QoS CLI Migration from PRE2 to PRE3

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The Quality of Service (QoS) Command Line Interface (CLI) Migration from PRE2 to PRE3 feature provides QoS CLI backward-compatibility between the PRE2 and PRE3, thereby enabling the PRE3 to accept PRE2-style commands.

History for the QoS CLI Migration from PRE2 to PRE3 Feature

Release	Modification
12.2(31)SB2	This feature was introduced and implemented on the Cisco 10000 series router for the PRE3.

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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Restrictions for QoS CLI Migration from PRE2 to PRE3

- The PRE3 accepts the PRE2 **bandwidth** command only if it is used without the unit argument: bps, kbps, mbps, or gbps. If the specified value is outside the PRE3 valid values range, the PRE3 rejects the PRE2 **bandwidth** command.
- On the PRE3, you cannot configure both the **bandwidth** and **bandwidth-remaining ratio** commands in the same class map or policy map at the same time.
- The PRE3 does not support the **priority** *rate* command.
- On the PRE3, if a policy map has classes with the **bandwidth** command configured, you can configure the **priority** command in another class only after you configure the **police** command in the class. For example:

```
policy-map C1
    class Gold
       bandwidth 8000
    class Premium
       police percent 30
       priority
```

- On the PRE3, you can apply service policies only to PVCs.

Information About QoS CLI Migration from PRE2 to PRE3

The Quality of Service (QoS) Command Line Interface (CLI) Migration from PRE2 to PRE3 feature provides QoS CLI backward-compatibility between the PRE2 and PRE3, thereby enabling the PRE3 to accept PRE2-style commands.

The PRE2 uses a proprietary version of the modular QoS CLI, while the PRE3 uses a non-proprietary CLI. The QoS CLI migration feature enables the PRE3 to parse PRE2-style commands and translate them to PRE3 commands.

For example, on the PRE2 the **shape** command has the following syntax. The optional second parameter defines the units of the specified committed rate. If unspecified, the unit is kbps by default.

shape *rate* [**bps** | **kbps** | **mbps** | **gbps**]

When parsed, the PRE3 translates the above PRE2-style command to the following PRE3-style command:

shape average *rate*

The PRE3 **shape** command defines the rate in bits per second. Only the PRE3 form of the command is nvgened.

PRE2 and PRE3 Command Line Interface Differences

Table 1 lists the differences between the PRE2 and PRE3 command line interfaces (CLIs).

Table 1 PRE2 and PRE3 Command Line Interface Differences

Command	PRE2 Command	PRE3 Command
facility-alarm	**facility-alarm core-temperature major 53**	**facility-alarm outlet-temperature major 58**
	facility-alarm core-temperature minor 45	**facility-alarm outlet-temperature minor 50**
	facility-alarm core-temperature critical 85	**facility-alarm outlet-temperature critical 85**
	Compatibility: On the PRE3, the alarm is set for the outlet temperature instead of the core temperature alarm set on the PRE2. The default values for major, minor, and critical alarms are 53, 45, and 85 on the PRE2, and 58, 50, and 85 on the PRE3, respectively.	
bandwidth	**bandwidth** *value* [**bps** | **kbps** | **mbps** | **gbps**]	**bandwidth** *value*
	Compatibility: On the PRE2, valid bandwidth values are from 1 to 2488320000 and by default are expressed in kbps. On the PRE3, valid bandwidth values are from 1 to 2000000 and are always expressed in kbps. The PRE3 accepts the PRE2 **bandwidth** command only if it is used without the unit argument: bps, kbps, mbps, or gbps. If the specified value is outside the PRE3 valid values range, the PRE3 rejects the PRE2 **bandwidth** command.	
bandwidth-remaining	**bandwidth-remaining** *ratio*	**bandwidth-remaining** *ratio*
	Compatibility: The PRE2 allows the **bandwidth** and **bandwidth-remaining** commands to be part of the same class map or policy map. However, the PRE3 does not allow these commands to coexist in a class map or policy map.	
priority	**priority** *rate*	**priority**
	Compatibility: The PRE2 accepts the **priority** *rate* command as a hidden command. However, the PRE3 does not accept the **priority** *rate* command.	

Table 1 PRE2 and PRE3 Command Line Interface Differences

Command	PRE2 Command	PRE3 Command
priority **police** **bandwidth**	**priority** **police** *rate* **bandwidth** *rate*	**priority** **police** *rate* **bandwidth** *rate*

	Compatibility: If a policy map has classes with the **bandwidth** command configured, the PRE2 allows you to configure the **priority** command in another class before configuring the **police** command in the class. For example:
	`class Child2`
	`  priority`
	`  police 8000`
	
	`class Child1`
	`  bandwidth 8000`
	
	If a policy map has classes with the **bandwidth** command configured, the PRE3 allows you to configure the **priority** command in another class only after you configure the **police** command in the class. For example:
	`class Child2`
	`  police 8000`
	`  priority`
	
	`class Child1`
	`  bandwidth 8000O`
	
	The PRE3 accepts the PRE2 configuration order (**priority** configured before **police** command) when the router is switching over to the redundant PRE.	

Table 1 PRE2 and PRE3 Command Line Interface Differences

Command	PRE2 Command	PRE3 Command
random-detect	**random-detect** *default-min-threshold default-max-threshold mark-probability-denominator*	**random-detect** [**dscp-based** | **precedence-based**] **aggregate** **minimum-thresh** *min-thresh* **maximum-thresh** *max-thresh* **mark-probability** *mark-prob*
	random-detect dscp *dscp-value min-thresh-value max-thresh-value mark-probability-denominator-value*	**random-detect dscp values** s*ub-class-val1* [...[*sub-class-val8*]] **minimum-thresh** *min-thresh* **maximum-thresh** *max-thresh* **mark-probability** *mark-prob*
	random-detect precedence *precedence-value min-thresh-value max-thresh-value mark-probability-denominator-value*	**random-detect precedence values** s*ub-class-val1* [...[*sub-class-val8*]] **minimum-thresh** *min-thresh* **maximum-thresh** *max-thresh* **mark-probability** *mark-prob*
	random-detect discard-class *discard-class-value min-thresh-value max-thresh-value mark-probability-denominator-value*	**random-detect discard-class** *discard-class-value min-thresh-value max-thresh-value mark-probability-denominator-value*
	random-detect dscp-based	**random-detect dscp-based aggregate** [**minimum-thresh** *min-thresh* **maximum-thresh** *max-thresh* **mark-probability** *mark-prob*]
	random-detect precedence-based	**random-detect precedence-based aggregate** [**minimum-thresh** *min-thresh* **maximum-thresh** *max-thresh* **mark-probability** *mark-prob*]
	random-detect discard-class-based	**random-detect discard-class-based**
	Compatibility: On the PRE2, the **random-detect** command specifies the default profile for the queue. On the PRE3, the supported **random-detect** commands specify the aggregate profile for the queue. To configure a default drop profile for a queue, the **random-detect** *basis* command is used (for example, **random-detect dscp-based aggregate** command). The **random-detect discard-class-based** command does not have an aggregate form of the command on the PRE3.	
service-policy	**service-policy** *policy-map-name*	**service-policy** *policy-map-name*
	Compatibility: On the PRE2, the **service-policy** command is configurable on an ATM subinterface or on a PVC. On the PRE3, the **service-policy** command is configurable only on a PVC.	
shape	**shape** *rate* [**bps** | **kbps** | **mbps** | **gbps**]] Default: kbps Valid values are from 1 to 2,488,320,000.	**shape average** *rate* *rate* is always bps Valid values are from 1000 to 2,488,320,000.
	Compatibility: The PRE3 accepts the PRE2 **shape** command; however, if the specified rate is outside the PRE3 range of valid values, the PRE3 rejects the PRE2 **shape** command.	

Table 1 PRE2 and PRE3 Command Line Interface Differences

Command	PRE2 Command	PRE3 Command
squeeze *bootflash:*	**squeeze** *bootflash:*	Not supported
	Compatibility: Disk0 and disk1 need to be squeezed on the PRE2. However, disk0 does not need to be squeezed on the PRE3.	
upgrade rom-monitor	Not supported	**upgrade** {**rom-monitor** | **fpga**}
	Compatibility: The ROM Monitor (ROMMON) cannot be upgraded on the PRE2.	

Weighted Random Early Detection on the PRE2 and PRE3

The following describes the behavior of weighted random early detection (WRED) on the PRE2 and PRE3:

WRED Commands

The PRE3 accepts the PRE2 commands.

Default Profile Accounting and Configuration

PRE2—Accounting is per precedence.

PRE3—Accounting and configuration is for the class map. On the PRE3, accounting is based on the aggregate configuration for single or multiple DSCP and precedence values.

Default Profile Default Threshold

PRE2—Default threshold is per precedence.

PRE3—Default threshold is to have no WRED configured.

WRED and CBQOSMIB Behavior

PRE2—For each precedence level configured in the default profile, the individual drop counter for the specific precedence level counts a dropped packet only if the packet matches the specific precedence level. The PRE2 default profile has default threshold values, which the PRE2 displays.

PRE3—For each precedence level configured in the default profile, the aggregate counter of the default profile (not the individual precedence level counter) counts dropped packets. The PRE3 displays default threshold values when specifically configured in the default profile.

PRE2 and PRE3 Disk Support

Table 2 describes the disks supported on the PRE2 and PRE3. On the PRE2, you can use slot0 and slot1, or disk0 and disk1 to describe the flash card; however, the PRE3 accepts only disk0.

Table 2 PRE Disk Support

PRE	Disks Supported	Disk Hardware
PRE2	disk0, disk1	Compact flash card
PRE3	disk0	Compact flash card

PRE3 Class Maps and QoS Scalability

The Cisco 10000 series router with a PRE3 counts QoS matches for each class or for each match. As the following describes, you can achieve greater scalability when per-class mode counting is enabled on the router:

- Per-match mode—(default mode) The router counts matches for each match statement and class, and supports 262,144 unique class maps per system.
- Per-class mode—The router counts matches for the entire class and supports 4,194,304 unique class maps. This mode provides greater scalability.

To configure per-match or per-class QoS match statistics, use the **qos match statistics** command. For more information see the "qos match statistics Command" section on page 3-4.

Note The **qos match statistics** command is not available on the PRE2. Due to memory limitations, the PRE2 cannot exceed 262,000 class maps.

When using the **show** commands in per-class mode, the per-match statistics display with a value of zero. In per-class mode, the per-match statistics are zero in the MIB.

How to Configure PRE3 Commands

To configure one of the commands listed in Table 1 on page 3, enter the command as specified in the table or see the "Command Reference" section on page 9.

Additional References

The following sections provide references related to the PRE2 and PRE3 commands with differing syntaxes.

