BECN and FECN Marking for Frame Relay over MPLS

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This feature explains how to configure backward explicit congestion notification (BECN) and forward explicit congestion notification (FECN) bits on packets for Frame Relay over MPLS.

History for the BECN and FECN Marking for Frame Relay over MPLS Feature

Release	Modification
12.0(26)S	This feature was introduced on the Cisco 7200 and 7500 series routers.
12.2(28)SB	This feature was integrated into Cisco IOS Release 12.2(28)SB.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at http://www.cisco.com/go/fn. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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Prerequisites for BECN and FECN Marking for Frame Relay over MPLS

The following prerequisites apply to the Cisco 7500 series router:

- Enable distributed IP CEF globally.
- Use VIP modules for both ingress and egress interfaces.

Restrictions for BECN and FECN Marking for Frame Relay over MPLS

- FECN and BECN marking does not work with L2VPN Interworking. FECN and BECN marking works only with Frame Relay over MPLS in like-to-like configurations.
- FECN and BECN marking does not work with Frame Relay over MPLS with port-to-port connections.
- If you configure the ECN thresholds at the interface level and also configure shaping, unpredictable behavior can occur. The software cannot differentiate between packets that are shaped and packets that experienced interface congestion.
- If you configure ECN thresholds at both the interface level and the class level, only the class-level ECN threshold is used.
- If you do not configure ECN thresholds at the class level, the software inherits the interface-level ECN threshold.
- You cannot configure priority or bandwidth after configuring the class ECN threshold. If you attempt to configure priority or bandwidth when ECN thresholds have been configured, you receive the following error:

```
Please remove set fr-fecn-becn from this class first
```

Information About BECN and FECN Marking for Frame Relay over MPLS

This feature provides congestion management on a provider edge (PE) router's egress interface when Frame Relay traffic is being tunneled across an MPLS cloud. When the congestion queue thresholds configured at the interface or class level of the PE router are exceeded, PE router does the following:

- Sets the FECN bit to 1 on the outgoing packets.
- Sets the BECN bit to 1 for all traffic destined for the originating CE router, which decreases its traffic based on the number of BECN packets it received.

You can configure FECN and BECN marking at the class level with the **set fr-fecn-becn** command. You can set up FECN and BECN marking at the interface level with the **threshold ecn** command.

How to Configure BECN and FECN Marking for Frame Relay over MPLS

You can configure BECN and FECN marking at either the class level or the interface level. This section shows both methods and includes the following sections:

Configuring BECN and FECN Marking at the Class Level

Use the following steps to enable BECN and FECN marking at the class level, using the **set fr-fecn-becn** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map** *class-map-name*
4. **match fr-dlci** *dlci-number*
5. **exit**
6. **policy-map** *policy-map-name*
7. **class** *class-name*
8. **priority** {*kbps* | **percent** *percent*} [*bytes*]
9. **set fr-fecn-becn** *percent*
10. **exit**
11. **interface** *type number*
12. **service-policy** {**input** | **output**} *policy-map-name*

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	**class-map** *class-map-name* **Example:** `Router (config)# class-map dcli-100`	Specifies the name of the class map to be created and enters class-map configuration mode.
Step 4	**match fr-dlci** *dlci-number* **Example:** `Router(config-cmap)# match fr-dlci 100`	(Optional) Configures the class map created above to match traffic based on the Frame Relay DLCI number associated with the packet.
Step 5	**exit** **Example:** `Router(config-cmap)# exit`	Exits class-map configuration mode.
Step 6	**policy-map** *policy-map-name* **Example:** `Router(config)# policy-map output-policy`	Specifies the name of the traffic policy to configure. Names can be a maximum of 40 alphanumeric characters.
Step 7	**class** *class-name* **Example:** `(config-pmap)# class dlci-100`	Specifies the name of a predefined traffic class, which was configured with the **class-map** command, used to classify traffic to the traffic policy.
Step 8	**priority** {*kbps* | **percent** *percent*} [*bytes*] **Example:** `Router(config-pmap-c)# priority 250`	(Optional) Specifies the guaranteed allowed bandwidth, in kbps or percentage, for priority (time-sensitive) traffic. The optional *bytes* argument controls the size of the burst allowed to pass through the system without being considered in excess of the configured kbps rate.
Step 9	**set fr-fecn-becn** *percent* **Example:** `Router(config-pmap-c)# set fr-fecn-becn 30`	Specifies the allowed maximum class queue size, in percentage. If the class queue depth matches or exceeds the percentage, the software initiates BECN and FECN marking.
Step 10	**exit** **Example:** `Router(config-pmap-c)# exit`	Exits policy-map configuration mode.
Step 11	**interface** *type number* **Example:** `Router(config-if)# interface s4/0`	Configures an interface (or subinterface) type and enters interface configuration mode.
Step 12	**service-policy** {**input** | **output**} *policy-map-name* **Example:** `Router(config-if)# service-policy output output-policy`	Specifies the name of the policy map to be attached to the input or output direction of the interface.

