.12 fragmentation.
- Enables intelligent packet drop by ensuring that packets are dropped at the VC queue rather than the interface.

Restrictions

This feature is supported on terminated and switched PVCs. It is not supported on switched virtual circuits (SVCs).

Related Features and Technologies

- Frame Relay traffic shaping

Related Documents

- *Cisco IOS Quality of Service Solutions Configuration Guide*, Release 12.2
- *Cisco IOS Quality of Service Solutions Command Reference*, Release 12.2
- *Cisco IOS Wide-Area Network Configuration Guide*, Release 12.2
- *Cisco IOS Wide-Area Network Command Reference*, Release 12.2

Supported Platforms

- Cisco 2500 series
- Cisco 2600 series
- Cisco 3600 series
- Cisco 7200 series

Platform Support Through Feature Navigator

Cisco IOS software is packaged in feature sets that support specific platforms. To get updated information regarding platform support for this feature, access Feature Navigator. Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Feature Navigator is a web-based tool that enables you to quickly determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image.

To access Feature Navigator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com. An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions at <http://www.cisco.com/register>.

Feature Navigator is updated when major Cisco IOS software releases and technology releases occur. As of May 2001, Feature Navigator supports M, T, E, S, and ST releases. You can access Feature Navigator at the following URL:

<http://www.cisco.com/go/fn>

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.

To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL:

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

RFCs

No new or modified RFCs are supported by this feature.

Prerequisites

In order to use the Adaptive Frame Relay Traffic Shaping for Interface Congestion feature, Frame Relay traffic shaping must be enabled on the interface.

Configuration Tasks

See the following sections for configuration tasks for the Adaptive Frame Relay Traffic Shaping for Interface Congestion feature. Each task in the list is identified as either required or optional.

- [Configuring Frame Relay Adaptive Traffic Shaping for Interface Congestion](#) (required)
- [Verifying Frame Relay Adaptive Traffic Shaping for Interface Congestion](#) (optional)

Configuring Frame Relay Adaptive Traffic Shaping for Interface Congestion

To configure a map class for adaptive traffic shaping for interface congestion, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# map-class frame-relay <i>map-class-name</i>	Specifies a map class to define quality of service (QoS) values.
Step 2	Router(config-map-class)# frame-relay cir {in out} bps	(Optional) Specifies the incoming or outgoing CIR for a Frame Relay VC. The default is 56,000 bps.
Step 3	Router(config-map-class)# frame-relay mincir {in out} bps	(Optional) Specifies the minimum acceptable incoming or outgoing CIR for a Frame Relay VC. The default is CIR/2.
Step 4	Router(config-map-class)# frame-relay adaptive-shaping interface-congestion [<i>queue-depth</i>]	Enables adaptive traffic shaping for interface congestion and sets the queue depth.

Verifying Frame Relay Adaptive Traffic Shaping for Interface Congestion

- Step 1** Use the **show frame-relay pvc** command to verify that Frame Relay adaptive traffic shaping for interface congestion is enabled. If it is enabled, the value IF_CONG will be displayed in the “Adaptive Shaping” field.

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

```
Router# show frame-relay pvc 41

PVC Statistics for interface Serial1 (Frame Relay DTE)

DLCI = 41, DLCI USAGE = LOCAL, PVC STATUS = DELETED, INTERFACE = Serial1.1

input pkts 0          output pkts 0          in bytes 0
out bytes 0           dropped pkts 0         in FECN pkts 0
in BECN pkts 0       out FECN pkts 0       out BECN pkts 0
in DE pkts 0         out DE pkts 0         out bcast pkts 0
out bcast pkts 0     out bcast bytes 0
pvc create time 4d22h, last time pvc status changed 4d22h
cir 56000    bc 7000    be 0    byte limit 875    interval 125
mincir 28000    byte increment 875    Adaptive Shaping IF_CONG
pkts 0    bytes 0    pkts delayed 0    bytes delayed 0
shaping inactive
traffic shaping drops 0
Queueing strategy:fifo
Output queue 0/40, 0 drop, 0 dequeued
```

- Step 2** Use the **show interfaces serial** command to verify that Frame Relay adaptive traffic shaping for interface congestion is working correctly. If it is working correctly, the number of packets in the output queue will equal or be close to the queue depth value.



Note

The number of packets in the output queue changes between CIR and minCIR, so at a specific point in time the value may not equal the queue depth. However, the “average” number of packets in the output queue should equal the queue depth.

The following is sample output from the **show interfaces serial** command for an interface that is configured with adaptive traffic shaping for interface congestion with a queue depth of 10 packets. The “Output queue” field indicates 10 packets in the interface queue.

```
Router# show interfaces serial 2

Serial2 is up, line protocol is up
  Hardware is HD64570
  Internet address is 2.0.0.2/8
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 10/255, rxload 10/255
  Encapsulation FRAME-RELAY, loopback not set
  Keepalive not set
  FR SVC disabled, LAPF state down
  Broadcast queue 0/64, broadcasts sent/dropped 0/0, interface broadcasts 0
  Last input 00:06:55, output 00:00:00, output hang never
  Last clearing of "show interface" counters 00:11:01
  Queueing strategy:fifo
  Output queue 10/40, 6731 drops; input queue 24/75, 0 drops
  .
  .
  .
```

**Note**

For a description of each output display field, refer to the **show interfaces serial** command reference page in the *Cisco IOS Interface Command Reference*.