Related Documents

Related Topic	Document Title
Bandwidth and priority queues	*Comparing the Bandwidth and Priority Commands of a QoS Service Policy*
Bandwidth starvation	*Cisco 10000 Series Router Quality of Service Configuration Guide* Prioritizing Services > Low-Latency Priority Queuing > Bandwidth Starvation
Congestion management	*QoS Congestion Management (Queuing), Introduction*
Priority queues	*Cisco IOS Quality of Service Solutions Configuration Guide* Part 2: Congestion Management > Configuring Priority Queues

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

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 releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

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 new and modified commands only.

bandwidth (policy-map class)

To specify or modify the bandwidth allocated for a class belonging to a policy map, or to enable ATM overhead accounting, use the **bandwidth** command in policy-map class configuration mode. To remove the bandwidth specified for a class, use the **no** form of this command.

bandwidth {*bandwidth-kbps* | **remaining percent** *percentage* | **percent** *percentage*} [**account** {**qinq** | **dot1q** | **user-defined** *offset*} **aal5** *subscriber-encap*]

no bandwidth {*bandwidth-kbps* | **remaining percent** *percentage* | **percent** *percentage*} [**account** {**qinq** | **dot1q** | **user-defined** *offset*} **aal5** *subscriber-encap*]

Syntax Description

bandwidth-kbps	Amount of bandwidth, in number of kbps, to be assigned to the class. The amount of bandwidth varies according to the interface and platform in use.
remaining percent	Amount of guaranteed bandwidth, based on a relative percent of available bandwidth.
percentage	Used in conjunction with the **remaining percent** keyword. Specifies a percentage. The percentage can be a number from 1 to 100.
percent	Amount of guaranteed bandwidth, based on an absolute percent of available bandwidth.
percentage	Used in conjunction with the **percent** keyword. Specifies the percentage of the total available bandwidth to be set aside for the priority class. The percentage can be a number from 1 to 100.
account	Enables ATM overhead accounting.
qinq	Specifies queue-in-queue encapsulation as the broadband aggregation system (BRAS) to digital subscriber line access multiplexer (DSLAM) encapsulation type for ATM overhead accounting.
dot1q	Specifies IEEE 802.1Q VLAN encapsulation as the BRAS-DSLAM encapsulation type for ATM overhead accounting.
user-defined	Indicates that the router is to use the specified offset size when calculating ATM overhead.
offset	Used in conjunction with the **user-defined** keyword. Specifies the offset size the router is to use when calculating ATM overhead. Valid values are from –48 to 48 bytes.
aal5	Specifies the ATM Adaptation Layer 5 for ATM overhead accounting. AAL5 supports connection-oriented variable bit rate (VBR) services.
subscriber-encap	Specifies the encapsulation type at the subscriber line. • snap-rbe • mux-rbe • snap-dot1q-rbe • mux-dot1q-rbe • snap-pppoa • mux-pppoa • snap-1483routed • mux-1483routed

Defaults

No bandwidth is specified.

ATM overhead accounting is disabled.

Command Modes

Policy–map class configuration

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was incorporated into Cisco IOS Release 12.0(5)XE and implemented on Versatile Interface Processor (VIP)-enabled Cisco 7500 series routers.
12.0(7)T	The **percent** keyword was added.
12.0(17)SL	This command was introduced on the Cisco 10000 series router.
12.0(22)S	This command was enhanced to include the **percent** keyword on the Cisco 10000 series router.
12.0(23)SX	This command was enhanced to include the **remaining percent** keyword on the Cisco 10000 series router.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T and implemented on VIP-enabled Cisco 7500 series routers.
12.2(2)T	The **remaining percent** keyword was added.
12.2(31)SB2	This command was introduced on the PRE3 for the Cisco 10000 series router, and was enhanced for ATM overhead accounting on the Cisco 10000 series router for the PRE3.

Usage Guidelines

You should use the **bandwidth** command when you configure a policy map for a class defined by the **class-map** command. The **bandwidth** command specifies the bandwidth for traffic in that class. Class–based weighted fair queueing (CBWFQ) derives the weight for packets belonging to the class from the bandwidth allocated to the class. CBWFQ then uses the weight to ensure that the queue for the class is serviced fairly.

Bandwidth Command Restrictions

The following restrictions apply to the **bandwidth** command:

- The amount of bandwidth configured should be large enough to also accommodate Layer 2 overhead.
- A policy map can have all the class bandwidths specified in kbps or all the class bandwidths specified in percentages but not a mix of both in the same class. However, the unit for the **priority** command in the priority class can be different from the bandwidth unit of the nonpriority class.
- When the **bandwidth percent** command is configured, and a policy map containing class policy configurations is attached to the interface to stipulate the service policy for that interface, available bandwidth is assessed. If a policy map cannot be attached to a particular interface because of insufficient interface bandwidth, the policy is removed from all interfaces to which it was successfully attached. This restriction does not apply to the **bandwidth remaining percent** command.

Note that when the policy map containing class policy configurations is attached to the interface to stipulate the service policy for that interface, available bandwidth is assessed. If a policy map cannot be attached to a particular interface because of insufficient interface bandwidth, then the policy is removed from all interfaces to which it was successfully attached.

Cisco 10000 Series Router

The Cisco 10000 series router supports the **bandwidth** command on outbound interfaces only. It does not support this command on inbound interfaces.

On the PRE2, you specify a bandwidth value and a unit for the bandwidth value. Valid values for the bandwidth are from 1 to 2488320000 and units are bps, kbps, mbps, gbps. The default unit is kbps. For example, the following commands configure a bandwidth of 10000 bps and 10000 kbps on the PRE2:

```
bandwidth 10000 bps

bandwidth 10000
```

On the PRE3, you only specify a bandwidth value. Because the unit is always kbps, the PRE3 does not support the *unit* argument. Valid values are from 1 to 2000000. For example, the following command configures a bandwidth of 128,000 kbps on the PRE3:

```
bandwidth 128000
```

The PRE3 accepts the PRE2 **bandwidth** command only if the command is used without the *unit* argument. The PRE3 rejects the PRE2 **bandwidth** command if the specified bandwidth is outside the valid PRE3 bandwidth value range (1 to 2000000).

Besides specifying the amount of bandwidth in kilobits per second (kbps), you can specify bandwidth as a percentage of either the available bandwidth or the total bandwidth. During periods of congestion, the classes are serviced in proportion to their configured bandwidth percentages. The bandwidth percentage is based on the interface bandwidth or when used in a hierarchical policy the minimum bandwidth percentage is based on the nearest parent shape rate.

Note It is important to remember that when the **bandwidth remaining percent** command is configured, hard bandwidth guarantees may not be provided and only relative bandwidths are assured. Class bandwidths are always proportional to the specified percentages of the interface bandwidth. When the link bandwidth is fixed, class bandwidth guarantees are in proportion to the configured percentages. If the link bandwidth is unknown or variable, the router cannot compute class bandwidth guarantees in kbps.

The router converts the specified bandwidth to the nearest multiple of 1/255 (PRE1) or 1/65535 (PRE2, PRE3) of the interface speed. Use the **show policy-map interface** command to display the actual bandwidth.

Modular QoS Command-Line Interface Queue Limits

The **bandwidth** command can be used with the Modular Command–Line Interface (MQC) to specify the bandwidth for a particular class. When used with the MQC, the **bandwidth** command uses a default queue limit for the class. This queue limit can be modified using the **queue-limit** command, thereby overriding the default set by the **bandwidth** command.

Note Using the **queue-limit** command to modify the default queue limit is especially important for higher-speed interfaces in order to meet the minimum bandwidth guarantees required by the interface.

ATM Overhead Accounting

When configuring ATM overhead accounting, you must specify the BRAS-DSLAM, DSLAM-CPE, and subscriber line encapsulation types. The router supports the following subscriber line encapsulation types:

- snap-rbe
- mux-rbe
- snap-dot1q-rbe
- mux-dot1q-rbe
- snap-pppoa
- mux-pppoa
- snap-1483routed
- mux-1483routed

The router calculates the offset size unless you specify the **user-defined** *offset* option.

For hierarchical policies, configure ATM overhead accounting in the following ways:

- Enabled on parent—If you enable ATM overhead accounting on a parent policy, you are not required to enable accounting on the child policy.
- Enabled on child and parent—If you enable ATM overhead accounting on a child policy, then you must enable ATM overhead accounting on the parent policy.

The encapsulation types must match for the child and parent policies.

Examples

Cisco 10000 Series Router

In the following example, the policy map named VLAN guarantees 30 percent of the bandwidth to the class named Customer1 and 60 percent of the bandwidth to the class named Customer2. If you apply the VLAN policy map to a 1–Mbps link, 300 kbps is guaranteed to class Customer1 and 600 kbps is guaranteed to class Customer2, with 100 kbps remaining for the class–default class. If the class-default class does not need additional bandwidth, the unused 100 kbps is available for use by class Customer1 and class Customer2. If both classes need the bandwidth, they share it in proportion to the configured rates. In this example, the sharing ratio is 30:60 or 1:2.

```
Router(config)# policy-map VLAN
Router(config-pmap)# class Customer1
Router(config-pmap-c)# bandwidth percent 30
Router(config-pmap-c)# exit
Router(config-pmap)# class Customer2
Router(config-pmap-c)# bandwidth percent 60
```

CBWFQ Bandwidth Guarantee Example

The following example creates a policy map with two classes, shows how bandwidth is guaranteed when only CBWFQ is configured, and attaches the policy to serial interface 3/2/1:

```
Router(config)# policy-map policy1
Router(config-pmap)# class class1
Router(config-pmap-c)# bandwidth percent 50
Router(config-pmap-c)# exit
Router(config-pmap)# class class2
Router(config-pmap-c)# bandwidth percent 25
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router (config)# interface serial3/2/1
```

```
Router(config-if)# service output policy1
Router(config-if)# end
```

The output from the **show policy-map interface** command shows that 50 percent of the interface bandwidth is guaranteed for the class called class1, and 25 percent is guaranteed for the class called class2. The output displays the amount of bandwidth as both a percentage and a number of kbps.

```
Router# show policy-map interface serial3/2/1

 Serial3/2

  Service-policy output:policy1

    Class-map:class1 (match-all)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match:none
      Weighted Fair Queueing
        Output Queue:Conversation 265
        Bandwidth 50 (%)
        Bandwidth 772 (kbps) Max Threshold 64 (packets)
        (pkts matched/bytes matched) 0/0
        (depth/total drops/no-buffer drops) 0/0/0

    Class-map:class2 (match-all)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match:none
      Weighted Fair Queueing
        Output Queue:Conversation 266
        Bandwidth 25 (%)
        Bandwidth 386 (kbps) Max Threshold 64 (packets)
        (pkts matched/bytes matched) 0/0
        (depth/total drops/no-buffer drops) 0/0/0

    Class-map:class-default (match-any)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match:any
```

CBWFQ and Low-Latency Queuing Bandwidth Allocation Example

In the following example, the interface has a total bandwidth of 1544 kbps. During periods of congestion, 50 percent (or 772 kbps) of the bandwidth is guaranteed to the class called class1, and 25 percent (or 386 kbps) of the link bandwidth is guaranteed to the class called class2.

The following sample output from the **show policy-map** command shows the configuration of a policy map called p1:

```
Router# show policy-map p1

  Policy Map p1
    Class voice
      Weighted Fair Queueing
            Strict Priority
            Bandwidth 500 (kbps) Burst 12500 (Bytes)
    Class class1
      Weighted Fair Queueing
            Bandwidth remaining 50 (%) Max Threshold 64 (packets)
    Class class2
      Weighted Fair Queueing
            Bandwidth remaining 25 (%) Max Threshold 64 (packets)
```

The following output from the **show policy-map interface** command on serial interface 3/2 shows that 500 kbps of bandwidth is guaranteed for the class called voice1. The classes called class1 and class2 receive 50 percent and 25 percent of the remaining bandwidth, respectively. Any bandwidth not allocated is divided proportionally among class1, class2, and any best-effort traffic classes.