Configuring BECN and FECN Marking at the Interface Level

Use the following steps to enable BECN and FECN marking at the class level, using the **threshold ecn** command.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map** *class-map-name*
4. **match fr-dlci** *dlci-number*
5. **exit**
6. **policy-map** *policy-map-name*
7. **class** *class-name*
8. **priority** {*kbps* | **percent** *percent*} [*bytes*]
9. **exit**
10. **interface** *type number*
11. **service-policy** {**input** | **output**} *policy-map-name*
12. **frame-relay congestion-management**
13. **threshold ecn** *percentage*

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	**class-map** *class-map-name* **Example:** `Router (config)# class-map dcli-100`	Specifies the name of the class map to be created and enters class-map configuration mode.
Step 4	**match fr-dlci** *dlci-number* **Example:** `Router(config-cmap)# match fr-dlci 100`	(Optional) Configures the class map created above to match traffic based on the Frame Relay DLCI number associated with the packet.

	Command or Action	Purpose
Step 5	**exit** **Example:** `Router(config-cmap)# exit`	Exits class-map configuration mode.
Step 6	**policy-map** *policy-map-name* **Example:** `Router(config)# policy-map output-policy`	Specifies the name of the traffic policy to configure. Names can be a maximum of 40 alphanumeric characters.
Step 7	**class** *class-name* **Example:** `Router(config-pmap)# class dlci-100`	Specifies the name of a predefined traffic class, which was configured with the **class-ma**p command, used to classify traffic to the traffic policy.
Step 8	**priority** {*kbps* | **percent** *percent*} [*bytes*] **Example:** `Router(config-pmap-c)# priority 250`	(Optional) Specifies the guaranteed allowed bandwidth, in kbps or percentage, for priority (time-sensitive) traffic. The optional *bytes* argument controls the size of the burst allowed to pass through the system without being considered in excess of the configured kbps rate.
Step 9	**exit** **Example:** `Router(config-pmap-c)# exit`	Exits policy-map configuration mode.
Step 10	**interface** *type number* **Example:** `Router(config-if)# interface s4/0`	Configures an interface (or subinterface) type and enters interface configuration mode.
Step 11	**service-policy** {**input** | **output**} *policy-map-name* **Example:** `Router(config-if)# service-policy output output-policy`	Specifies the name of the policy map to be attached to the input or output direction of the interface.
Step 12	**frame-relay congestion-management** **Example:** `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 13	**threshold ecn** *percentage* **Example:** `Router(config-fr-congest)# threshold ecn 50`	Configures the threshold at which ECN bits will be set on packets in switched PVCs on the output interface.

Verifying the Configuration

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

- To displays statistics about PVCs for Frame Relay interfaces, issue the **show frame-relay pvc** command:

```
Router# show frame-relay pvc [interface interface] [dlci]
```

- To display information about the configuration and queue at the interface, issue the **show interfaces** command:

```
Router# show interfaces type number
```

For the Cisco 7200 series routers, you can issue the **show hqf interface** command to show the queue size for interface and class. For the Cisco 7500 series routers, log on to VIP slot and issue **show vip hqf** command. For the marking to start, the queue size has to be greater than the aggregate limit multiplied by the threshold ECN percentage.

```
Router # show hqf interface s2/1

Interface Number 7 (type 53) Serial2/1
    blt (0x61DDB97C, index 0, fast_if_number 8) layer PHYSICAL
    scheduling policy: WFQ
    classification policy: CLASS_BASED
    drop policy: TAIL
    blt flags: 0x0    scheduler: 0x61E9377C

    txcount 1532432 drops 0 qdrops 0 nobuffers 0 flowdrops 0
    qsize 0 qsize_bytes 0 aggregate limit 918 availbuffers 918 weight 1 perc 0.00
    visible_bw 10000000 allocated_bw 10000000 vc_encap 0 ecn_threshold 91
    quantum 1500 credit 0 backpressure_policy 1 scheduler_flags 3F
    calQ[A]->last_sortq 75, calQ[B]->last_sortq 0, leaf_blt 0x61E9372C

    next layer HQFLAYER_CLASS_HIER0 (max entries 256)

    blt (0x61DDB918, index 0, fast_if_number 8) layer CLASS_HIER0
    scheduling policy: FIFO
    classification policy: NONE
    drop policy: TAIL
    blt flags: 0x0    scheduler: 0x61E9372C
    txcount 1532432 drops 0 qdrops 0 nobuffers 0 flowdrops 0
    qsize 0 qsize_bytes 0 aggregate limit 918 availbuffers 918 weight 1 perc 0.00
    visible_bw 10000000 allocated_bw 10000000 vc_encap 0 ecn_threshold 91
    quantum 1500 credit 0 backpressure_policy 1 scheduler_flags 3F
    calQ[A]->last_sortq 75, calQ[B]->last_sortq 0, leaf_blt 0x61E9372C
```

Configuration Examples for BECN and FECN Marking for Frame Relay over MPLS

Table 1 shows two examples of FECN and BECN marking; one at the class level, the other at the interface level.

