Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation

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The Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation feature helps ensure voice quality by adjusting the rate of traffic and activating fragmentation on the basis of the presence of voice on the permanent virtual circuit (PVC). Frame Relay voice-adaptive traffic shaping enables a PVC to adjust the rate of traffic if packets are detected in the priority queue or if H.323 call setup signaling packets are detected. Frame Relay voice-adaptive fragmentation allows fragmentation to be activated when priority-queue or H.323 signaling packets are detected. When priority-queue traffic and signaling packets are not present, Frame Relay voice-adaptive fragmentation allows fragmentation to be deactivated.

Feature Specifications for Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation

Feature History	
Release	Modification
12.2(15)T	This feature was introduced.
Supported Platforms	
Cisco 1700 series, Cisco 2600 series, Cisco 3600 series, Cisco 3700 series, Cisco 4500, Cisco 7200 series, Cisco 7400 series, Cisco 7500 series (without Versatile Interface Processor.)	

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Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

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. An account on Cisco.com is not required.

Prerequisites for Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation

Prerequisites for Frame Relay Voice-Adaptive Traffic Shaping

- Traffic shaping and low latency queueing must be configured using the Modular QoS CLI (MQC).

Prerequisites for Frame Relay Voice-Adaptive Fragmentation

- End-to-end fragmentation must be configured in a map class or on the interface.
- Frame Relay traffic shaping or traffic shaping using the MQC must be configured. If end-to-end fragmentation is configured on the interface, traffic shaping must be configured using the MQC.
- Low latency queueing must be configured.
- End-to-end fragmentation must be configured on the peer router. Although the peer router may not see the expected fragmented packets from the router doing voice-adaptive fragmentation, the peer will be able to handle large unfragmented packets in addition to fragmented packets.

Restrictions for Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation

The feature supports FRF.12 fragmentation only. Neither FRF.11 Annex C nor Cisco proprietary fragmentation is supported.

Information About Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation

Benefits of Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation

Before the introduction of this new feature, Frame Relay adaptive shaping could be used to reduce the sending rate when a network was congested. Because the adaptive shaping mechanism was triggered by network congestion, voice traffic might already have been delayed by the time the sending rate was reduced. The Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation feature helps to ensure voice quality by adjusting the rate of traffic based on the presence of voice on the PVC.

Frame Relay voice-adaptive traffic shaping and fragmentation

- Prevents delay of voice packets when network congestion occurs by reducing the traffic rate to the minimum committed information rate (minCIR) and turning on fragmentation when voice packets are present on a PVC.
- Maximizes utilization of the PVC by increasing the traffic rate to committed information rate (CIR) when voice packets are not present.
- Reduces CPU utilization by turning off fragmentation when there are no voice packets present.

Frame Relay Voice-Adaptive Traffic Shaping

Frame Relay voice-adaptive traffic shaping enables a router to reduce the PVC sending rate to the minCIR whenever packets (usually voice) are detected in the low latency queueing priority queue or H.323 call setup signaling packets are present. When there are no packets in the priority queue and signaling packets are not present for a configured period of time, the router increases the PVC sending rate from minCIR to CIR to maximize throughput.

Note Although the priority queue is generally used for voice traffic, Frame Relay voice-adaptive traffic shaping will respond to any packets (voice or data) in the priority queue.

Frame Relay voice-adaptive traffic shaping can be used at the same time as other types of adaptive traffic shaping. For example, if both Frame Relay voice-adaptive traffic shaping and adaptive shaping based on interface congestion are configured, the router will reduce the sending rate to minCIR if there are packets in the priority queue or the interface queue size exceeds the configured threshold.

Frame Relay voice-adaptive traffic shaping can be used in conjunction with or independently of voice-adaptive fragmentation.

Frame Relay Voice-Adaptive Fragmentation

Frame Relay voice-adaptive fragmentation enables a router to fragment large data packets whenever packets (usually voice) are detected in the low latency queueing priority queue or H.323 call setup signaling packets are present. When there are no packets in the priority queue for a configured period of time and signaling packets are not present, fragmentation is stopped.

Note Although the priority queue is generally used for voice traffic, Frame Relay voice-adaptive fragmentation will respond to any packets (voice or data) in the priority queue.