Note Note that in this sample output (unlike many of the others earlier in this section) the bandwidth is displayed only as a percentage. Bandwidth expressed as a number of kbps is not displayed because the **percent** keyword was used with the **bandwidth remaining** command. The **bandwidth remaining percent** command allows you to allocate bandwidth as a relative percentage of the total bandwidth available on the interface.

```
Router# show policy-map interface serial3/2

 Serial3/2

  Service-policy output:p1

    Class-map:voice (match-all)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match:ip precedence 5
      Weighted Fair Queueing
        Strict Priority
        Output Queue:Conversation 264
        Bandwidth 500 (kbps) Burst 12500 (Bytes)
        (pkts matched/bytes matched) 0/0
        (total drops/bytes drops) 0/0

    Class-map:class1 (match-all)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match:none
      Weighted Fair Queueing
        Output Queue:Conversation 265
        Bandwidth remaining 50 (%) Max Threshold 64 (packets)
        (pkts matched/bytes matched) 0/0
        (depth/total drops/no-buffer drops) 0/0/0

    Class-map:class2 (match-all)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match:none
      Weighted Fair Queueing
        Output Queue:Conversation 266
        Bandwidth remaining 25 (%) Max Threshold 64 (packets)
        (pkts matched/bytes matched) 0/0
        (depth/total drops/no-buffer drops) 0/0/0

    Class-map:class-default (match-any)
      0 packets, 0 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match:any
```

ATM Overhead Accounting Example

When a parent policy has ATM overhead accounting enabled, you are not required to enable ATM overhead accounting on a child traffic class that does not contain the **bandwidth** or **shape** command. In the following configuration example, ATM overhead accounting is enabled for bandwidth on the gaming and class-default class of the child policy map named subscriber_classes, and on the class-default class of the parent policy map named subscriber_line. The voip and video classes do not have ATM overhead accounting explicitly enabled; these priority queues have overhead accounting implicitly enabled because ATM overhead accounting is enabled on the parent policy. Notice that the features in the parent and child policies use the same encapsulation type.

```
policy-map subscriber_classes
    class voip
        priority level 1
        police 8000
    class video
        priority level 2
        police 20
    class gaming
        bandwidth remaining percent 80 account aal5 snap-rbe-dot1q
    class class-default
        bandwidth remaining percent 20 account aal5 snap-rbe-dot1q
policy-map subscriber_line
    class class-default
        bandwidth remaining ratio 10 account aal5 snap-rbe-dot1q
        shape average 512 account aal5 snap-rbe-dot1q
        service policy subscriber_classes
```

Related Commands

Command	Description
class (policy map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
class–map	Creates a class map to be used for matching packets to a specified class.
max-reserved-bandwidth	Changes the percent of interface bandwidth allocated for CBWFQ, LLQ, and IP RTP Priority.
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
queue-limit	Specifies or modifies the maximum number of packets the queue can hold for a class policy configured in a policy map.
random-detect (interface)	Enables WRED or DWRED.
random-detect exponential-weighting-constant	Configures the WRED and DWRED exponential weight factor for the average queue size calculation.
random-detect precedence	Configures WRED and DWRED parameters for a particular IP precedence.
shape	Shapes traffic to the indicated bit rate according to the algorithm specified, and enables ATM overhead accounting.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps. The displayed information includes ATM overhead accounting, if configured.

Command	Description
show policy-map interface	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 PVC on the interface. The command output includes information about excess ratios, used to determine a queue's fair share of excess bandwidth during congestion.
show running-config	Displays the current configuration of the router. The displayed information includes ATM overhead accounting, if configured.

bandwidth remaining ratio

To specify a bandwidth-remaining ratio for class-level or subinterface-level queues to be used during congestion to determine the amount of excess bandwidth (unused by priority traffic) to allocate to non-priority queues, use the **bandwidth remaining ratio** command in policy-map class configuration mode. To remove the bandwidth-remaining ratio, use the **no** form of this command.

bandwidth remaining ratio *ratio*

no bandwidth remaining ratio *ratio*

Syntax Description

ratio	Specifies the relative weight of this subinterface or queue with respect to other subinterfaces or queues. Valid values are from 1 to 1000. The default value is platform dependent.

Command Default

Cisco 10000 Series Router

When using default bandwidth-remaining ratios at the subinterface level, the Cisco 10000 series router distinguishes between interface types. At the subinterface level, the default bandwidth-remaining ratio is 1 for VLAN subinterfaces and Frame Relay DLCIs. For ATM subinterfaces, the router computes the default bandwidth-remaining ratio based on the subinterface speed.

When using default bandwidth-remaining ratios at the class level, the Cisco 10000 series router makes no distinction between interface types. At the class level, the default bandwidth-remaining ratio is 1.

Command Modes

Policy-map class

Command History

Release	Modification
12.2(31)SB2	This command was introduced and implemented on the Cisco 10000 series router for the PRE3.

Usage Guidelines

Cisco 10000 Series Router

The scheduler uses the ratio specified in the **bandwidth remaining ratio** command to determine the amount of excess bandwidth (unused by priority traffic) to allocate to a class-level queue or a subinterface-level queue during periods of congestion. The scheduler allocates the unused bandwidth relative to other queues or subinterfaces.

The **bandwidth remaining ratio** command cannot coexist with another **bandwidth** command in different traffic classes of the same policy map. For example, the following configuration is not valid and causes an error message to display:

```
policy-map Prec1
    class precedence_0
        bandwidth remaining ratio 10
    class precedence_2
        bandwidth 1000
```

For the PRE2, the **bandwidth remaining ratio** command can coexist with another **bandwidth** command in the same class of a policy map. On the PRE3, the **bandwidth remaining ratio** command cannot coexist with another **bandwidth** command in the same class. For example, the following configuration is not valid on the PRE3 and causes an error message to display:

```
policy-map Prec1
    class precedence_0
        bandwidth 1000
        bandwidth remaining ratio 10
```

In a hierarchical policy map in which the parent policy has only the class-default class defined with a child queuing policy applied, the router accepts only the **bandwidth remaining ratio** form of the **bandwidth** command in the class-default class.

The **bandwidth remaining ratio** command cannot coexist with the **priority** command in the same class. For example, the following configuration is not valid and causes an error message to display:

```
policy-map Prec1
    class precedence_1
        priority
        police percent 30
        bandwidth remaining ratio 10
```

All of the queues for which the **bandwidth remaining ratio** command is not specified receive the platform-specified minimum bandwidth-remaining ratio. The router determines the minimum committed information rate (CIR) based on the configuration.

Examples

The following example shows how to configure a bandwidth-remaining ratio on an ATM subinterface. In the example, the router guarantees a peak cell rate of 50 Mbps for the variable bit rate-non-real time (VBR-nrt) PVC 0/200. During periods of congestion, the subinterface receives a share of excess bandwidth (unused by priority traffic) based on the bandwidth-remaining ratio of 10, relative to the other subinterfaces configured on the physical interface.

```
policy-map Child
    class precedence_0
        bandwidth 10000
    class precedence_1
        shape average 100000
        bandwidth 100
!
policy-map Parent
    class class-default
        bandwidth remaining ratio 10
        shape average 20000000
        service-policy Child
!
interface ATM2/0/3.200 point-to-point
    ip address 10.20.1.1 255.255.255.0
    pvc 0/200
        protocol ip 10.20.1.2
        vbr-nrt 50000
        encapsulation aal5snap
        service-policy output Parent
```

The following example shows how to configure bandwidth remaining ratios for individual class queues. Some of the classes configured have bandwidth guarantees and a bandwidth-remaining ratio explicitly specified. When congestion occurs within a subinterface level, the class queues receive excess bandwidth (unused by priority traffic) based on their class-level bandwidth-remaining ratios: 20, 30, 120, and 100, respectively for the precedence_0, precedence_1, precedence_2, and precedence_5 classes. Normally, the precedence_3 class (without a defined ratio) would receive bandwidth based on the bandwidth-remaining ratio of the class-default class defined in the Child policy. However, in the example, the Child policy does not define a class-default bandwidth remaining ratio, therefore, the router uses a ratio of 1 to allocate excess bandwidth to precedence_3 traffic.

```
policy-map Child
    class precedence_0
        shape average 100000
        bandwidth remaining ratio 20
    class precedence_1
        shape 10000
        bandwidth remaining ratio 30
    class precedence_2
        shape average 200000
        bandwidth remaining ratio 120
    class precedence_3
        set ip precedence 3
    class precedence_5
        set ip precedence 5
        bandwidth remaining ratio 100
policy-map Parent
    class class-default
        bandwidth remaining ratio 10
        service-policy Child
!
interface GigabitEthernet 2/0/1.10
    encapsulation dot1q 10
    service-policy output Parent
```

Related Commands

Command	Description
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps. If configured, the command output includes information about ATM overhead accounting and bandwidth-remaining ratios, used to determine a queue's fair share of excess bandwidth during congestion.
show policy-map interface	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 PVC on the interface. If configured, the command output includes information about bandwidth-remaining ratios, used to determine a queue's fair share of excess bandwidth during congestion.

clear facility-alarm

To clear alarm conditions and reset the alarm contacts, use the **clear facility-alarm** command in privileged EXEC configuration mode.

clear facility-alarm [critical | major | minor]

Syntax Description

critical	Clears critical facility alarms.
major	Clears major facility alarms.
minor	Clears minor facility alarms.

Defaults

Clears all facility alarms.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(17)SL	This command was introduced on the Cisco 10000 series router.
12.2(16)BX	This command was introduced on the PRE2.
12.2(31)SB2	This command was introduced on the PRE3 for the Cisco 10000 series router.

Usage Guidelines

The **clear facility-alarm** command acts like an audible cut-off (ACO). Only a reoccurrence of the original alarm source after the original alarm condition is removed can restart the alarm.

Examples

The following example shows how to clear minor facility alarms only:

```
Router# clear facility-alarm minor
Clearing minor alarms
Router#
```

The following example shows how to clear all facility alarms:

```
Router# clear facility-alarm
Clearing all alarms
Router#
```

Related Commands

Command	Description
facility-alarm	Configures threshold temperatures for minor, major, and critical alarms.
show facility-alarm status	Displays the current major, minor, and critical alarm status, if any, and displays the configuration of the alarm thresholds.

facility-alarm

To configure threshold temperatures for minor, major, and critical alarms, use the **facility-alarm** command in global configuration mode. You can configure explicit threshold temperatures to override the defaults for major, minor, and critical alarms. To disable alarms for the threshold and reset the threshold to the default value, use the **no** form of this command.

facility-alarm {**core-temperature** | **outlet-temperature**} {**major** [*temperature*] | **minor** [*temperature*] | **critical** [*temperature*]}

no facility-alarm {**core-temperature** | **outlet-temperature**} {**major** [*temperature*] | **minor** [*temperature*] | **critical** [*temperature*]}

Syntax Description

core-temperature	Specifies that the alarm applies to the temperature of the internal core of the router. The temperature sensor close to the router's processor measures the core temperature.
outlet-temperature	Specifies that the alarm applies to the air flow temperature. **Note** This keyword is valid only on the Cisco 10000 series router for the PRE3.
major [*temperature*]	Major alarm threshold temperature threshold in degrees Celsius (C). The default value is 53 degrees C. Major alarms affect several subscribers who connect to the reporting node.
minor [*temperature*]	Minor alarm threshold temperature threshold in degrees Celsius (C). The default value is 45 degrees C. Minor alarms affect a single or small number of subscribers who connect to the reporting node.
critical [*temperature*]	Critical alarm threshold temperature threshold in degrees Celsius (C). The default value is 85 Celsius (C). Critical alarms affect most or all subscribers that connect to the reporting node.

Defaults

This command has no default behavior.

Command Modes

Global configuration

Command History

Release	Modification
12.0(17)SL	This command was introduced on the Cisco 10000 series router.
12.2(16)BX	This command was introduced on the PRE2.
12.2(31)SB2	This command was introduced on the PRE3 for the Cisco 10000 series router.

Usage Guidelines

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On the PRE2, use the **facility-alarm core-temperature** command. On the PRE3, use the **facility-alarm outlet-temperature** command.