Table 1 FECN and BECN Marking at the Class Level and Interface Level Configuration Examples

Class Level	Interface Level

`class-map match-all dlci-100`
`  match fr-dlci 100`
`!`
`policy-map output-policy`
`  class dlci-100`
`  bandwidth 250`
`  queue-limit 10`
`  set fr-fecn-becn 30`
`!`
`interface Serial2/1`
`  service-policy output output-policy`
	`class-map match-all dlci-100`
	`  match fr-dlci 100`
	`!`
	`policy-map output-policy`
	`  class dlci-100`
	`  bandwidth 250`
	`!`
	`interface Serial2/1`
	`  bandwidth 50000`
	`  service-policy output output-policy`
	`  frame-relay congestion-management`
	`  threshold ecn 50`

Additional References

The following sections provide references related to the BECN and FECN Marking for Frame Relay over MPLS feature.

Related Documents

Related Topic	Document Title
Frame Relay over MPLS	*Any Transport over MPLS*

Standards

Standard	Title
None	—

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	—

Technical Assistance

Description	Link
The Cisco Technical Support & Documentation website contains thousands of 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/techsupport

Command Reference

This section documents modified commands only.

- **frame-relay congestion-management**
- **set fr-fecn-becn**
- **threshold ecn**

frame-relay congestion-management

To enable Frame Relay congestion management functions on all switched permanent virtual circuits (PVCs) on an interface, and to enter Frame Relay congestion management configuration mode, use the **frame-relay congestion-management** command in interface configuration mode. 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

Frame Relay congestion management is not enabled on switched PVCs.

Command Modes

Interface configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.
12.0(26)S	This command was integrated into Cisco IOS Release 12.0(26)S.
12.2(27)SXA	This command was integrated into Cisco IOS Release 12.2(27)SXA.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.

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 class-based weighted fair queuing (WFQ).

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
```

Related Commands

Command	Description
threshold ecn	Configures the threshold at which ECN bits are set on packets in switched PVCs on the output interface.

set fr-fecn-becn

To enable forward explicit congestion notification (FECN) and backward explicit congestion notification (BECN) with Frame Relay over MPLS, use the **set fr-fecn-becn** command in policy map class configuration mode. To disable the configuration notification, use the **no** form of this command.

set fr-fecn-becn *percent*

no set fr-fecn-becn *percent*

Syntax Description

percent	Specifies how much (percentage) of the total queue size should be used before marking the FECN and BECN bits. The valid range of percentages is 0 to 99. Setting the threshold to 0 indicates that all traffic is marked with FECN and BECN bits.

Defaults

Frame Relay does not perform FECN and BECN marking.

Command Modes

Policy map class configuration

Command History

Release	Modification
12.0(26)S	This command was introduced.
12.2(27)SXA	This command was integrated into Cisco IOS Release 12.2(27)SXA.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.

Usage Guidelines

This command works only with Frame Relay over MPLS.

If you configure FECN and BECN bit marking, you cannot configure bandwidth or priority.

Examples

The following example enables marking the FECN and BECN bits when 20 percent of the queue is used:

```
Router(config)# policy-map policy1
Router(config-pmap)# class class1
Router(config-pmap-c)# shape 80000
Router(config-pmap-c)# set fr-fecn-becn 20
```

Related Commands

Command	Description
threshold ecn	Sets the FECN and BECN marking at the interface level.

threshold ecn

To configure the threshold at which explicit congestion notification (ECN) bits will be set on packets in switched permanent virtual circuits (PVCs) on the output interface, use the **threshold ecn** command in Frame Relay congestion management configuration mode. To remove the threshold configuration, use the **no** form of this command.

For Frame Relay Switching

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

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

For Frame Relay over MPLS

threshold ecn *percentage*

no threshold ecn *percentage*

Syntax Description

bc	Specifies threshold for committed traffic. This keyword is not available for Frame Relay over MPLS.
be	Specifies threshold for excess traffic. This keyword is not available for Frame Relay over MPLS.
percentage	Threshold at which ECN bits will be set on packets, specified as a percentage of maximum queue size. Default is 100 percent.

Defaults

An ECN threshold is not configured.

Command Modes

Frame Relay congestion management configuration

Command History

Release	Modification
12.1(2)T	This command was introduced.
12.0(26)S	This command was modified for Frame Relay over MPLS.
12.2(27)SXA	This command was integrated into Cisco IOS Release 12.2(27)SXA.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.

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.

Frame Relay Switching Guidelines

- 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 BECN threshold so that it is greater than or equal to zero and less than or equal to the BECN threshold. Configure the BECN threshold so that it is less than or equal to 100.

Examples

Frame Relay Switching Example

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

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

Frame Relay over MPLS Example

The following example shows a configuration of interface serial2/1 for a threshold of 50 percent.

```
interface Serial2/1
    bandwidth 50000
    service-policy output output-policy
    frame-relay congestion-management
        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 switching	Enables PVC switching on a Frame Relay DCE or NNI.