



FRF.12 Support on Additional Platforms

This feature module describes the FRF.12 Support on Additional Platforms feature. It includes information about the benefits of this feature, supported platforms, related documents, and more.

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Feature Overview

The end-to-end FRF.12 fragmentation functionality that was introduced in Cisco IOS Release 12.0(4)T is now extended to the Cisco 805, 1600, 1700, 2500, 4500, and 4700 router platforms.

The purpose of end-to-end FRF.12 fragmentation is to support real-time and non-real-time data packets on lower-speed links without causing excessive delay to the real-time data. FRF.12 fragmentation is defined by the FRF.12 Implementation Agreement. This standard was developed to allow long data frames to be fragmented into smaller pieces (fragments) and interleaved with real-time frames. In this way, real-time and non-real-time data frames can be carried together on lower-speed links without causing excessive delay to the real-time traffic.

End-to-end FRF.12 fragmentation is recommended for use on permanent virtual circuits (PVCs) that share links with other PVCs that are transporting voice and on PVCs transporting Voice over IP (VoIP). Although VoIP packets should not be fragmented, they can be interleaved with fragmented packets.



Note

End-to-end FRF.12 fragmentation should not be used with Voice over Frame Relay (VoFR). FRF.11 Annex C fragmentation or Cisco proprietary fragmentation are the recommended types of fragmentation for use with VoFR. For more information about VoFR, see the *Cisco IOS Multiservice Applications Configuration Guide*, Release 12.1.

FRF.12 is configured on a per-PVC basis. You will configure FRF.12 fragmentation in a Frame Relay map class using the **frame-relay fragment** command, and you will associate that map class with specific data-link connection identifiers (DLCIs). In addition, you must enable Frame Relay traffic shaping on the interface in order for fragmentation to work.

Benefits

End-to-end FRF.12 fragmentation enables real-time and non-real-time traffic to be carried over the same Frame Relay links without compromising quality of service for the delay-sensitive traffic.

Restrictions

When Frame Relay fragmentation is configured, the following conditions and restrictions apply:

- Hardware compression is not supported.
- Packets are dropped if fragments arrive out of sequence.
- Fragmentation is performed after frames are removed from the weighted fair queue.
- The **frame-relay route** command does not support fragmentation.

Related Documents

More information about end-to-end FRF.12 fragmentation can be found in the following 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
- *Voice over Frame Relay Using FRF.11 and FRF.12*, Cisco IOS Release 12.0(4)T

Supported Platforms

End-to-end FRF.12 fragmentation is supported on the following platforms:

- Cisco 805
- Cisco 1600
- Cisco 1700
- Cisco 2500
- Cisco 2600 series
- Cisco 3600 series
- Cisco 4500
- Cisco 4700
- Cisco MC3810 series multiservice access concentrators
- Cisco 7200 series

Supported Standards, MIBs, and RFCs

Standards

Frame Relay Fragmentation Implementation Agreement (FRF.12), Frame Relay Forum, December, 1997

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

The following prerequisites apply to end-to-end FRF.12 fragmentation:

- Frame Relay traffic shaping must be enabled on the interface.
- Weighted fair queueing (WFQ) or low latency queueing (LLQ) must be configured on the PVC.

Configuration Tasks

See the following sections for configuration tasks for FRF.12 fragmentation. Each task in the list is identified as optional or required.

- Configuring End-to-End FRF.12 Fragmentation in a Frame Relay Map Class (Required)
- Verifying the Configuration of End-to-End FRF.12 Fragmentation (Optional)

Configuring End-to-End FRF.12 Fragmentation in a Frame Relay Map Class

To configure the map class to support FRF.12 fragmentation, use the following map-class configuration command:

Command	Purpose
Router(config-map-class)# frame-relay fragment <i>fragment_size</i>	<p>Configures Frame Relay fragmentation for the map class. The <i>fragment_size</i> argument defines the payload size of a fragment; it excludes the Frame Relay headers and any Frame Relay fragmentation header. The valid range is from 16 to 1600 bytes, and the default is 53.</p> <p>The value of <i>fragment_size</i> should be less than or equal to the MTU size.</p> <p>Set the fragmentation size such that the largest data packet is not larger than any voice packets.</p>



Note

When Frame Relay fragmentation is configured, WFQ or LLQ is mandatory. If a map class is configured for Frame Relay fragmentation and the queueing type on that map class is not WFQ or LLQ, the configured queueing type is automatically overridden by WFQ with the default values.