Frame Relay voice-adaptive fragmentation can be used in conjunction with or independent of voice-adaptive traffic shaping.

To use voice-adaptive fragmentation, you must also have end-to-end fragmentation configured in a map class or on the interface.

How to Configure Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation

The following tasks enable both Frame Relay voice-adaptive traffic shaping and fragmentation. The features can also be used separately. If you choose to use voice-adaptive fragmentation by itself, you can configure either MQC traffic shaping (as in the tasks that follow) or Frame Relay traffic shaping. If you use Frame Relay traffic shaping, end-to-end fragmentation must be configured in a map class.

Configuring Class Policy for the Priority Queue and Bandwidth Queues

Perform this task to configure a policy map for the priority class and other classes.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map*
4. **class** *class-name*
5. **priority** *bandwidth-kbps*
6. **exit**
7. **class** *class-name*
8. **bandwidth** *bandwidth-kbps*
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**policy-map** *policy-map* **Example:** `Router(config)# policy-map FR-VATS`	Specifies the name of the policy map to be created or modified. • Use this command to define the queueing policy for the priority queue.
Step 4	**class** *class-name* **Example:** `Router(config-pmap)# class VOICE`	Specifies the name of a class to be created and included in the service policy. • The class name that you specify in the policy map defines the characteristics for that class and its match criteria as configured using the **class-map** command.
Step 5	**priority** *bandwidth-kbps* **Example:** `Router(config-pmap-c)# priority 10`	Creates a strict priority class and specifies the amount of bandwidth, in kbps, to be assigned to the class.
Step 6	**exit** **Example:** `Router(config-pmap-c)# exit`	Returns to policy map configuration mode.
Step 7	**class** *class-name* **Example:** `Router(config-pmap)# class DATA`	Specifies the name of a class to be created and included in the service policy. • The class name that you specify in the policy map defines the characteristics for that class and its match criteria as configured using the **class-map** command.
Step 8	**bandwidth** *bandwidth-kbps* **Example:** `Router(config-pmap-c)# bandwidth 10`	Specifies the amount of bandwidth to be assigned to the class, in kbps or as a percentage of the available bandwidth. Bandwidth must be specified in kbps or as a percentage consistently across classes. (Bandwidth of the priority queue must be specified in kbps.)

	Command or Action	Purpose
Step 9	**end** **Example:** `Router(config-pmap-c)# end`	Exits to privileged EXEC mode.

Configuring Frame Relay Voice-Adaptive Traffic Shaping Using the Class-Default Class

Perform the following task to configure the shaping policy, including Frame Relay voice-adaptive traffic shaping, in the class-default class.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map** *policy-map*
4. **class class-default**
5. **shape** [**average** | **peak**] *mean-rate* [[*burst-size*] [*excess-burst-size*]]
6. **shape adaptive** *mean-rate-lower-bound*
7. **shape fr-voice-adapt** [**deactivation** *seconds*]
8. **Service-policy** *policy-map-name*
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

	Command or Action	Purpose
Step 3	**policy-map** *policy-map* **Example:** `Router(config)# policy-map SHAPE`	Specifies the name of the policy map to be created or modified. • Use this command to define the shaping policy.
Step 4	**class class-default** **Example:** `Router(config-pmap)# class class-default`	Specifies the default class so that you can configure or modify its policy.

Step 5	**shape** [**average** | **peak**] *mean-rate* [[*burst-size*] [*excess-burst-size*]]
	
	Example:
	
	`Router(config-pmap-c)#`
	`shape average 60000`
		Shapes traffic to the indicated bit rate according to the algorithm specified.

Step 6	**shape adaptive** *mean-rate-lower-bound*
	
	Example:
	
	`Router(config-pmap-c)#`
	`shape adaptive 30000`
		(Optional) Configures a Frame Relay interface or a point-to-point subinterface to estimate the available bandwidth while traffic shaping is active.

Step 7	**shape fr-voice-adapt** [**deactivation** *seconds*]
	
	Example:
	
	`Router(config-pmap-c)#`
	`shape fr-voice-adapt deactivation 10`
		Enables Frame Relay voice-adaptive traffic shaping.