Configuration Examples

This section provides the following configuration example:

- [Frame Relay Adaptive Traffic Shaping for Interface Congestion Example](#)

Frame Relay Adaptive Traffic Shaping for Interface Congestion Example

In the following example, the rate of traffic destined for PVC 200 will be reduced to the minCIR if the number of packets in the interface queue exceeds 10. When the number of packets in the interface queue drops below 10, then the traffic rate will immediately return to the CIR.

```
interface serial0
  encapsulation frame-relay
  frame-relay traffic-shaping
  frame-relay interface-dlci 200
  class adjust_vc_class_rate
  !
map-class frame-relay adjust_vc_class_rate
  frame-relay cir 64000
  frame-relay mincir 32000
  frame-relay adaptive-shaping interface-congestion 10
```

Command Reference

This section documents the modified **frame-relay adaptive-shaping** command that configures the Adaptive Frame Relay Traffic Shaping for Interface Congestion feature. All other commands used with this feature are documented in the Cisco IOS Release 12.2 command reference publications.

- [frame-relay adaptive-shaping](#)

frame-relay adaptive-shaping

To enable Frame Relay adaptive traffic shaping, use the **frame-relay adaptive-shaping** command in map-class configuration mode. To disable adaptive traffic shaping, use the **no** form of this command.

```
frame-relay adaptive-shaping {[becn | foresight] | [interface-congestion queue-depth]}
```

```
no frame-relay adaptive-shaping {[becn | foresight] | [interface-congestion]}
```

Syntax Description

becn	Enables rate adjustment in response to backward explicit congestion notification (BECN).
foresight	Enables rate adjustment in response to ForeSight messages.
interface-congestion	Enables rate adjustment in response to interface congestion.
<i>queue-depth</i>	(Optional) Maximum number of packets that can be in the interface queue before the interface is considered congested. The range is from 0 to 40 packets. The default is 0 packets.

Defaults

Frame Relay adaptive traffic shaping is not enabled by default.

The default queue depth is 0 packets.

Command Modes

Static maps class configuration

Command History

Release	Modification
11.3	This command was introduced.
12.2(4)T	This command was modified to configure adaptive traffic shaping for interface congestion.

Usage Guidelines

This command replaces the **frame-relay becn-response-enable** command. If you use the **frame-relay becn-response-enable** command in scripts, you should replace it with the **frame-relay adaptive-shaping** command.

The **frame-relay adaptive-shaping** command configures a router to adjust virtual circuit (VC) sending rates in response to BECN or ForeSight backward congestion notification messages or interface congestion.

Include this command in a map-class definition and apply the map class either to the main interface or to a subinterface.

Adaptive traffic shaping for interface congestion can be configured along with BECN or ForeSight. When adaptive shaping for interface congestion is used with BECN or ForeSight, if interface congestion exceeds the queue-depth, then the PVC send rate is reduced to minCIR. When interface congestion drops below the queue-depth, then the send rate is adjusted in response to BECN or ForeSight.

**Note**

For adaptive traffic shaping for interface congestion to work, the sum of the minCIR values for all PVCs on the interface must be less than the usable interface bandwidth.

Examples**ForeSight Example**

This example shows the map-class definition for a router configured with traffic shaping and Router ForeSight enabled:

```
interface Serial0
  no ip address
  encapsulation frame-relay
  frame-relay traffic-shaping
  frame-relay class control-A
!
map-class frame-relay control-A
  frame-relay adaptive-shaping foresight
  frame-relay cir 56000
  frame-relay bc 64000
```

Adaptive Shaping for Interface Congestion Example

In the following example, the queue depth is set at 10 packets. If the number of packets in the interface queue exceeds 10, the rate of traffic destined for PVC 200 will be reduced to the minCIR. When the number of packets in the interface queue drops below 10, then the traffic rate will immediately return to the CIR.

```
interface serial0
  encapsulation frame-relay
  frame-relay traffic-shaping
  frame-relay interface-dlci 200
  class adjust_vc_class_rate
!
map-class frame-relay adjust_vc_class_rate
  frame-relay cir 64000
  frame-relay mincir 32000
  frame-relay adaptive-shaping interface-congestion 10
```

Related Commands

Command	Description
frame-relay traffic-shaping	Enables both traffic shaping and per-VC queuing for all PVCs and SVCs on a Frame Relay interface.
map-class frame-relay	Specifies a map class to define QoS values for an SVC.

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. DTE receiving frames with the BECN bit set can request that higher-level protocols take flow control action as appropriate.

CIR—committed information rate. The rate at which a Frame Relay network agrees to transfer information under normal conditions, averaged over a minimum increment of time. CIR, measured in bits per second, is one of the key negotiated traffic metrics.

ForeSight—A network traffic control feature used in Cisco switches. When the ForeSight feature is enabled on the switch, the switch will periodically send out a ForeSight message. When a Cisco router receives a ForeSight message indicating that certain data-link connection identifiers (DLCIs) are experiencing congestion, the router reacts by activating its traffic-shaping function to slow down the output rate.

FRF.12—An implementation agreement 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.

minCIR—The minimum acceptable incoming or outgoing committed information rate (CIR) for a Frame Relay virtual circuit.

PVC—permanent virtual circuit or connection. A virtual circuit that is permanently established. PVCs save bandwidth associated with circuit establishment and teardown in situations where certain virtual circuits must exist all the time.

SVC—switched virtual circuit. Virtual circuit that is dynamically established on demand and is torn down when transmission is complete. SVCs are used in situations where data transmission is sporadic.