Verifying the Configuration of End-to-End FRF.12 Fragmentation

To verify FRF.12 fragmentation, use one or more of the following commands in privileged EXEC mode:

Command	Purpose
Router# show frame-relay fragment [interface <i>interface</i>] [<i>dldci</i>]	Displays Frame Relay fragmentation information.
Router# show frame-relay pvc [interface <i>interface</i>] [<i>dldci</i>]	Displays statistics about PVCs for Frame Relay interfaces.

Configuration Examples

This section provides a configuration example for FRF.12 fragmentation.

FRF.12 Fragmentation Configuration Example

The following example shows the configuration of pure end-to-end FRF.12 fragmentation and weighted fair queuing in the map class called “frag.” The fragment payload size is set to 160 bytes. The “frag” map class is associated with DLCI 100 on serial interface 1.

```
router(config)# interface serial 1
router(config-if)# frame-relay traffic-shaping
router(config-if)# frame-relay interface-dlci 100
router(config-fr-dlci)# class frag
router(config-fr-dlci)# exit

router(config)# map-class frame-relay frag
router(config-map-class)# frame-relay cir 128000
router(config-map-class)# frame-relay bc 1280
router(config-map-class)# frame-relay fragment 160
router(config-map-class)# frame-relay fair-queue
```

Command Reference

This section documents the command that configures FRF.12 fragmentation.

frame-relay fragment

To enable fragmentation of Frame Relay frames for a Frame Relay map class, use the **frame-relay fragment** map-class configuration command. To disable Frame Relay fragmentation, use the **no** form of this command.

frame-relay fragment *fragment_size*

no frame-relay fragment

Syntax Description

<i>fragment_size</i>	Specifies the number of payload bytes from the original Frame Relay frame that will go into each fragment. This number excludes the Frame Relay header of the original frame. All the fragments of a Frame Relay frame except the last will have a payload size equal to <i>fragment_size</i> ; the last fragment will have a payload less than or equal to <i>fragment_size</i> . Valid values are from 16 to 1600 bytes; the default is 53.
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Defaults

Fragmentation is disabled.

Command Modes

Map-class configuration

Command History

Release	Modification
12.0(3)XG	This command was introduced.
12.0(4)T	This command was implemented in Cisco IOS Release 12.0 T.
12.1(2)T	This command was modified to extend end-to-end FRF.12 fragmentation support to additional platforms.

Usage Guidelines

You should enable fragmentation for low-speed links (meaning those operating at less than 768 kbps). Frame Relay fragmentation is enabled on a per-PVC basis. Before enabling Frame Relay fragmentation, you must first associate a Frame Relay map class with a specific data-link connection identifier (DLCI), and then enter map-class configuration mode and enable or disable fragmentation for that map class. In addition, you must enable Frame Relay traffic shaping on the interface in order for fragmentation to work.

Selecting a Fragmentation Format

Frame Relay frames are fragmented using one of the following formats, depending on how the PVC is configured:

- Pure end-to-end FRF.12 format
- FRF.11 Annex C format
- Cisco proprietary format

Cisco recommends pure end-to-end FRF.12 fragmentation on PVCs that are carrying VoIP packets and on PVCs that are sharing the link with other PVCs carrying Voice over Frame Relay (VoFR) traffic.

In pure end-to-end FRF.12 fragmentation, Frame Relay frames having a payload less than the fragment size configured for that PVC are transmitted without the fragmentation header.

FRF.11 Annex C and Cisco proprietary fragmentation are used when VoFR frames are transmitted on a PVC. When fragmentation is enabled on a PVC, FRF.11 Annex C format is implemented when **vofr** is configured on that PVC; Cisco proprietary format is implemented when **vofr cisco** is configured.

In FRF.11 Annex C and Cisco proprietary fragmentation, VoFR frames are never fragmented, and all data packets (including VoIP packets) contain the fragmentation header regardless of the payload size.

Selecting a Fragment Size

You should set the fragment size based on the lowest port speed between the routers. For example, for a hub-and-spoke Frame Relay topology where the hub has a T1 speed and the remote routers have 64 kbps port speeds, the fragmentation size must be set for the 64 kbps speed on both routers. Any other PVCs that share the same physical interface must use the same fragmentation size used by the voice PVC.

With pure end-to-end FRF.12 fragmentation, you should select a fragment size that is larger than the voice packet size.

Table 1 shows the recommended fragmentation sizes for a serialization delay of 10 ms.