Step 8	**Service-policy** *policy-map-name* **Example:** `Router(config-pmap-c)#service-policy FR-VATS`	Specifies the name of a policy map to be used as a matching criterion (for nesting traffic policies [hierarchical traffic policies] within one another). • Use this command to attach the policy map for the priority queue and bandwidth queues (the child policies) to the shaping policy (the parent policy).
Step 9	**end**	(Optional) Exits to privileged EXEC mode.

Configuring a Map Class for Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation

Perform the following task to configure a map class for Frame Relay voice-adaptive traffic shaping and fragmentation.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **map-class frame-relay** *map-class-name*
4. **frame-relay fragment** *fragment_size*
5. **service-policy output** *policy-map-name*
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**map-class frame-relay** *map-class-name* **Example:** `Router(config)# map-class frame-relay VOICE-CLASS`	Specifies the name of a Frame Relay map class that is to be created or modified.
Step 4	**frame-relay fragment** *fragment_size* **Example:** `Router(config-map-class)# frame-relay fragment 80`	Enables Frame Relay fragmentation. **Note** For voice-adaptive fragmentation to work, fragmentation must be enabled here in a map class, or it can be configured directly on the interface.

	Command or Action	Purpose
Step 5	**service-policy output** *policy-map-name* **Example:** `Router(config-map-class)# service-policy output SHAPE`	Attaches a policy map to an output interface, to be used as the service policy for that interface. • Use this command to attach the shaping policy to the map class.
Step 6	**end** **Example:** `Router(config-map-class)# end`	Exits to privileged EXEC mode.

Enabling Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation on the Interface

Perform the following task to enable Frame Relay voice-adaptive traffic shaping and fragmentation on the interface.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **encapsulation frame-relay**
5. **frame-relay fragmentation voice-adaptive** [**deactivation** *seconds*
6. **frame-relay fragment** *fragment-size* **end-to-end**
7. **frame-relay interface-dlci** *dlci* [**ietf** | **cisco**] [**voice-cir** *cir*]
8. **class** *name*
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface serial0`	Specifies the interface to be configured and enters interface configuration mode.
Step 4	**encapsulation frame-relay** **Example:** `Router(config-if)# encapsulation frame-relay`	Enables Frame Relay encapsulation.
Step 5	**frame-relay fragmentation voice-adaptive** [**deactivation** *seconds* **Example:** `Router(config-if)# frame-relay fragmentation voice-adaptive deactivation 50`	Enables Frame Relay voice-adaptive fragmentation.
Step 6	**frame-relay fragment** *fragment-size* **end-to-end** **Example:** `Router(config-if)# frame-relay fragment 80 end-to-end`	Enables Frame Relay fragmentation on an interface. **Note** For voice-adaptive fragmentation to work, fragmentation must be enabled here on the interface, or it can be configured in a map class. • When fragmentation is enabled on an interface, all PVCs on the main interface and its subinterfaces will have fragmentation enabled with the same configured fragment size. • To maintain low latency and low jitter for priority queue traffic, configure the fragment size to be greater than the largest high-priority frame that would be expected.
Step 7	**frame-relay interface-dlci** *dlci* [**ietf** | **cisco**] [**voice-cir** *cir*] **Example:** `Router(config-if)#`	Specifies a PVC to be configured.

	Command or Action	Purpose
Step 8	**class** *name* **Example:** `Router(config-fr-dlci)#`	Associates a map class with a specified data-link connection identifier (DLCI). • Use this command to assign the map class that was configured with Frame Relay voice-adaptive traffic shaping to the PVC.
Step 9	**end** **Example:** `Router(config-fr-dlci)#` **end**	Exits to privileged EXEC mode.

Verifying Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation

Perform this task to verify the configuration and operation of Frame Relay voice-adaptive traffic shaping and fragmentation.

SUMMARY STEPS

1. **enable**
2. **show policy-map** [*policy-map*]
3. **show policy-map interface** *interface-name* [**dlci** *dlci*] [**input** | **output**]
4. **show frame-relay pvc** [**interface** *interface*] [*dlci*] [**64-bit**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show policy-map** [*policy-map*] **Example:** `Router# show policy-map`	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.