The default value for a threshold temperature depends on the performance routing engine (PRE) installed in the router as the following describes:

- Major alarm

  PRE2—The default value is 53.

  PRE3—The default value is 58.

- Minor alarm

  PRE2—The default value is 45.

  PRE3—The default value is 50.

- Critical alarm

  PRE2—The default value is 85.

  PRE3—The default value is 85.

Examples

The following example sets a threshold temperature of 53 for major alarms on the PRE2:

```
Router> enable
Router# config terminal
Router(config)# facility-alarm core-temperature major 53
```

The following example sets a threshold temperature of 50 for minor alarms on the PRE3:

```
Router> enable
Router# config terminal
Router(config)# facility-alarm core-temperature major 50
```

Related Commands

Command	Description
clear facility-alarm	Clears alarm conditions and resets the alarm contacts.
show facility-alarm status	Displays the current major, minor, and critical alarm status, if any, and displays the configuration of the alarm thresholds.

priority

To give priority to a class of traffic belonging to a policy map, use the **priority** command in policy-map class configuration mode. To remove a previously specified priority for a class, use the **no** form of this command.

priority {*bandwidth-kbps* | **percent** *percentage*} [*burst*]

no priority {*bandwidth-kbps* | **percent** *percentage*} [*burst*]

Syntax Description

bandwidth-kbps	Guaranteed allowed bandwidth, in kbps, for the priority traffic. The amount of guaranteed bandwidth varies according to the interface and platform in use. Beyond the guaranteed bandwidth, the priority traffic will be dropped in the event of congestion to ensure that the nonpriority traffic is not starved.
percent	Specifies that the amount of guaranteed bandwidth will be specified by the percent of available bandwidth.
percentage	Used in conjunction with the **percent** keyword, specifies the percentage of the total available bandwidth to be set aside for the priority class. The percentage can be a number from 1 to 100.
burst	(Optional) Specifies the burst size in bytes. The burst size configures the network to accommodate temporary bursts of traffic. The default burst value, which is computed as 200 milliseconds of traffic at the configured bandwidth rate, is used when the burst argument is not specified. The range of the burst is from 32 to 2000000 bytes.

Defaults

No default behavior or values

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.0(7)T	This command was introduced.
12.0(5)XE5	This command was introduced for the Versatile Interface Processor (VIP) as part of the Distributed Low Latency Queueing (Low Latency Queueing for the VIP) feature.
12.0(9)S	This command was introduced for the VIP as part of the Distributed Low Latency Queueing (Low Latency Queueing for the VIP) feature.
12.1(2)E	The *burst* argument was added.
12.1(3)T	The *burst* argument was integrated in Release 12.1(3)T.
12.1(5)T	This command was introduced for the VIP as part of the Distributed Low Latency Queueing (Low Latency Queueing for the VIP) feature.
12.2(2)T	The **percent** keyword and the *percentage* argument were added.

Release	Modification
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was introduced on the PRE3 for the Cisco 10000 series router.

Usage Guidelines

This command configures low latency queueing (LLQ), providing strict priority queueing (PQ) for class-based weighted fair queueing (CBWFQ). Strict PQ allows delay-sensitive data such as voice to be dequeued and sent before packets in other queues are dequeued.

The **priority** command allows you to set up classes based on a variety of criteria (not just User Datagram Ports (UDP) ports) and assign priority to them, and is available for use on serial interfaces and ATM permanent virtual circuits (PVCs). A similar command, the **ip rtp priority** command, allows you to stipulate priority flows based only on UDP port numbers and is not available for ATM PVCs.

When the device is not congested, the priority class traffic is allowed to exceed its allocated bandwidth. When the device is congested, the priority class traffic above the allocated bandwidth is discarded.

The **bandwidth** and **priority** commands cannot be used in the same class, within the same policy map. These commands can be used together in the same policy map, however.

Within a policy map, you can give one or more classes priority status. When multiple classes within a single policy map are configured as priority classes, all traffic from these classes is queued to the same, single, priority queue.

When the policy map containing class policy configurations is attached to the interface to stipulate the service policy for that interface, available bandwidth is assessed. If a policy map cannot be attached to a particular interface because of insufficient interface bandwidth, the policy is removed from all interfaces to which it was successfully attached.

For more information on bandwidth allocation, refer to the chapter "Congestion Management Overview" in the *Cisco IOS Quality of Service Solutions Configuration Guide.*

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The PRE2 supports strict priority queuing, which you configure using the **priority** command and the **police** command. The PRE2 also accepts the **priority** *bandwidth-kbps* command.

The PRE3 supports only strict priority queuing and does not support the **priority** *bandwidth-kbps* command. Instead, use the **priority** command and then specify the rate using the **police** command.

For the PRE2, when a policy map has classes with the **bandwidth** command configured, you can still configure the **priority** command in another class *before* you configure the **police** command in that class. For example:

```
policy-map C1
    class Gold
        bandwidth 8000
    class Silver
        bandwidth 10000
    class Premium
        priority
        police percent 40
```

The PRE3 accepts the PRE2 configuration order (**priority** command before **police** command) only when the router is switching over to the secondary PRE mode. For the PRE3, if a policy map already has classes with the **bandwidth** command configured, you can only configure the **priority** command in another class *after* you configure the **police** command in that class. For example:

```
policy-map C1
    class Gold
        bandwidth 8000
    class Silver
        bandwidth 10000
    class Premium
        police percent 40
        priority
```

Examples

The following example configures PQ with a guaranteed bandwidth of 50 kbps and a one-time allowable burst size of 60 bytes for the policy map called policy1:

```
Router(config)# policy-map policy1
Router(config-pmap)# class voice
Router(config-pmap-c)# priority 50 60
```

In the following example, 10 percent of the available bandwidth is reserved for the class called voice on interfaces to which the policy map called policy1 has been attached:

```
Router(config)# policy-map policy1
Router(config-pmap)# class voice
Router(config-pmap-c)# priority percent 10
```

Related Commands

Command	Description
bandwidth	Specifies or modifies the bandwidth allocated for a class belonging to a policy map.
ip rtp priority	Reserves a strict priority queue for a set of RTP packet flows belonging to a range of UDP destination ports.
ip rtp reserve	Reserves a special queue for a set of RTP packet flows belonging to a range of UDP destination ports.
max-reserved-bandwidth	Changes the percent of interface bandwidth allocated for CBWFQ, LLQ, and IP RTP Priority.
show interfaces fair-queue	Displays information and statistics about WFQ for a VIP-based interface.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	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 PVC on the interface.
show queue	Displays the contents of packets inside a queue for a particular interface or VC.

qos match statistics

To configure the router to count QoS matches for each class or for each match statement and class, use the **qos match statistics** command in global configuration mode.

qos match statistics {**per-class** | **per-match**}

Syntax Description

per-class	Specifies to count QoS matches for the entire class. This mode provides greater scalability.
per-match	Specifies to count matches for each match statement and class. This mode provides PRE2 backward compatibility.

Command Default

Per-match is the default mode.

Command Modes

Global configuration

Command History

Release	Modification
Release 12.2(31)SB2	This command was introduced and implemented on the Cisco 10000 series router for the PRE3.

Usage Guidelines

This command does not allow a **no** form of the command. The command operates in either per-match mode or per-class mode. Specifying one mode automatically negates the current mode.

The Cisco 10000 series router with a PRE3 supports 262,144 unique class maps per system in per-match mode and 4,194,304 unique class maps per system in per-class mode. Per-class mode provides greater QoS scalability.

This command is not available on the PRE2. Due to memory limitations, the PRE2 supports a maximum of 262,000 class maps per system.

When using the **show** commands in per-class mode, the per-match statistics display with a value of zero. In per-class mode, the per-match statistics are zero in the MIB.

Examples

The following example enables per-class mode. In this mode the router counts QoS matches for the entire class:

```
Router(config)# qos match statistics per-class
```

Related Commands

Command	Description
class-map	Creates or modifies a class map that the router uses to classify traffic.
match	Specifies the criteria by which the router classifies traffic.
policy-map	Creates or modifies a QoS policy map.

random-detect aggregate

To enable aggregate Weighted Random Early Detection (WRED), use the **random-detect aggregate** command in policy-map class configuration mode. To disable aggregate WRED, use the **no** form of this command.

random-detect [**precedence-based | dscp-based**] **aggregate** [**minimum-thresh** *min-thresh* **maximum-thresh** *max-thresh* **mark-probability** *mark-prob*]

no random-detect [**precedence-based | dscp-based**] **aggregate**

Syntax Description

precedence-based	(Optional) Enables aggregate WRED based on IP precedence values. This is the default.
dscp-based	(Optional) Enables aggregate WRED based on differentiated services code point (DSCP) values.
minimum-thresh *min-thresh*	(Optional) Default minimum threshold (in number of packets) to be used for all subclasses (IP precedence or DSCP values) that have not been specifically configured. Valid values are from 1 to 12288.
maximum-thresh *max-thresh*	(Optional) Default maximum threshold (in number of packets) to be used for all subclasses (IP precedence or DSCP values) that have not been specifically configured. Valid values are from the minimum threshold argument to 12288.
mark-probability *mark-prob*	(Optional) Default denominator for the fraction of packets dropped when the average queue depth is at the maximum threshold. This value is used for all subclasses (IP precedence or DSCP values) that have not been specifically configured. Valid values are from 1 to 255.

Defaults

If no **precedence-based** or **dscp-based** keyword is specified in the command, the default is **precedence-based**.

If optional parameters for a default aggregate class are not defined, all subclass values that are not explicitly configured will use plain (non-weighted) RED drop behavior. This is different from standard random-detect configuration where the default is to always use WRED behavior.

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.2(18)SXE	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2 on the Cisco 10000 series router for the PRE3.

Usage Guidelines

For ATM interfaces, the Aggregate WRED feature requires that the ATM SPA cards are installed in a Cisco 7600 SIP-200 carrier card or a Cisco 7600 SIP-400 carrier card.

To configure WRED on an ATM interface, you must use the random-detect aggregate commands; the standard random-detect commands are no longer supported on ATM interfaces.

The **precedence-based** and **dscp-based** keywords are mutually exclusive. If you do not specify either keyword, **precedence-based** is the default.

Defining WRED profile parameter values for the default aggregate class is optional. If defined, WRED profile parameters applied to the default aggregate class will be used for all subclasses that have not been explicitly configured. If all possible IP precedence or DSCP values are defined as subclasses, a default specification is unnecessary. If the optional parameters for a default aggregate class are not defined and packets with an unconfigured IP precedence or DSCP value arrive at the interface, plain (non-weighted) RED drop behavior will be used.

Use this command with a **random-detect precedence** (aggregate) or **random-detect dscp** (aggregate) command within a policy map configuration to configure aggregate Weighted Random Early Detection (WRED) parameters for specific IP precedence or DSCP value(s).

After the policy map is defined, the policy map must be attached at the VC level.

Use the **show policy-map interface** command to display the statistics for aggregated subclasses.