Table 1 Recommended Fragment Size for 10 ms Serialization Delay

Lowest Link Speed in Path	Recommended Fragment Size
56 kbps	70 bytes
64 kbps	80 bytes
128 kbps	160 bytes
256 kbps	320 bytes
512 kbps	640 bytes
768 kbps	1000 bytes
1536 kbps	1600 bytes

Examples

End-to-End FRF.12 Fragmentation Configuration Example

The following example shows how to enable pure end-to-end FRF.12 fragmentation for the “frag” map class. The fragment payload size is set to 160 bytes. Frame Relay traffic shaping is required on the PVC; the only queueing type supported on the PVC when fragmentation is configured is weighted fair queueing (WFQ).

```
router(config)# interface serial 1/0/0
router(config-if)# frame-relay traffic-shaping
router(config-if)# frame-relay interface-dlci 100
router(config-fr-dlci)# class frag
router(config-fr-dlci)# exit

router(config)# map-class frame-relay frag
router(config-map-class)# frame-relay cir 128000
router(config-map-class)# frame-relay bc 1280
router(config-map-class)# frame-relay fragment 160
router(config-map-class)# frame-relay fair-queue
```

FRF.11 Annex C Fragmentation Configuration Example

The following example shows how to enable FRF.11 Annex C fragmentation for data on a Cisco MC3810 PVC configured for VoFR. Note that fragmentation must be configured if a VoFR PVC is to carry data. The fragment payload size is set to 160 bytes. Frame Relay traffic shaping is required on the PVC; the only queueing type supported on the PVC when fragmentation is configured is weighted fair queueing (WFQ).

```
router(config)# interface serial 1/1
router(config-if)# frame-relay traffic-shaping
router(config-if)# frame-relay interface-dlci 101
router(config-fr-dlci)# vofr
router(config-fr-dlci)# class frag
router(config-fr-dlci)# exit

router(config)# map-class frame-relay frag
router(config-map-class)# frame-relay cir 128000
router(config-map-class)# frame-relay bc 1280
router(config-map-class)# frame-relay fragment 160
router(config-map-class)# frame-relay fair-queue
router(config-map-class)#
```

Cisco Proprietary Fragmentation Configuration Example

The following example shows how to enable Cisco proprietary Frame Relay fragmentation for the “frag” Frame Relay map class on a Cisco 2600 series, 3600 series, or 7200 series router, starting from global configuration mode. The fragment payload size is set to 160 bytes. Frame Relay traffic shaping is required on the PVC; the only queueing type supported on the PVC when fragmentation is configured is weighted fair queueing (WFQ).

```
router(config)# interface serial 2/0/0
router(config-if)# frame-relay traffic-shaping
router(config-if)# frame-relay interface-dlci 102
router(config-fr-dlci)# vofr cisco
router(config-fr-dlci)# class frag
router(config-fr-dlci)# exit

router(config)# map-class frame-relay frag
router(config-map-class)# frame-relay cir 128000
router(config-map-class)# frame-relay bc 1280
router(config-map-class)# frame-relay fragment 160
router(config-map-class)# frame-relay fair-queue
```

Related Commands

Command	Description
class (virtual circuit)	Associates a map class with a specified DLCI.
frame-relay fragment	Enables weighted fair queueing for one or more Frame Relay PVCs.
frame-relay interface-dlci	Assigns a DLCI to a specified Frame Relay subinterface on the router or access server.
frame-relay traffic-shaping	Enables traffic shaping and per-virtual circuit queueing 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

FRF—Frame Relay Forum. An association of corporate members consisting of vendors, carriers, users, and consultants committed to the implementation of Frame Relay in accordance with national and international standards. Refer to the Web site <http://www.frforum.com>.

FRF.11—Frame Relay Forum implementation agreement for Voice over Frame Relay (v1.0 May 1997). This specification defines multiplexed data, voice, fax, DTMF digit-relay, and CAS/Robbed-bit signalling frame formats, but does not include call setup, routing, or administration facilities. Refer to the Web site <http://www.frforum.com>.

FRF.11 Annex C—An agreement that describes a standard transfer syntax used to support transport of data frames between two VoFR service users.

FRF.12—Frame Relay Fragmentation Implementation Agreement. The FRF.12 standard 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.

VoFR—Voice over Frame Relay.

Voice over Frame Relay—A protocol that enables a router to carry voice traffic (for example, telephone calls and faxes) over a Frame Relay network. When voice traffic is sent over Frame Relay, it is segmented and encapsulated for transit across the Frame Relay network using FRF.12 encapsulation.

Voice over IP—A protocol that enables a router to carry voice traffic (for example, telephone calls and faxes) over an IP network. In Voice over IP, the DSP segments the voice signal into frames, which are then coupled in groups of two and stored in voice packets. These voice packets are transported using IP in compliance with ITU-T specification H.323.

VoIP—Voice over IP.

Weighted Fair Queueing—Congestion management algorithm that identifies conversations, separates packets that belong to each conversation, and ensures that capacity is shared fairly among those individual conversations.

WFQ—weighted fair queueing.