	Command or Action	Purpose
Step 3	**show policy-map interface** *interface-name* [**dlci** *dlci*] [**input** | **output**] **Example:** `Router# show policy interface Serial3/1.1`	Displays the packet statistics of all classes that are configured for all service policies either on the specified interface or subinterface or on a specific permanent virtual circuit (PVC) on the interface.
Step 4	**show frame-relay pvc** [**interface** *interface*] [*dlci*] [**64-bit**] **Example:** `Router# show frame-relay pvc 202`	Displays statistics about permanent virtual circuits (PVCs) for Frame Relay interface.

Configuration Examples for Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation

Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation Examples

The following examples show the configuration of Frame Relay voice-adaptive traffic shaping and fragmentation. The first example shows end-to-end fragmentation configured in a map class that is associated with PVC 100. In the second example, end-to-end fragmentation is configured directly on the interface.

With both example configurations, priority-queue packets or H.323 call setup signaling packets destined for PVC 100 will result in the reduction of the sending rate from CIR to minCIR and the activation of FRF.12 end-to-end fragmentation. If signaling packets and priority-queue packets are not detected for 50 seconds, the sending rate will increase to CIR and fragmentation will be deactivated.

Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation with End-to-End Fragmentation Configured in a Map Class

```
interface serial0
 encapsulation frame-relay
 frame-relay fragmentation voice-adaptive deactivation 50
 frame-relay interface-dlci 100
  class voice_adaptive_class
!
map-class frame-relay voice_adaptive_class
 frame-relay fragment 80
 service-policy output shape
class-map match-all voice
 match access-group 102
class-map match-all data
 match access-group 101
```

```
policy-map vats
 class voice
  priority 10
 class data
  bandwidth 10
policy-map shape
 class class-default
  shape average 60000
  shape adaptive 30000
  shape fr-voice-adapt deactivation 50
  service-policy vats
```

Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation with End-to-End Fragmentation Configured on the Interface

```
interface serial0
 encapsulation frame-relay
 frame-relay fragmentation voice-adaptive deactivation 50
 frame-relay interface-dlci 100
  class voice_adaptive_class
  frame-relay fragment 80 end-to-end
!
map-class frame-relay voice_adaptive_class
 service-policy output shape

class-map match-all voice
 match access-group 102
class-map match-all data
 match access-group 101

policy-map vats
 class voice
  priority 10
 class data
  bandwidth 10
policy-map shape
 class class-default
  shape average 60000
  shape adaptive 30000
  shape fr-voice-adapt deactivation 50
  service-policy vats
```

Verifying Frame Relay Voice-Adaptive Traffic Shaping and Fragmentation Example

Sample Output for the show policy-map Command

The following sample output for the **show-policy map** command indicates that Frame Relay voice-adaptive traffic shaping is configured in the class-default class in the policy map "MQC-SHAPE-LLQ1" and that the deactivation timer is set at 30 seconds.

```
Router# show policy-map
  Policy Map VSD1
    Class VOICE1
      Strict Priority
      Bandwidth 10 (kbps) Burst 250 (Bytes)
    Class SIGNALS1
      Bandwidth 8 (kbps) Max Threshold 64 (packets)
    Class DATA1
      Bandwidth 15 (kbps) Max Threshold 64 (packets)
  Policy Map MQC-SHAPE-LLQ1
    Class class-default
      Traffic Shaping
         Average Rate Traffic Shaping
                 CIR 63000 (bps) Max. Buffers Limit 1000 (Packets)
```

```
                Adapt to 8000 (bps)
                Voice Adapt Deactivation Timer 30 Sec
      service-policy VSD1
```