Examples

The following example shows a precedence-based aggregate WRED configuration for an ATM interface. Note that first a policy map named prec-aggr-wred is defined for the default class, then precedence-based Aggregate WRED is enabled with the **random-detect aggregate** command, then subclasses and WRED parameter values are assigned in a series of **random-detect precedence** (aggregate) commands, and, finally, the policy map is attached at the ATM VC level using the **interface** and **service-policy** commands.

```
Router (config)# policy-map prec-aggr-wred
Router (config-pmap)# class class-default
Router (config-pmap-c)# random-detect aggregate
Router (config-pmap-c)# random-detect precedence 0 1 2 3 minimum-thresh 10 maximum-thresh
100 mark-prob 10
Router (config-pmap-c)# random-detect precedence 4 5 minimum-thresh 40 maximum-thresh 400
mark-prob 10
Router (config-pmap-c)# random-detect precedence values 6 minimum-thresh 60 maximum-thresh
600 mark-prob 10
Router (config-pmap-c)# random-detect precedence values 7 minimum-thresh 70 maximum-thresh
700 mark-prob 10
Router (config-pmap-c)# interface ATM4/1/0.10 point-to-point
Router (config-subif)# ip address 10.0.0.2 255.255.255.0
Router (config-subif)# pvc 10/110
Router (config-subif)# service-policy output prec-aggr-wred
```

The following example shows a DSCP-based aggregate WRED configuration for an ATM interface. Note that first a policy map named dscp-aggr-wred is defined for the default class, then dscp-based Aggregate WRED is enabled with the **random-detect dscp-based aggregate** command, then subclasses and WRED parameter values are assigned in a series of **random-detect dscp** (aggregate) commands, and, finally, the policy map is attached at the ATM VC level using the **interface** and **service-policy** commands.

```
Router (config)# policy-map dscp-aggr-wred
Router (config-pmap)# class class-default
Router (config-pmap-c)# random-detect dscp-based aggregate minimum-thresh 1 maximum-thresh
10 mark-prob 10
Router (config-pmap-c)# random-detect dscp 0 1 2 3 4 5 6 7 minimum-thresh 10
maximum-thresh 20 mark-prob 10
Router (config-pmap-c)# random-detect dscp 8 9 10 11 minimum-thresh 10 maximum-thresh 40
mark-prob 10
Router (config)# interface ATM4/1/0.11 point-to-point
Router (config-subif)# ip address 10.0.0.2 255.255.255.0
Router (config-subif)# pvc 11/101
Router (config-subif)# service-policy output dscp-aggr-wred
```

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The following example shows how to enable IP precedence-based WRED on the Cisco 10000 series router. In this example, the configuration of the class map named Class1 indicates to classify traffic based on IP precedence 3, 4, and 5. Traffic that matches IP precedence 3, 4, or 5 is assigned to the class named Class1 in the policy map named Policy1. WRED-based packet dropping is configured for Class1 and is based on IP precedence 3 with a minimum threshold of 500, maximum threshold of 1500, and a mark-probability-denominator of 200. The QoS policy is applied to PVC 1/32 on the point-to-point ATM subinterface 1/0/0.1.

```
Router(config)# class-map Class1
Router(config-cmap)# match ip precedence 3 4 5
Router(config-cmap)# exit
Router(config)# policy-map Policy1
Router(config-pmap)# class Class1
Router(config-pmap-c)# bandwidth 1000
Router(config-pmap-c)# random-detect precedence-based
Router(config-pmap-c)# random-detect precedence values 3 minimum-thresh 500 maximum-thresh
1500 mark-probability 200
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface atm 1/0/0
Router(config-if)# atm pxf queuing
Router(config-if)# interface atm 1/0/0.1 point-to-point
Router(config-subif)# pvc 1/32
Router(config-subif-atm-vc)# ubr 10000
Router(config-subif-atm-vc)# service-policy output policy1
```

Related Commands

Command	Description
class (policy-map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
interface	Configures an interface type and enters interface configuration mode.
policy-map	Creates a policy map that can be attached to one or more interfaces to specify a service policy.

Command	Description
random-detect precedence (aggregate)	Configures aggregate WRED parameters for specific IP precedence values.
random-detect dscp (aggregate)	Configures aggregate WRED parameters for specific DSCP values.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.

random-detect dscp (aggregate)

To configure aggregate Weighted Random Early Detection (WRED) parameters for specific differentiated services code point (DSCP) value(s), use the **random-detect dscp (aggregate)** command in policy-map class configuration mode. To disable configuration of aggregate WRED DSCP values, use the **no** form of this command.

random-detect dscp s*ub-class-val1 sub-class-val2 sub-class-val3 sub-class-val4 min-thresh max-thresh mark-prob*

no random-detect dscp s*ub-class-val1 sub-class-val2 sub-class-val3 sub-class-val4 min-thresh max-thresh mark-prob*

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random-detect dscp values s*ub-class-val1* [...[*sub-class-val8*]] **minimum-thresh** *min-thresh* **maximum-thresh** *max-thresh* **mark-probability** *mark-prob*

no random-detect dscp values s*ub-class-val1* [...[*sub-class-val8*]]

Syntax Description

s*ub-class-val1* s*ub-class-val2* s*ub-class-val3* s*ub-class-val4*	DSCP value(s) to which the following WRED profile parameter specifications are to apply. A maximum of eight subclasses (DSCP values) can be specified per command-line interface (CLI) entry. See the "Usage Guidelines" for a list of valid DSCP values.
min-thresh	Minimum threshold (in number of packets) for the subclass(es). Valid values are from 1 to 12288.
max-thresh	Specifies the maximum threshold (in number of packets) for the subclass(es). Valid values are from the minimum threshold argument to 12288.
mark-prob	Specifies the denominator for the fraction of packets dropped when the average queue depth is at the maximum threshold for the subclass(es). Valid values are from 1 to 255.
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values s*ub-class-val1* [...[*subclass-val8*]]	DSCP value(s) to which the following WRED profile parameter specifications are to apply. A maximum of 8 subclasses (DSCP values) can be specified per CLI entry. The DSCP value can be a number from 0 to 63, or it can be one of the following keywords: **ef**, **af11**, **af12**, **af13**, **af21**, **af22**, **af23**, **af31**, **af32**, **af33**, **af41**, **af42**, **af43**, **cs1**, **cs2**, **cs3**, **cs4**, **cs5**, or **cs7**.
minimum-thresh *min-thresh*	Specifies the minimum number of packets allowed in the queue. When the average queue length reaches the minimum threshold, WRED randomly drops some packets with the specified DSCP value. Valid minimum threshold values are 1 to 16384.

maximum-thresh *max-thresh*	Specifies the maximum number of packets allowed in the queue. When the average queue length exceeds the maximum threshold, WRED drops all packets with the specified DSCP value. Valid maximum threshold values are 1 to 16384.
mark-probability *mark-prob*	Specifies the denominator for the fraction of packets dropped when the average queue depth is at the maximum threshold. For example, if the denominator is 512, 1 out of every 512 packets is dropped when the average queue is at the maximum threshold. Valid values are 1 to 65535.

Defaults

Cisco 10000 Series Router

For all precedence levels, the *mark-prob* default value is 10 packets.

Command Modes

Policy–map class configuration

Command History

Release	Modification
12.2(18)SXE	This command was introduced.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2 and implemented on the Cisco 10000 series router for the PRE3.

Usage Guidelines

For ATM interfaces, the Aggregate WRED feature requires that the ATM SPA cards are installed in a Cisco 7600 SIP-200 carrier card or a Cisco 7600 SIP-400 carrier card.

To configure WRED on an ATM interface, you must use the random-detect aggregate commands; the standard random-detect commands are no longer supported on ATM interfaces.

Use this command with a **random-detect aggregate** command within a policy map configuration.

Repeat this command for each set of DSCP values that share WRED parameters.

After the policy map is defined, the policy map must be attached at the VC level.

The set of subclass (DSCP precedence) values defined on a **random-detect dscp (aggregate)** CLI will be aggregated into a single hardware WRED resource. The statistics for these subclasses will also be aggregated.

Use the **show policy-map interface** command to display the statistics for aggregated subclasses.

Cisco 10000 Series Router

For the PRE2, the **random-detect** command specifies the default profile for the queue. For the PRE3, the aggregate **random-detect** command is used instead to configure aggregate parameters for WRED. The PRE3 accepts the PRE2 **random-detect** command as a hidden command.

On the PRE2, accounting for the default profile is per precedence. On the PRE3, accounting and configuration for the default profile is per class map.

On the PRE2, the default threshold is per precedence for a DSCP or precedence value without an explicit threshold configuration. On the PRE3, the default threshold is to have no WRED configured.

On the PRE2, the drop counter for each precedence belonging to the default profile only has a drop count that matches the specific precedence value. Because the PRE2 has a default threshold for the default profile, the CBQOSMIB displays default threshold values. On the PRE3, the drop counter for each precedence belonging to the default profile has the aggregate counter of the default profile and not the individual counter for a specific precedence. The default profile on the PRE3 does not display any default threshold values in the CBQOSMIB if you do not configure any threshold values for the default profile.

Examples

The following example shows a DSCP-based aggregate WRED configuration for an ATM interface. Note that first a policy map named dscp-aggr-wred is defined for the default class, then dscp-based aggregate WRED is enabled with the **random-detect dscp-based aggregate** command, then subclasses and WRED parameter values are assigned in a series of **random-detect dscp (aggregate)** commands, and, finally, the policy map is attached at the ATM VC level using the **interface** and **service-policy** commands.

```
Router(config)# policy-map dscp-aggr-wred
Router(config-pmap)# class class-default
Router(config-pmap-c)# random-detect dscp-based aggregate minimum-thresh 1 maximum-thresh
10 mark-prob 10
!
! Define an aggregate subclass for packets with DSCP values of 0-7 and assign the WRED
! profile parameter values for this subclass
Router(config-pmap-c)# random-detect dscp 0 1 2 3 4 5 6 7 minimum-thresh 10 maximum-thresh
20 mark-prob 10
Router(config-pmap-c) random-detect dscp 8 9 10 11 minimum-thresh 10 maximum-thresh 40
mark-prob 10
Router(config)# interface ATM4/1/0.11 point-to-point
Router(config-subif)# ip address 10.0.0.2 255.255.255.0
Router(config-subif) pvc 11/101
Router(config-subif)# service-policy output dscp-aggr-wred
```

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The following example shows how to create a class map named Gold and associate it with the policy map named Business. The configuration enables WRED to drop Gold packets based on DSCP 8 with a minimum threshold of 24 and a maximum threshold of 40. The Business policy map is attached to the outbound ATM interface 1/0/0.

```
Router(config-if)# class-map Gold
Router(config-cmap)# match access-group 10
Router(config-cmap)# exit
Router(config)# policy-map Business
Router(config-pmap)# class Gold
Router(config-pmap-c)# bandwidth 48
Router(config-pmap-c)# random-detect dscp-based
Router(config-pmap-c)# random-detect dscp values 8 minimum-thresh 24 maximum-thresh 40
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface atm 1/0/0
Router(config-if)# service-policy output Business
```

Related Commands

Command	Description
class (policy-map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
interface	Configures an interface type and enters interface configuration mode.

Command	Description
policy-map	Creates a policy map that can be attached to one or more interfaces to specify a service policy.
random-detect aggregate	Enables aggregate WRED and optionally specifies default WRED parameter values for a default aggregate class. This default class will be used for all subclasses that have not been explicitly configured.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.

random-detect precedence (aggregate)

To configure aggregate Weighted Random Early Detection (WRED) parameters for specific IP precedence value(s), use the **random-detect precedence (aggregate)** command in policy-map class configuration mode. To disable configuration of aggregate WRED precedence values, use the **no** form of this command.

random-detect precedence s*ub-class-val1* [*sub-class-val2* s*ub-class-val3* s*ub-class-val4*] *min-thresh max-thresh mark-prob*

no random-detect precedence s*ub-class-val1* [*sub-class-val2* s*ub-class-val3* s*ub-class-val4*]

Cisco 10000 Series Router (PRE3)

random-detect precedence values s*ub-class-val1* [...[*sub-class-val8*]] **minimum-thresh** *min-thresh* **maximum-thresh** *max-thresh* **mark-probability** *mark-prob*

no random-detect precedence values s*ub-class-val1* [...[*sub-class-val8*]]

Syntax Description

s*ub-class-val1* *sub-class-val2* s*ub-class-val3* s*ub-class-val4*	IP precedence value to which the following WRED profile parameter specifications are to apply. Up to four subclasses (IP precedence values) can be specified per command line interface (CLI) entry. The value range is from 0 to 7.
min-thresh	Minimum threshold (in number of packets) for the subclass(es). Valid values are from 1 to 12288.
max-thresh	Specifies the maximum threshold (in number of packets) for the subclass(es). Valid values are from the minimum threshold argument to 12288.
mark-prob	Specifies the denominator for the fraction of packets dropped when the average queue depth is at the maximum threshold for the subclass(es). Valid values are from 1 to 255.
Cisco 10000 Series Router	
values s*ub-class-val1* [...[*subclass-val8*]]	IP precedence value(s) to which the following WRED profile parameter specifications are to apply. A maximum of 8 subclasses (IP precedence values) can be specified per CLI entry. The value range is from 0 to 7.
minimum-thresh *min-thresh*	Specifies the minimum number of packets allowed in the queue. When the average queue length reaches the minimum threshold, WRED randomly drops some packets with the specified IP precedence value. Valid minimum threshold values are 1 to 16384.
maximum-thresh *max-thresh*	Specifies the maximum number of packets allowed in the queue. When the average queue length exceeds the maximum threshold, WRED drops all packets with the specified IP precedence value. Valid maximum threshold values are 1 to 16384.
mark-probability *mark-prob*	Specifies the denominator for the fraction of packets dropped when the average queue depth is at the maximum threshold. For example, if the denominator is 512, 1 out of every 512 packets is dropped when the average queue is at the maximum threshold. Valid values are 1 to 65535.

Defaults

Cisco 10000 Series Router

For all precedence levels, the *mark-prob* default is 10 packets.

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.0(17)SL	This command was introduced on the Cisco 10000 series router.
12.2(18)SXE	This command was introduced.
12.2(31)SB2	This command was integrated into Cisco IOS Release 12.2(31)SB2 and implemented on the Cisco 10000 series router for the PRE3.

Usage Guidelines

For ATM interfaces, the Aggregate WRED feature requires that the ATM SPA cards are installed in a Cisco 7600 SIP-200 carrier card or a Cisco 7600 SIP-400 carrier card.

To configure WRED on an ATM interface, you must use the random-detect aggregate commands; the standard random-detect commands are no longer supported on ATM interfaces

Use this command with a **random-detect aggregate** command within a policy map configuration.

Repeat this command for each set of IP precedence values that share WRED parameters.

After the policy map is defined, the policy map must be attached at the VC level.

The set of subclass (IP precedence) values defined on a **random-detect precedence (aggregate)** CLI will be aggregated into a single hardware WRED resource. The statistics for these subclasses will also be aggregated.

Use the **show policy-map interface** command to display the statistics for aggregated subclasses.

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Table 3 lists the default drop thresholds for WRED based on DSCP, IP precedence, and discard-class. The drop probability indicates that the router drops one packet for every 10 packets.

Table 3 WRED Default Drop Thresholds

DSCP, Precedence, and Discard-Class Values	Minimum Threshold (times the queue size)	Maximum Threshold (times the queue size)	Drop Probability
All DSCPs	1/4	1/2	1/10
0	1/4	1/2	1/10
1	9/32	1/2	1/10
2	5/16	1/2	1/10
3	11/32	1/2	1/10
4	3/8	1/2	1/10
5	13/32	1/2	1/10
6	7/16	1/2	1/10
7	15/32	1/2	1/10

For the PRE2, the **random-detect** command specifies the default profile for the queue. For the PRE3, the aggregate **random-detect** command is used instead to configure aggregate parameters for WRED. The PRE3 accepts the PRE2 **random-detect** command as a hidden CLI.

On the PRE2, accounting for the default profile is per precedence. On the PRE3, accounting and configuration for the default profile is per class map.

On the PRE2, the default threshold is per precedence for a DSCP or precedence value without an explicit threshold configuration. On the PRE3, the default threshold is to have no WRED configured.

On the PRE2, the drop counter for each precedence belonging to the default profile only has a drop count that matches the specific precedence value. Because the PRE2 has a default threshold for the default profile, the CBQOSMIB displays default threshold values. On the PRE3, the drop counter for each precedence belonging to the default profile has the aggregate counter of the default profile and not the individual counter for a specific precedence. The default profile on the PRE3 does not display any default threshold values in the CBQOSMIB if you do not configure any threshold values for the default profile.

Examples

Cisco 10000 Series Router

The following example shows how to enable IP precedence-based WRED on the Cisco 10000 series router. In this example, the configuration of the class map named Class1 indicates to classify traffic based on IP precedence 3, 4, and 5. Traffic that matches IP precedence 3, 4, or 5 is assigned to the class named Class1 in the policy map named Policy1. WRED-based packet dropping is configured for Class1 and is based on IP precedence 3 with a minimum threshold of 500, maximum threshold of 1500, and a mark-probability-denominator of 200. The QoS policy is applied to PVC 1/32 on the point-to-point ATM subinterface 1/0/0.1.

```
Router(config)# class-map Class1
Router(config-cmap)# match ip precedence 3 4 5
Router(config-cmap)# exit
Router(config)# policy-map Policy1
Router(config-pmap)# class Class1
Router(config-pmap-c)# bandwidth 1000
Router(config-pmap-c)# random-detect precedence-based
Router(config-pmap-c)# random-detect precedence values 3 minimum-thresh 500 maximum-thresh
1500 mark-probability 200
Router(config-pmap-c)# exit
Router(config-pmap)# exit
Router(config)# interface atm 1/0/0
Router(config-if)# atm pxf queuing
Router(config-if)# interface atm 1/0/0.1 point-to-point
Router(config-subif)# pvc 1/32
Router(config-subif-atm-vc)# ubr 10000
Router(config-subif-atm-vc)# service-policy output policy1
```

Related Commands

Command	Description
class (policy-map)	Specifies the name of the class whose policy you want to create or change, and the default class (commonly known as the class-default class) before you configure its policy.
interface	Configures an interface type and enters interface configuration mode.
policy-map	Creates a policy map that can be attached to one or more interfaces to specify a service policy.

Command	Description
random-detect aggregate	Enables aggregate WRED and optionally specifies default WRED parameter values for a default aggregate class. This default class will be used for all subclasses that have not been explicitly configured.
service-policy	Attaches a policy map to an input interface or VC, or an output interface or VC, to be used as the service policy for that interface or VC.
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.

service-policy

To attach a policy map to an input interface or virtual circuit (VC), or an output interface or VC, to be used as the service policy for that interface or VC, use the **service-policy** command. To remove a service policy from an input or output interface or input or output VC, use the **no** form of this command.

service-policy [**type access-control**] {**input** | **output**} *policy-map-name*

no service-policy [**type access-control**] {**input** | **output**} *policy-map-name*

Syntax Description

type access-control	(Optional) Determines the exact pattern to look for in the protocol stack of interest. **Note** This option is not available on the Cisco 10000 series router.
input	Attaches the specified policy map to the input interface or input VC.
output	Attaches the specified policy map to the output interface or output VC.
policy-map-name	The name of a service policy map (created using the **policy-map** command) to be attached. The name can be a maximum of 40 alphanumeric characters.

Defaults

No service policy is specified.

Command Modes

Interface configuration
VC submode (for a standalone VC)
Bundle-vc configuration (for ATM VC bundle members)
PVC range subinterface configuration (for a range of ATM PVCs)
PVC-in-range configuration (for an individual PVC within a PVC range)
Map-class configuration (for Frame Relay VCs)

Command History

Release	Modification
12.0(5)T	This command was introduced.
12.0(5)XE	This command was integrated into Cisco IOS Release 12.0(5)XE.
12.0(7)S	This command was integrated into Cisco IOS Release 12.0(7)S.
12.1(1)E	This command was integrated into Cisco IOS Release 12.1(1)E.
12.1(2)T	This command was modified to enable low latency queueing (LLQ) on Frame Relay VCs.
12.4(2)T	This command was made available in the PVC range subinterface configuration mode and in the PVC-in-range configuration mode to extend policy map functionality on an ATM VC to the ATM VC range.
12.4(4)T	The **type stack** and the **type access-control** keywords were added to support flexible packet matching.
12.3(7)XI2	This command was modified to support PVC range configuration mode and PVC-in-range configuration mode for ATM VCs on the Cisco 10000 series router and the Cisco 7200 series router.

Release	Modification
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB and implemented on the Cisco 10000 series router.
12.2(31)SB2	This command was introduced on the PRE3 for the Cisco 10000 series router.

Usage Guidelines

You can attach a single policy map to one or more interfaces or one or more VCs to specify the service policy for those interfaces or VCs.

Currently a service policy specifies class-based weighted fair queueing (CBWFQ). The class policies comprising the policy map are then applied to packets that satisfy the class map match criteria for the class.

To successfully attach a policy map to an interface or a VC, the aggregate of the configured minimum bandwidths of the classes comprising the policy map must be less than or equal to 75 percent of the interface bandwidth or the bandwidth allocated to the VC.

To enable LLQ for Frame Relay (priority queueing (PQ)/CBWFQ), you must first enable Frame Relay Traffic Shaping (FRTS) on the interface using the **frame-relay traffic-shaping** command in interface configuration mode. You then attach an output service policy to the Frame Relay VC using the **service-policy** command in map-class configuration mode.

To successfully attach a policy map to an interface or ATM VC, the aggregate of the configured minimum bandwidths of the classes that make up the policy map must be less than or equal to 75 percent of the interface bandwidth or the bandwidth allocated to the VC. For a Frame Relay VC, the total amount of bandwidth allocated must not exceed the minimum committed information rate (CIR) configured for the VC less any bandwidth reserved by the **frame-relay voice bandwidth** or **frame-relay ip rtp priority** map-class commands. If not configured, the minimum CIR defaults to half of the CIR.

Configuring CBWFQ on a physical interface is only possible if the interface is in the default queueing mode. Serial interfaces at E1 (2.048 Mbps) and below use WFQ by default. Other interfaces use FIFO by default. Enabling CBWFQ on a physical interface overrides the default interface queueing method. Enabling CBWFQ on an ATM permanent virtual circuit (PVC) does not override the default queueing method.

When you attach a service policy with CBWFQ enabled to an interface, commands related to fancy queueing such as commands pertaining to fair queueing, custom queueing, priority queueing, and Weighted Random Early Detection (WRED) are available using the modular quality of service command line interface (MQC). However, you cannot configure these features directly on the interface until you remove the policy map from the interface.

You can modify a policy map attached to an interface or a VC, changing the bandwidth of any of the classes comprising the map. Bandwidth changes that you make to an attached policy map are effective only if the aggregate of the bandwidth amounts for all classes comprising the policy map, including the modified class bandwidth, less than or equal to 75 percent of the interface bandwidth or the VC bandwidth. If the new aggregate bandwidth amount exceeds 75 percent of the interface bandwidth or VC bandwidth, the policy map is not modified.

Cisco 10000 Series Router Usage Guidelines

The Cisco 10000 series router does not support applying class-based weighted fair queuing (CBWFQ) policies to unspecified bit rate (UBR) VCs.

To successfully attach a policy map to an interface or a VC, the aggregate of the configured minimum bandwidths of the classes comprising the policy map must be less than or equal to 99 percent of the interface bandwidth or the bandwidth allocated to the VC. If you attempt to attach a policy map to an interface when the sum of the bandwidth assigned to classes is greater than 99 percent of the available bandwidth, the router logs a warning message and does not allocate the requested bandwidth to all of the classes. If the policy map is already attached to other interfaces, it is removed from them.

The total bandwidth is the speed (rate) of the ATM layer of the physical interface. The router converts the minimum bandwidth that you specify to the nearest multiple of 1/255 (ESR-PRE1) or 1/65535 (ESR-PRE2) of the interface speed. When you request a value that is not a multiple of 1/255 or 1/65535, the router chooses the nearest multiple.

The bandwidth percentage is based on the interface bandwidth. In a hierarchical policy, the bandwidth percentage is based on the nearest parent shape rate.

By default, a minimum bandwidth guaranteed queue has buffers for up to 50 milliseconds of 256-byte packets at line rate, but not less than 32 packets.

For Cisco IOS Release 12.0(22)S and later releases, to enable LLQ for Frame Relay (priority queueing (PQ)/CBWFQ) on the Cisco 10000 series router, first create a policy map and then assign priority to a defined traffic class using the **priority** command. For example, the following sample configuration shows how to configure a priority queue with a guaranteed bandwidth of 8000 kbps. In the example, the Business class in the policy map named Gold is configured as the priority queue. The Gold policy also includes the Non-Business class with a minimum bandwidth guarantee of 48 kbps. The Gold policy is attached to serial interface 2/0/0 in the outbound direction.

```
class-map Business
 match ip precedence 3
policy-map Gold
 class Business
  priority
  police 8000
 class Non-Business
  bandwidth 48
interface serial 2/0/0
 frame-relay encapsulation
 service-policy output Gold
```

On the PRE2, you can use the **service-policy** command to attach a QoS policy to an ATM subinterface or to a PVC. However, on the PRE3, you can attach a QoS policy only to a PVC.

Examples

The following example shows how to attach the service policy map called policy9 to data-link connection identifier (DLCI) 100 on output serial subinterface 1 and enable LLQ for Frame Relay:

```
interface Serial1/0.1 point-to-point
  frame-relay interface-dlci 100
    class fragment
!
map-class frame-relay fragment
  service-policy output policy9
```

The following example shows how to attach the service policy map called policy9 to input serial interface 1:

```
interface Serial1
  service-policy input policy9
```

The following example shows how to attach the service policy map called policy9 to the input PVC called cisco:

```
pvc cisco 0/34
 service-policy input policy9
vbr-nt 5000 3000 500
 precedence 4-7
```

The following example shows how to attach the policy called policy9 to output serial interface 1 to specify the service policy for the interface and enable CBWFQ on it:

```
interface serial1
 service-policy output policy9
```

The following example shows how to attach the service policy map called policy9 to the output PVC called cisco:

```
pvc cisco 0/5
 service-policy output policy9
vbr-nt 4000 2000 500
 precedence 2-3
```

Cisco 10000 Series Router Examples

The following example shows how to attach the service policy named user_policy to data link connection identifier (DLCI) 100 on serial subinterface 1/0/0.1 for outbound packets.

```
interface serial 1/0/0.1 point-to-point
 frame-relay interface-dlci 100
  service-policy output user_policy
```

Note You must be running Cisco IOS Release 12.0(22)S or later releases to attach a policy to a DLCI in this way. If you are running a release prior to Cisco IOS Release 12.0(22)S, attach the service policy as described in the previous configuration examples using the Frame Relay legacy commands.

The following example shows how to attach a QoS service policy named bronze to PVC 0/101 on the ATM subinterface 3/0/0.1 for inbound traffic.

```
interface atm 3/0/0
 atm pxf queuing
interface atm 3/0/0.1
 pvc 0/101
  service-policy input bronze
```

The following example shows how to attach a service policy named myQoS to the physical Gigabit Ethernet interface 1/0/0 for inbound traffic. VLAN 4, configured on the GigabitEthernet subinterface 1/0/0.3, inherits the service policy of the physical Gigabit Ethernet interface 1/0/0.

```
interface GigabitEthernet 1/0/0
 service-policy input myQoS
interface GigabitEthernet 1/0/0.3
 encapsulation dot1q 4
```

The following example shows how to apply the policy map named policy1 to the virtual template named virtual-template1 for all inbound traffic. In this example, the virtual template configuration also includes CHAP authentication and point-to-point protocol (PPP) authorization and accounting.

```
interface virtual-template1
 ip unnumbered Loopback1
 no peer default ip address
 ppp authentication chap vpn1
 ppp authorization vpn1
 ppp accounting vpn1
 service-policy policy1
```

The following example shows how to attach the service policy map called voice to ATM VC 2/0/0 within a PVC range of a total of 3 PVCs and enable PVC range configuration mode where a point-to-point subinterface is created for each PVC in the range. Each PVC created as part of the range has the voice service policy attached to it.

```
configure terminal
 interface atm 2/0/0
  range pvc 1/50 1/52
   service-policy input voice
```

The following example shows how to attach the service policy map called voice to ATM VC 2/0/0 within a PVC range, where every VC created as part of the range has the voice service policy attached to it. The exception is PVC 1/51, which is configured as an individual PVC within the range and has a different service policy called data attached to it in PVC-in-range configuration mode.

```
configure terminal
 interface atm 2/0/0
  range pvc 1/50 1/52
   service-policy input voice
  pvc-in-range 1/51
   service-policy input data
```

Related Commands

Command	Description
policy-map	Creates or modifies a policy map that can be attached to one or more interfaces to specify a service policy.
show frame-relay pvc	Displays statistics about PVCs for Frame Relay interfaces.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps.
show policy-map interface	Displays the configuration of all classes configured for all service policies on the specified interface or displays the classes for the service policy for a specific PVC on the interface.

shape (policy-map class)

To shape traffic to the indicated bit rate according to the algorithm specified, or to enable ATM overhead accounting, use the **shape** command in policy-map class configuration mode. To remove shaping or disable ATM overhead accounting, use the **no** form of this command.

shape [**average** | **peak**] *mean-rate* [[*burst-size*] [*excess-burst-size*]] [**account** {**qinq** | **dot1q** | **user-defined** *offset*} **aal5** *subscriber-encap*]

no shape [**average** | **peak**] *mean-rate* [[*burst-size*] [*excess-burst-size*]] [**account** {**qinq** | **dot1q** | **user-defined** *offset*} **aal5** *subscriber-encap*]

Cisco 10000 Series Router

PRE2

shape *mean-rate* [*unit*] [[*burst-size*] [*excess-burst-size*]] [**account** {**qinq** | **dot1q** | **user-defined** *offset*} **aal5** *subscriber-encap*]

no shape *mean-rate* [*unit*] [[*burst-size*] [*excess-burst-size*]] [**account** {**qinq** | **dot1q** | **user-defined** *offset*} **aal5** *subscriber-encap*]

PRE3

shape [**average**] *mean-rate* [*unit*] [[*burst-size*] [*excess-burst-size*]] [**account** {**qinq** | **dot1q** | **user-defined** *offset*} **aal5** *subscriber-encap*]

no shape [**average**] *mean-rate* [*unit*] [[*burst-size*] [*excess-burst-size*]] [**account** {**qinq** | **dot1q** | **user-defined** *offset*} **aal5** *subscriber-encap*]

Syntax Description

average	(Optional) Indicates that the Committed Burst (Bc) is the maximum number of bits sent out in each interval.
peak	(Optional) Bc + Excess Burst (Be) is the maximum number of bits sent out in each interval.
mean-rate	(Optional) Also called committed information rate (CIR). Indicates the bit rate used to shape the traffic, in bits per second. When this command is used with backward explicit congestion notification (BECN) approximation, the bit rate is the upper bound of the range of bit rates that will be permitted.
unit	Specifies the unit of the specified bit rate (for example, kbps). **Note** This option is available on the Cisco 10000 series router for the PRE2 only.
burst-size	(Optional) The number of bits in a measurement interval (Bc).
excess-burst-size	(Optional) The acceptable number of bits permitted to go over the Be.
account	(Optional) Enables ATM overhead accounting. **Note** This keyword is required if you configure ATM overhead accounting.

qinq	Specifies queue-in-queue (qinq) encapsulation as the broadband aggregation system (BRAS) to digital subscriber line access multiplexer (DSLAM) encapsulation type for ATM overhead accounting.
dot1q	Specifies IEEE 802.1Q VLAN encapsulation as the BRAS-DSLAM encapsulation type for ATM overhead accounting.
user-defined	Indicates that the router is to use the specified offset size when calculating ATM overhead.
offset	Specifies the offset size the router is to use when calculating ATM overhead. Valid values are from –48 to 48 bytes.
aal5	Specifies the ATM Adaptation Layer 5 service for ATM overhead accounting. AAL5 supports connection-oriented variable bit rate (VBR) services.
subscriber-encap	Specifies the encapsulation type at the subscriber line. • snap-rbe • mux-rbe • snap-dot1q-rbe • mux-dot1q-rbe • snap-pppoa • mux-pppoa • snap-1483routed • mux-1483routed

Defaults

When the excess burst size (Be) is not configured, the default Be value is equal to the committed burst size (Bc).

Traffic shaping overhead accounting for ATM is disabled.

Command Modes

Policy-map class configuration

Command History

Release	Modification
12.0(5)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.0(17)SL	This command was integrated into Cisco IOS Release 12.0(17)SL and implemented on the PRE1 for the Cisco 10000 series router.
12.2(16)BX	This command was integrated into Cisco IOS Release 12.2(16)BX and implemented on the PRE2 for the Cisco 10000 series router.
12.2(28)SB	This command was integrated into Cisco IOS Release 12.2(28)SB.
12.2(31)SB2	This command was enhanced for ATM overhead accounting and implemented on the Cisco 10000 series router for the PRE3.

Usage Guidelines

The measurement interval is the committed burst size (Bc) divided by committed information rate (CIR). Bc cannot be set to 0. If the measurement interval is too large (greater than 128 milliseconds), the system subdivides it into smaller intervals.

If you do not specify the committed burst size (Bc) and the excess burst size (Be), the algorithm decides the default values for the shape entity. The algorithm uses a 4 milliseconds measurement interval, so Bc is CIR * (4 / 1000).

Burst sizes larger than the default committed burst size (Bc) need to be explicitly specified. The larger the Bc, the longer the measurement interval. A long measurement interval may affect voice traffic latency, if applicable.

When the excess burst size (Be) is not configured, the default value is equal to the committed burst size (Bc).

Traffic Shaping on the Cisco 10000 Series Performance Routing Engine

The Cisco 10000 series router does not support the **peak** keyword.

On the PRE2, you specify a shape rate and a unit for the rate. Valid values for the rate are from 1 to 2488320000 and units are bps, kbps, mbps, gbps. The default unit is kbps. For example:

```
shape 128000 bps
```

On the PRE3, you only need to specify a shape rate. Because the unit is always bps on the PRE3, the *unit* argument is not available. Valid values for the shape rate are from 1000 to 2488320000.

```
shape 1000
```

The PRE3 accepts the PRE2 **shape** command as a hidden command. However, the PRE3 rejects the PRE2 **shape** command if the specified rate is outside the valid PRE3 shape rate range (1000 to 2488320000).

Traffic Shaping Overhead Accounting for ATM (Cisco 10000 Series Router)

When configuring ATM overhead accounting on the Cisco 10000 series router, you must specify the BRAS-DSLAM, DSLAM-CPE, and subscriber line encapsulation types. The router supports the following subscriber line encapsulation types:

- snap-rbe
- mux-rbe
- snap-dot1q-rbe
- mux-dot1q-rbe
- snap-pppoa
- mux-pppoa
- snap-1483routed
- mux-1483routed

The router calculates the offset size unless you specify the **user-defined** *offset* option.

For hierarchical policies, configure ATM overhead accounting in the following ways:

- Enabled on parent—If you enable ATM overhead accounting on a parent policy, you are not required to enable accounting on the child policy.
- Enabled on child and parent—If you enable ATM overhead accounting on a child policy, then you must enable ATM overhead accounting on the parent policy.

The encapsulation types must match for the child and parent policies.

Examples

The following example configures a shape entity with a CIR of 1 Mbps and attaches the policy map called dts-interface-all-action to interface pos1/0/0:

```
policy-map dts-interface-all-action
 class class-interface-all
   shape average 1000000

    interface pos1/0/0
       service-policy output dts-interface-all-action
```

Traffic Shaping Overhead Accounting for ATM

When a parent policy has ATM overhead accounting enabled for shaping, you are not required to enable accounting at the child level using the **police** command. In the following configuration example, ATM overhead accounting is enabled for bandwidth on the gaming and class-default class of the child policy map named subscriber_classes, and on the class-default class of the parent policy map named subscriber_line. The voip and video classes do not have ATM overhead accounting explicitly enabled. These priority classes have ATM overhead accounting implicitly enabled because the parent policy has ATM overhead accounting enabled. Notice that the features in the parent and child policies use the same encapsulation type.

```
policy-map subscriber_classes
    class voip
        priority level 1
        police 8000
    class video
        priority level 2
        police 20
    class gaming
        bandwidth remaining percent 80 account aal5 snap-rbe-dot1q
    class class-default
        bandwidth remaining percent 20 account aal5 snap-rbe-dot1q
policy-map subscriber_line
    class class-default
        bandwidth remaining ratio 10 account aal5 snap-rbe-dot1q
        shape average 512 account aal5 snap-rbe-dot1q
        service policy subscriber_classes
```

Related Commands

Command	Description
bandwidth	Specifies or modifies the bandwidth allocated for a class belonging to a policy map, and enables ATM overhead accounting.
shape adaptive	Configures a Frame Relay interface or a point-to-point subinterface to estimate the available bandwidth by BECN integration while traffic shaping is enabled.
shape fecn-adapt	Configures a Frame Relay PVC to reflect received FECN bits as BECN bits in Q.922 TEST RESPONSE messages.
show policy-map	Displays the configuration of all classes for a specified service policy map or all classes for all existing policy maps. If configured, the command output includes information about ATM overhead accounting.
show running-config	Displays the current configuration of the router. If configured, the command output includes information about ATM overhead accounting.

show facility-alarm

To display the status of a generated alarm, use the **show facility-alarm** command in global configuration mode.

show facility-alarm {**status** [*severity*] | **relay**}

Syntax Description

status	Shows facility alarms by status and displays the settings of all user-configurable alarm thresholds.
severity	(Optional) String that identifies the severity of an alarm. The default severity level is informational, which shows all alarms. Severity levels are defined as the following: • 1—Critical. The condition affects service. • 2—Major. Immediate action is needed. • 3—Minor. Minor warning conditions. • 4—Informational. No action is required. This is the default.
relay	Shows facility alarms by relay.

Command Default

All alarms are shown.

Command Modes

Global configuration

Command History

Release	Modification
12.0(1)T	This command was introduced.
12.4(4)T	The *severity* argument was added in Cisco IOS Release 12.4(4)T.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(31)SB2	This command was introduced on the PRE3 for the Cisco 10000 series router.

Usage Guidelines

When a severity level is configured, statuses of alarms at that level and higher are shown. For example, when you set a severity of major, all major and critical alarms are shown.

Examples

The following example shows output of the **show facility-alarm status** command:

```
Router# show facility-alarm status

System Totals  Critical:1  Major:0  Minor:0
Source              Severity      Description [Index]
------              --------      -------------------
Fa0/0               CRITICAL      Physical Port Link Down [0]
Fa1/0               INFO          Physical Port Administrative State Down [1]
```

The following example shows output of a **show facility-alarm status** command with a severity level set at major:

```
Router# show facility-alarm status major

System Totals  Critical:1  Major:0  Minor:0

Source              Severity      Description [Index]
------              --------      -------------------
Fa0/0               CRITICAL      Physical Port Link Down [0]
```

Table 4 describes the significant fields shown in the output.

Table 4 show facility-alarm status Field Descriptions

Field	Description
System Totals	Total number of alarms generated, identified by severity.
Source	Interface from which the alarm was generated.
Severity	Severity level of the alarm generated.
Description [Index]	Type of the alarm and the index of the alarm type. The index can be any number based on the number of alarm types that the device supports.

Related Commands

Command	Description
clear facility-alarm	Clears alarm conditions and resets the alarm contacts.
facility-alarm	Configures threshold temperatures for minor, major, and critical alarms.

upgrade rom-monitor file

To upgrade the ROM monitor (ROMmon) image, use the **upgrade rom-monitor file** command in privileged EXEC mode.

Cisco 7200 VXR Router with NPE-G1

upgrade rom-monitor file {**bootflash:** [*file-path*] | **disk0:** [*file-path*] | **disk1:** [*file-path*] | **disk2:** [*file-path*] | **flash:** [*file-path*] | **ftp:** [*file-path*] | **slot0:** [*file-path*] | **slot1:** [*file-path*] | **tftp:** [*file-path*]}

Cisco 7301 Router

upgrade rom-monitor file {**flash:** [*file-path*] | **ftp:** [*file-path*] | **disk0:** [*file-path*] | **tftp:** [*file-path*]}

Cisco 7304 Router

upgrade rom-monitor {**rom0** | **rom1** | **rom2**} **file** {**bootdisk:** [*file-path*] | **disk0:** [*file-path*] | **flash:** [*file-path*] | **ftp:** [*file-path*] | **rcp:** [*file-path*] | **tftp:** [*file-path*]}

Cisco 10008 Router (PRE3 only)

upgrade {**rom-monitor** | **fpga**}

Syntax Description

file-path	Directory path name or filename where the Upgrade ROMmon image is located.
bootflash:	Filename location of Upgrade ROMmon image in boot flash memory.
disk0:	Disk 0 is only present on a Cisco 7200 VXR that has an I/O controller. The filename location of the Upgrade ROMmon image in disk 0 of the router chassis.
disk1:	Disk 1 is only present on a Cisco 7200 VXR that has an I/O controller. The filename location of the Upgrade ROMmon image in disk 1 of the router chassis.
disk2:	Disk 2 is always present on a Cisco 7200 VXR. The filename location of the Upgrade ROMmon image in disk 2 of the router chassis.
flash:	Filename location of Upgrade ROMmon image in Flash memory.
fpga	(Cisco 10008 router only) Upgradable field-programmable gate array (FPGA).
ftp:	Filename location of the Upgrade ROMmon image using File Transfer Protocol (FTP).
rom-monitor	(Cisco 10008 router only) Upgradeable ROM monitor.
slot0:, **slot1:**	Slot 0 and slot 1 are only present on a Cisco 7200 VXR that has an I/O controller. The filename location of the Upgrade ROMmon image in slot 0 and slot 1 of the router chassis.
tftp:	Filename location of the Upgrade ROMmon image on the TFTP server.
rom0	One-time programmable, always there “golden” ROMmon.
rom1	Upgradable ROM monitor 1.
rom2	Upgradable ROM monitor 2.

bootdisk:	Filename location of Upgrade ROMmon image in the boot disk.
rcp:	Filename location of the Upgrade ROMmon image using Remote Copy Protocol (RCP).

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(28)S	This command was introduced on the Cisco 7200 VXR router.
12.3(8)T	This command was integrated into Cisco IOS Release 12.3(8)T and supported on the Cisco 7200 VXR router and Cisco 7301 router.
12.3(9)	This command was integrated into Cisco IOS Release 12.3(9) and supported on the Cisco 7200 VXR router and Cisco 7301 router.
12.2(18)S	This command was integrated into Cisco IOS Release 12.2(18)S and supported on the Cisco 7304 router.
12.0S	This command was introduced on the PRE2 for the Cisco 10000 series router.
12.2(31)SB2	This command was introduced on the PRE3 for the Cisco 10000 series router.

Usage Guidelines

You can use the **upgrade rom-monitor file** command to download a new ROMmon image instead of having to replace the processor to obtain a new image.

Note Images are marked as invalid if the first bootup is not completed. Do not reset the router when it is doing an initial bootup.

Cisco 7200 VXR Router

A Cisco 7200 VXR that has an I/O controller card installed has the following additional devices on its chassis: disk 0, disk 1, slot 0, and slot 1.

Cisco 7304 Router

There are three ROMmon images. ROM 0 is a one-time programmable, always-there ROMmon image, referred to as the “golden” ROMmon. ROM 1 and ROM 2 are upgradable ROMmon images. At bootup, the system uses the golden ROMmon by default. If either ROM 1 or ROM 2 are configured, the system still begins bootup with the golden ROMmon, then switches to the configured ROMmon. If a new configured ROMmon image fails to boot up Cisco IOS software, the router marks this ROMmon image as invalid and reverts to the golden image for the next Cisco IOS bootup.

After downloading a new ROMmon image to the writable ROMmon, you must reload Cisco IOS software for the new ROMmon to take effect. The first time a new ROMmon image is loaded, you must allow the system to boot up Cisco IOS before doing any resets or power cycling. If the ROMmon loading process is interrupted, the system interprets this as a bootup failure of the new ROMmon image and reverts the ROMmon back to the golden ROMmon image in ROM 0.

Cisco 10008 Router

The PRE2 does not allow you to upgrade the ROM monitor image. However, the PRE3 does allow this using the **upgrade rom-monitor** command.

Examples

The following example of a Cisco 7200 VXR using an I/O controller loads the Upgrade ROMmon image from a disk 1 filename:

```
Router# upgrade rom-monitor file disk1:C7200_NPEG1_RMFUR.srec.123-4r.T1

This command will reload the router. Continue? [yes/no]:yes
ROMMON image upgrade in progress.

Erasing boot flash eeeeeeeeeeeeeeeee
Programming boot flash pppppp
Now Reloading via hard watchdog timeout
```

The following example on a Cisco 7301 router loads the Upgrade ROMmon image from a specified TFTP file location:

```
Router# upgrade rom-monitor file tftp://00.0.00.0/biff/C7301_RMFUR.srec

Loading biff/C7301_RMFUR.srec from 00.0.00.0 (via GigabitEthernet0/1):
 !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
[OK - 392348 bytes]

This command will reload the router. Continue? [yes/no]:yes
ROMMON image upgrade in progress.
Erasing boot flash eeeeeeeeeeeeeeeee
Programming boot flash ppppp
Now Reloading via hard watchdog timeout

Unexpected exception, CP
System Bootstrap, Version 12.2(20031011:151758) [biff]
Copyright (c) 2004 by cisco Systems, Inc.

 Running new upgrade for first time

System Bootstrap, Version 12.2(20031011:151758) [biff]
Copyright (c) 2004 by cisco Systems, Inc.

ROM:Rebooted by watchdog hard reset
C7301 platform with 1048576 Kbytes of main memory


Upgrade ROMMON initialized
rommon 1 >
```

The following example configures the system to install a file called “rommonfile” as ROM 1 from the bootdisk:

```
Router# upgrade rom-monitor rom1 file bootdisk:rommonfile

ROM 1 upgrade in progress
Erasing (this may take a while)...
Programming...
CC
Do you want to verify this image (may take a few minutes)? [yes/no]: y
Verifying ROM 1
  Reading from ROM 1....Done
  Comparing with the source file...Passed
```

```
Set this ROMMON image as the default (will take effect on next reload/reset)? y
```

Related Commands

Command	Description
show diag	Displays hardware information for any slot or the chassis.