Sample Output for the show policy interface Command

The following sample output shows that Frame Relay voice-adaptive traffic shaping is active and has 29 seconds left on the deactivation timer. This means that the current sending rate on DLCI 201 is minCIR, but if no voice packets are detected for 29 seconds, the sending rate will increase to CIR.

```
Router# show policy interface Serial3/1.1
 Serial3/1.1:DLCI 201 -
  Service-policy output:MQC-SHAPE-LLQ1

    Class-map:class-default (match-any)
      1434 packets, 148751 bytes
      30 second offered rate 14000 bps, drop rate 0 bps
      Match:any
      Traffic Shaping
           Target/Average   Byte   Sustain   Excess    Interval  Increment
             Rate           Limit  bits/int  bits/int  (ms)      (bytes)
            63000/63000     1890   7560      7560      120       945

        Adapt  Queue     Packets   Bytes     Packets   Bytes     Shaping
        Active Depth                         Delayed   Delayed   Active
        BECN   0         1434      162991    26        2704      yes
        Voice Adaptive Shaping active, time left 29 secs
      Service-policy :VSD1
        Class-map:VOICE1 (match-all)
          9 packets, 621 bytes
          30 second offered rate 0 bps, drop rate 0 bps
          Match:access-group 111
          Match:not access-group 112
          Queueing
            Strict Priority
            Output Queue:Conversation 24
            Bandwidth 10 (kbps) Burst 250 (Bytes)
            (pkts matched/bytes matched) 18/1242
            (total drops/bytes drops) 0/0

        Class-map:SIGNALS1 (match-all)
          0 packets, 0 bytes
          30 second offered rate 0 bps, drop rate 0 bps
          Match:access-group 112
          Queueing
            Output Queue:Conversation 25
            Bandwidth 8 (kbps) Max Threshold 64 (packets)
            (pkts matched/bytes matched) 0/0
        (depth/total drops/no-buffer drops) 0/0/0
        Class-map:DATA1 (match-all)
          1424 packets, 148096 bytes
          30 second offered rate 14000 bps, drop rate 0 bps
          Match:access-group 113
          Queueing
            Output Queue:Conversation 26
            Bandwidth 15 (kbps) Max Threshold 64 (packets)
            (pkts matched/bytes matched) 1442/149968
        (depth/total drops/no-buffer drops) 0/0/0

        Class-map:class-default (match-any)
          1 packets, 34 bytes
          30 second offered rate 0 bps, drop rate 0 bps
          Match:any
```

Sample Output for the show frame-relay pvc Command

The following sample output indicates that Frame Relay voice-adaptive fragmentation is active on DLCI 202 and there are 29 seconds left on the deactivation timer. If no packets are detected in the priority queue and no H.323 signaling packets are detected in the next 29 seconds, fragmentation will stop.

```
Router# show frame-relay pvc 202

PVC Statistics for interface Serial3/1 (Frame Relay DTE)

DLCI = 202, DLCI USAGE = LOCAL, PVC STATUS = STATIC, INTERFACE = Serial3/1.2

  input pkts 0             output pkts 479          in bytes 0
  out bytes 51226          dropped pkts 0           in pkts dropped 0
  out pkts dropped 0                out bytes dropped 0
  in FECN pkts 0           in BECN pkts 0           out FECN pkts 0
  out BECN pkts 0          in DE pkts 0             out DE pkts 0
  out bcast pkts 0         out bcast bytes 0
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 5000 bits/sec, 5 packets/sec
  pvc create time 00:23:36, last time pvc status changed 00:23:31
  fragment type end-to-end fragment size 80 adaptive active, time left 29 secs
```

Additional References

Related Documents

Related Topic	Document Title
Traffic shaping, low latency queueing for Frame Relay, and Modular QoS CLI configuration tasks	*Cisco IOS Quality of Service Configuration Guide , Release 12.2*
Traffic shaping, low latency queueing for Frame Relay, and Modular QoS CLI commands	*Cisco IOS Quality of Service Command Reference , Release 12.2 T*
Frame Relay fragmentation configuration tasks	*Cisco IOS Wide-Area Networking Configuration Guide* , Release 12.2
Frame Relay fragmentation commands	*Cisco IOS Wide-Area Networking Command Reference* , Release 12.2 T
Frame Relay interface queueing and fragmentation configuration tasks and commands	"Frame Relay Queueing and Fragmentation at the Interface," Cisco IOS Release 12.2(13)T feature module
Adaptive Frame Relay traffic shaping for interface congestion configuration tasks and commands	"Adaptive Frame Relay Traffic Shaping for Interface Congestion," Cisco IOS Release 12.2(4)T feature module

Standards

Standards	Title
No new or modified standards are supported by this feature. Support for existing standards has not been modified by this feature.	--

MIBs

MIBs	MIBs Link
No new or modified MIBs are supported by this feature. Support for existing MIBs has not been modified 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

RFCs	Title
No new or modified RFCs are supported by this feature. Support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml